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1	1	JE Van Beek	<i>JE Van Beek</i>	4/17/00	R3-47
1	1	CE Grenard	<i>CE Grenard</i>	4/17/00	R3-73
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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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1.0 SCOPE

1.1 DESCRIPTION

This specification establishes the performance requirements and provides the references to the requisite codes and standards to be applied during the design of the Double-Shell Tank (DST) Utilities Subsystems that support the first phase of waste feed delivery (WFD). The DST Utilities Subsystems provide electrical power, raw/potable water, and service/instrument air to the equipment and structures used to transfer low-activity waste (LAW) and high-level waste (HLW) to designated DST staging tanks. The DST Utilities Subsystems also support the equipment and structures used to deliver blended LAW and HLW feed from these staging tanks to the River Protection Project (RPP) Privatization Contractor facility where the waste will be immobilized.

This specification is intended to be the basis for new projects/installations. This specification is not intended to retroactively affect previously established project design criteria without specific direction by the program.

1.2 CLASSIFICATION

Not applicable.

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2.0 APPLICABLE DOCUMENTS

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

2.1 GOVERNMENT DOCUMENTS

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

Table 2-1. Government Documents.

Document Number	Title
<i>Criteria for Sewage Works Design</i> , 1998	<i>Criteria for Sewage Works Design</i> , Washington State Department of Ecology, Olympia, Washington.
DOE Order 5820.2A, 1988	<i>Radioactive Waste Management</i> , U. S. Department of Energy, Washington D.C.
DOE Order 6430.1A, 1989	<i>General Design Criteria</i> , U. S. Department of Energy, Washington, D.C.
DOE/RL-96-109, Rev. 2, 1999	<i>Hanford Radiological Control Manual</i> , U.S. Department of Energy, Richland Operations Office, Richland, Washington.
DOH 331-123, 1999	<i>Water System Design Manual</i> , Washington State Department of Health, Olympia, Washington.
MIL-STD-1472C, 1989	<i>Human Engineering Design Criteria for Military Systems, Equipment, and Facilities</i> , U.S. Military Standard, as amended.
NUREG 0700, Rev. 1, 1995	<i>Human-System Interface Design Review</i> , U.S. Nuclear Regulatory Commission, Rockville, Maryland.
RCW 19.27, 1993	"State Building Code," <i>Revised Code of Washington</i> , as amended.
WAC 173-303-640, 1999	"Dangerous Waste Regulations," <i>Washington Administrative Code</i> , as amended.
WAC 246-290, 1999	"Public Water Supplies," "Water System Operations," <i>Washington Administrative Code</i> , as amended.

2.2 NON-GOVERNMENT DOCUMENTS

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

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

Document Number	Title
ACI 318, 1995	<i>Building Code Requirements for Reinforced Concrete</i> , American Concrete Institute, Farmington Hills, Michigan.
ANSI C2, 1997	<i>National Electrical Safety Code</i> American National Standards Institute, New York, New York.
ANSI C84.1, 1995	<i>Voltage Ratings for Electric Power Systems and Equipment (60 Hz)</i> , American National Standards Institute, New York, New York.
ASME B16.34, 1998	<i>Valves-Flanged, Threaded, and Welding End</i> , American Society of Mechanical Engineers, New York, New York.
ASME B31.3, 1999	<i>Process Piping</i> , American Society of Mechanical Engineers, New York, New York.
ASME NQA-1, 1997 Subpart 2.2, Section 3.2	<i>Quality Assurance Requirements for Nuclear Facility Applications</i> , American Society of Mechanical Engineers, New York, New York.
<i>Cross Connection Control Accepted Procedure and Practice Manual</i> , 6 th ed., 1996.	<i>PNWS/AWWA Cross Connection Control Accepted Procedure and Practice Manual</i> , Pacific Northwest Section of the American Water Works Association, Beaverton, Oregon.
HNF-2962, Rev. 0, 1998	<i>A List of EMI/EMC Requirements</i> , Numatec Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.
HNF-IP-0842, Vol. II, Section 4.9.1, Rev. 5e, 1999	<i>RPP Administration</i> , "Lock and Tag Program," Lockheed Martin Hanford Corporation, Richland, Washington.
HNF-IP-0842, Vol. II, Section 6.1, Rev. 0a, 1999	<i>RPP Administration</i> , "Tank Farm Operations Equipment Labeling," Lockheed Martin Hanford Corporation, Richland, Washington.

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

Document Number	Title
HNF-IP-0842, Vol XI, Section 1.0, Rev. 2a, 1999	<i>RPP Administration</i> , "Quality Assurance Program," Lockheed Martin Hanford Corporation, Richland, Washington.
HNF-IP-1266, Rev. 2, 1999	<i>Tank Farms Operations Administrative Controls</i> , DE&S Hanford, Incorporated, for Fluor Daniel Hanford, Inc., Richland, Washington.
HNF-PRO-481, Rev. 0	<i>Electrical Utilities Interface Agreement with Facilities/Plants</i> , Rev. 1, Fluor Hanford, Richland, Washington.
HNF-SD-GN-ER-501, Rev. 1, 1998	<i>Natural Phenomena Hazards, Hanford Site Washington</i> , Numatec Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.
HNF-SD-WM-HSP-002, Rev. 3B, 1999	<i>Tank Farms Health and Safety Plan</i> , Lockheed Martin Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.
HNF-SD-WM-SAR-067, Rev. 1, 1999	<i>Tank Waste Remediation System Final Safety Analysis Report</i> , Lockheed Martin Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.
HNF-SD-WM-TSR-006, Rev. 1, 1999	<i>Tank Waste Remediation System Technical Safety Requirements</i> , Fluor Daniel Hanford Inc., Richland, Washington.
IEEE 242, 1986	<i>Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems</i> , Institute of Electrical and Electronics Engineers, New York, New York.
IEEE 493, 1997	<i>Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems</i> , Institute of Electrical and Electronics Engineers, New York, New York.
IEEE C37 Series, 1998	<i>IEEE Standards Collection: Power and Energy – Switchgear, Circuit Breakers and Substations</i> , Institute of Electrical and Electronics Engineers, New York, New York.
IEEE C57 Series, 1998	<i>Distribution, Power, and Regulating Transformers Standards Collection</i> , Institute of Electrical and Electronics Engineers, New York, New York.
<i>The IESNA Lighting Handbook</i> , 9 th ed., 2000	<i>The IESNA Lighting Handbook</i> , Illumination Engineering Society of North America, New York, New York.
<i>Manual of Cross-Connection Control</i> , 9 th ed., 1993	<i>Manual of Cross-Connection Control</i> , Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California, Los Angeles, California.

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

Document Number	Title
NACE RP 0169-96, 1996	<i>Control of External Corrosion on Underground or Submerged Metallic Piping Systems</i> , National Association of Corrosion Engineers, Houston, Texas.
NACE RP 0285-95, 1995	<i>Corrosion Control of Underground Storage Tank Systems by Cathodic Protection</i> , National Association of Corrosion Engineers, Houston, Texas.
NEMA ICS 6, 1993	<i>Industrial Controls and Systems</i> , National Electrical Manufacturers Association, Arlington, Virginia.
NFPA 24, 1995	<i>Installation of Private Fire Service Mains and Their Appurtenances</i> , National Fire Protection Association, Quincy, Massachusetts.
NFPA 70, 1999	<i>National Electrical Code</i> , National Fire Protection Association, Quincy, Massachusetts.
NFPA 780, 1997	<i>Standards for the Installation of Lightning Protection Systems</i> , National Fire Protection Association, Quincy, Massachusetts.
RPP-PRO-089, Rev. 0, 1999	<i>Electrical Installation Safety</i> , CH2M HILL Hanford Group, Inc., Richland, Washington.
RPP-PRO-097, Rev. 0, 1999	<i>Engineering Design and Evaluation</i> , CH2M HILL Hanford Group, Inc., Richland, Washington.
RPP-PRO-222, Rev. 0, 1999	<i>Quality Assurance Records Standards</i> , CH2M HILL Hanford Group, Inc., Richland, Washington.
RPP-PRO-224, Rev. 0, 1999	<i>Document Control Program Standards</i> , CH2M HILL Hanford Group, Inc., Richland, Washington.
RPP-PRO-700, Rev. 0, 1999	<i>Safety Analysis and Technical Safety Requirements</i> , CH2M HILL Hanford Group, Inc., Richland, Washington.
RPP-PRO-702, Rev. 0, 1999	<i>Safety Analysis Process - Facility Change or Modification</i> , CH2M HILL Hanford Group, Inc., Richland, Washington.
RPP-PRO-703, Rev. 0, 1999	<i>Safety Analysis Process - New Project</i> , CH2M HILL Hanford Group, Inc., Richland, Washington.
RPP-PRO-704, Rev. 1, 1999	<i>Hazard and Accident Analysis Process</i> , CH2M HILL Hanford Group, Inc., Richland, Washington.
RPP-PRO-709, Rev. 0, 1999	<i>Preparation and Control Standards for Engineering Drawings</i> , CH2M HILL Hanford Group, Inc., Richland, Washington.
RPP-PRO-1621, Rev. 0, 1999	<i>ALARA Decision-Making Methods</i> , CH2M HILL Hanford Group, Inc., Richland, Washington.

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

Document Number	Title
RPP-PRO-1622, Rev. 0, 1999	<i>Radiological Design Review Process</i> , CH2M HILL Hanford Group, Inc., Richland, Washington.
RPP-PRO-1819, Rev. 0, 1999, Section 2.9.1	<i>Engineering Requirements</i> , CH2M HILL Hanford Group, Inc., Richland, Washington.
UL 508, 1999	<i>UL Standard for Safety for Industrial Control Equipment</i> , Underwriters Laboratories Inc., Northbrook, Illinois.
<i>Uniform Plumbing Code</i> , 2000	<i>Uniform Plumbing Code</i> , International Association of Plumbing and Mechanical Officials, Walnut, California.

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3.0 REQUIREMENTS

3.1 SUBSYSTEM/COMPONENT DEFINITION

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

The DST System includes six tank farms containing a total of 28 DSTs. Five of the DST farms are located in the 200 East Area (241-AN, 241-AP, 241-AW, 241-AY, and 241-AZ), and one is located in the 200 West Area (241-SY). The four tanks in the 241-AY and 241-AZ tank farms are designed to store high heat or “aging” waste and have a design storage capacity of 3,800 m³ (1 Mgal) each. Each of the other DSTs has a design capacity of 4,390 m³ (1.16 Mgal) per tank. Tank 241-AN-107, with a capacity of 4,390 m³ (1.16 Mgal), could be used as an aging waste storage tank. The planned usage of the DSTs during Phase 1 Waste Feed Delivery is detailed in the *Tank Waste Remediation System Operation and Utilization Plan to Support Waste Feed Delivery*, HNF-SD-WM-SP-012. This specification’s requirements are based on the Case 3, Project Planning, DST usage scenario documented therein. Notice that Case 3S6D, 2006 Hot Start, will be documented in Revision 2 of HNF-SD-WM-SP-012 and will serve as the baseline case for the Readiness to Proceed-2 (RTP-2) RPP milestone. Case 3S6D incorporates changes to Case 3 to resolve feed staging tank issues, reflect changes in the assumptions, and include additional programmatic constraints, as directed by the DOE ORP. Preliminary quantitative and qualitative assessments were performed to determine the impacts of these changes to the DST subsystem requirements. Generally, the DST subsystem requirements were determined to be insensitive to the aforementioned changes; that is, the fundamental system-level requirements remained constant between Cases 3 and 3S6D (e.g., the need to prepare and transfer AN Farm tank waste to the vitrification facility). In instances where quantitative assessments were performed, the enveloping case was selected to develop the DST subsystem requirements.

The DST System specification (*Technical Requirements Specification for the Double-Shell Tank System*, HNF-SD-WM-TRD-007) identifies several second-tier functions one of which is Distribute Utilities Within the DST System (Figure 3-1). The Distribute Utilities Within the DST System function has been further decomposed as shown. These are shown as third- and fourth-tier functions in Figure 3-1. *Functional Analysis for Double-Shell Tank Subsystems*, HNF-5136, allocates the third- and fourth-tier functions of Figure 3-1 to the DST Utilities Subsystems. Section 3.2.1 of this specification is organized to accommodate these functions.

The DST System consists of the 12 subsystems identified in Figure 3-2. Five of these subsystems (electrical, raw water, potable water, service air, and instrument air) will be collected into one specification for the DST Utilities Subsystems. Several of these subsystems have been further subdivided to identify lower level subsystem/components. Subsystem specifications will be prepared for the subsystems/components shaded in Figure 3-2, because they will be constructed or modified in support of Phase 1 Waste Feed Delivery.

Figure 3-1. Double-Shell Tank Utilities Subsystems Functional Hierarchy for “Distribute Utilities.”

DST = double-shell tank.
V ac = volts alternating current.

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

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

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

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

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

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

Diluent is routed by the valving subsystem either to the transfer pump for in-line dilution of the waste or to the confinement subsystem for in-tank dilution. When a transfer is complete, the transfer pump, valving, and piping subsystems are flushed with water.

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

Figure 3-4 generically shows how the DST Monitor and Control Subsystem interfaces with other systems. The subsystems shown in Figure 3-3 provide instrument data signals to the DST Monitor and Control Subsystem. The DST Monitor and Control Subsystem transmits selected

data to the Master Monitor and Control System. The DST Monitor and Control Subsystem also receives data and control signals from the Master Monitor and Control System. Based on the data and control signals received, the DST Monitor and Control Subsystem sends control signals to the multiple DST subsystems.

The DST Utilities Subsystems provide the electrical power, raw/potable water, and service/instrument air that supports the systems used to maintain safe storage within the DSTs; to process, stage, and transfer LAW and HLW feed to the Privatization Contractor; and to receive and manage routine waste receipts. Waste is moved among DSTs by transfer systems using transfer pumps, valve manifolds, jumpers, and underground pipelines. The waste is pumped through the piping subsystem and routed through diversion boxes and valve and pump pits to direct the waste to its destination. The DST Electrical Power Subsystem provides electrical power to the motors, instrumentation, and control vent fans. The DST Raw Water Subsystem supplies raw water for DST and transfer line dilution and flushing and for mixer pump fill and sparging. The DST Service Air Subsystem and DST Instrument Air Subsystem provide service and instrument air for pneumatically operated components, and instrumentation. The DST Potable Water Subsystem provides potable water to the safety showers and eyewash fountains in the DST Diluent and Flush Subsystem.

3.1.1 Subsystem/Component Diagrams

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

- Electrical Power
- Raw Water
- Potable Water
- Instrument Air
- Service Air.

The electrical and raw/potable water subsystems includes the electrical and water distribution *within* each DST farm but not the delivery of electrical and raw water utilities *to* each DST farm. The delivery of electrical and raw/potable water to each DST farm is under the exclusive control of DynCorp Tri-Cities Services, Inc. (DYN). DYN is considered a utility provider company and, as such, the codes and standards used for systems under their exclusive control may be different from similar systems installed within the DST farm complex. In summary, there are three interfaces between DYN and the DST Utilities Subsystems:

- 200 Area electrical distribution infrastructure/DST farm electrical distribution
- 200 Area raw water distribution infrastructure/DST farm raw water distribution
- 200 Area potable water distribution infrastructure/DST farm potable water distribution.

The two DST air subsystems – service air and instrument air – do not interface with DYN. A general description of each subsystem and its components is provided in Section 3.7, Characteristics of Subelements.

Figure 3-5. Architectural Decomposition of the Double-Shell Tank Utilities Subsystems.

Figure 3-6 provides a simplified schematic representation of the DST Electrical Power Subsystem for a typical DST farm. Interfaces with the central plateau electrical system and other DST systems also are represented schematically.

Figure 3-7 provides a simplified schematic representation of the DST Raw Water Subsystem and DST Potable Water Subsystem, their components, and their interfaces with the Central Plateau Water System and the other DST systems.

Figure 3-6. Schematic of Double-Shell Tank Electrical Power Subsystem.

Notes:

Shaded areas are not in DST Electrical Power Subsystem.

All items receiving normal power may be classed as SS, SC, or GS.

^(a)Distribution Equipment includes motor control centers, circuit breaker panels, transformers, switches, and related equipment.^(b)Miscellaneous Utilities include security, lighting, convenience outlets, etc.^(c)New Transformers are designed and furnished by the DST Utility Contractor and owned by the Central Plateau Electrical System.

DST = double-shell tank.

GS = general service.

SC = safety class.

SS = safety significant.

V ac = volts alternating current.

Figure 3-7. Schematic of Double-Shell Tank Raw Water Subsystem and Double-Shell Tank Potable Water Subsystem.

Note: Shaded areas are not in DST Potable/Raw Water Subsystems
 (a) These items when required, are designed and furnished by the DST
 Utility Contractors and owned by the Central Plateau Water System.
 *If Required

DST = double-shell tank.
FM = flow meter.

Figure 3-8 provides a simplified schematic representation of the DST Service Air Subsystem and DST Instrument Air Subsystem, their components, mutual interface, and their interfaces with other DST systems.

Figures 3-6, 3-7 and 3-8 are representations of typical DST Tank Farm architecture and interfaces. Some elements shown may not be required and some required elements may not be shown. Actual utilities subsystems architecture and interfaces will be as defined in definitive design.

3.1.2 Interface Definition

This section identifies the major interfaces of the DST Utilities Subsystems with other systems. The interface descriptions that follow are intended to help define the subsystem boundaries. These interface relationships are illustrated in Figures 3-9 through 3-13. This section discusses the inputs from these interfacing subsystems and facilities. Outputs from the DST Utilities Subsystems to other systems and facilities are discussed in Section 3.2.1.

3.1.2.1 Functional Interfaces

3.1.2.1.1 Double-Shell Tank Electrical Power Subsystem Interfaces with the Central Plateau Electrical System. Interfaces with the DST Electrical Power Subsystem are shown in Figure 3-9. The 251-W, A-8, 13.8-kV substation provides 13.8-kV distribution lines to the 200 Area DST farm service point(s). Functionally, the 13.8-kV infrastructure distributes electrical power to each DST farm, whereas the DST Electrical Power Subsystem distributes electrical power within each DST farm.

- a. The DST Electrical Power Subsystem shall obtain electricity from the Central Plateau Electrical System as indicated in Table 3-1.

3.1.2.1.2 Double-Shell Tank Raw Water Subsystem Interfaces with the Central Plateau Water System. Interfaces with the DST Raw Water Subsystem are illustrated in Figure 3-10. The central plateau raw water distribution infrastructure delivers unfiltered raw water to each DST farm service point. The central plateau raw water infrastructure distributes raw water to each DST farm.

- a. The DST Raw Water Subsystem shall be designed to operate within the values in Table 3-2.

3.1.2.1.3 Double-Shell Tank Potable Water Subsystem Interfaces with the Central Plateau Water Subsystem. Interfaces with the DST Potable Water Subsystem are illustrated in Figure 3-11. The Central Plateau Water System distribution infrastructure delivers potable water to each DST farm service point. The Central Plateau Water System infrastructure distributes potable water to each DST farm. The DST Potable Water Subsystem shall distribute potable water in each DST farm complex.

- a. The DST Potable Water Subsystem shall be designed to operate within the values in Table 3-3.

Figure 3-8. Schematic of Double-Shell Tank Service Air and Instrument Air Subsystems.

Figure 3-9. Double-Shell Tank Electrical Power Subsystem Interfaces.

3.1.2.1.4 Double-Shell Tank Service Air Subsystem Interfaces with DST Electrical Power Subsystem. Interfaces with the DST Service Air Subsystem are illustrated in Figure 3-12. The DST Electrical Power Subsystem provides electrical power to the service air distribution subsystems' electrical components (e.g., compressors, valves).

- a. The DST Service Air Subsystem shall be designed to operate with 480 V ac 60 Hz, three-phase electrical power.

3.1.2.1.5 Double-Shell Tank Instrument Air Subsystem Interfaces. Interfaces with the DST Instrument Air Subsystem are shown in Figure 3-13.

Figure 3-10. Double-Shell Tank Raw Water Subsystem Interfaces.

3.1.2.1.5.1 Instrument Air Interfaces with DST Electrical Power Subsystem. The DST Electrical Power Subsystem provides electrical power to the instrument air distribution subsystems' electrical components.

- a. The DST Instrument Air Subsystem shall be designed to operate with 240/120 V ac 60 Hz.

3.1.2.1.5.2 Instrument Air Interfaces with DST Service Air Subsystem. The DST Service Air Subsystem will supply service air to the DST Instrument Air Subsystem. The DST Instrument Air Subsystem shall dry, filter, regulate, and distribute instrument air to the various elements of the DST farm as required by definitive design.

- a. The DST Instrument Air Subsystem shall be designed to operate within the values in Table 3-5.

Figure 3-11. Double-Shell Tank Potable Water Subsystem Interfaces.

Figure 3-12. Double-Shell Tank Service Air Subsystem Interfaces.

3.1.2.2 Physical Interfaces

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

Figure 3-13. Double-Shell Tank Instrument Air Subsystem Interfaces.

3.1.3 Major Component List

Major components of the DST Utilities Subsystems are listed in Figure 3-5.

3.1.4 Government-Furnished Property List

Not applicable.

3.1.5 Government-Loaned Property Lists

Not applicable.

3.2 CHARACTERISTICS

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

3.2.1 Performance Characteristics

This section contains requirements related to functionality and performance capabilities for the DST Utilities Subsystems.

3.2.1.1 Distribute Double-Shell Tank Electrical Power

The DST Electrical Power Subsystem shall transform, control, protect, and distribute electrical power to support the operations and maintenance electrical loads of the DST System.

- a. The DST farm electrical distribution subsystem shall have a leading or lagging power factor of greater than 85 percent.

3.2.1.1.1 Distribute 480/277 V ac Electrical Power. The DST Electrical Power Subsystem shall transform, control, protect, and distribute 480/277 V ac electrical power to DST System components.

- 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 an electrical load study in preparation.

Table 3-1. 480 Volt Alternating Current Electrical Load Requirements.

Tank Farm	Demand ^a (kVA)	Projected ^b (kVA)
AN	152.5	854
AP	208.8	924
AW	104	893
AY	319.9	1075.5
AZ	40.25	883.3
SY	1291.2	2864

^aDemand – is the current usage of power on a system.

^bProjected – is the anticipated usage of power on a system.

- b. The DST Electrical Power Subsystem distribution shall provide voltage regulation in compliance with *Voltage Ratings for Electric Power Systems and Equipment (60 Hz)*, ANSI C84.1.

3.2.1.1.2 Light Double-Shell Tank System. The DST Electrical Power Subsystem shall light exterior and interior portions of the DST System to facilitate operations and maintenance (all shifts).

- a. Exterior and interior lighting shall comply with *The IESNA Lighting Handbook*.

3.2.1.1.3 Distribute 240/120 V ac Or 208/120 V ac Electrical Power. The DST Electrical Power Subsystem shall transform, control, protect, and distribute 240/120 and/or 208/120 V ac electrical power to DST System components.

- a. The DST electrical power subsystem distribution shall provide 240/120 V ac or 208/120 V ac services to the DST System equipment.

3.2.1.1.4 Provide Backup Electrical Power for the Double-Shell Tank System. The DST Electrical Power Subsystem shall control, protect, and distribute back-up electrical power for DST System components requiring electrical power in the event of normal power loss.

- 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.

3.2.1.2 Distribute Raw Water within the Double-Shell Tank System

The DST Raw Water Subsystem shall control and distribute raw water within the DST System to support operations, including water needed for industrial safety and fire protection.

- a. RPP-5227, *Waste Feed Delivery Raw Water, Potable Water and Compressed Air Capacity Evaluation*, 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 raw water demand shall be as determined by detail design and controlled by a water load study in preparation.

Table 3-2. Raw/Strained Water Requirements.

Tank Farm	Projected Maximum Demand		Required Minimum Pressure	
	L/s	gal/min	kPa	(lbf/in ² gauge)
A Complex (AN/AY/AZ)	72	1,140	552	80
AP	42	660	552	80
AW	50	800	552	80
SY	53	840	552	80

- 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/in² gauge) <TBR> to the DST Maintenance and Recovery Subsystem.
- 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>.

- 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.

3.2.1.3 Distribute Potable Water Within the Double-Shell Tank System

The DST Raw Water Subsystem shall control and distribute potable water to the DST Diluent and Flush Subsystem.

- a. RPP-5227, *Waste Feed Delivery Raw Water, Potable Water and Compressed Air Capacity Evaluation*, 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 potable water demand shall be as determined by detail design and controlled by a water load study in preparation.

Table 3-3. Potable Water Requirements.

Tank Farm	Projected Maximum Demand		Required Minimum Pressure	
	L/s	gal/min	kPa	(lbf/in ² gauge)
AN	1.9	30	276	40
AP	1.9	30	276	40
AW	1.9	30	276	40
AY	1.9	30	276	40
AZ	1.9	30	276	40
SY	1.9	30	276	40

3.2.1.4 Distribute Service Air within the Double-Shell Tank System

The DST Service Air Subsystem shall condition and distribute service air to DST System components, including the DST Instrument Air Subsystem.

- a. RPP-5227, *Waste Feed Delivery Raw Water, Potable Water and Compressed Air Capacity Evaluation*, 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.

Table 3-4. Service Air Requirements.

Tank Farm	Projected Maximum Demand		Required Minimum Pressure	
	L/s	ft ³ /min	kPa	(lbf/in ² gauge)
AN	N/A	N/A	N/A	N/A
AP	N/A	N/A	N/A	N/A
AW		48	275	40
AY/AZ		180	275	40
SY	N/A	N/A	N/A	N/A

3.2.1.5 Distribute Instrument Air Within the Double-Shell Tank System

The DST Instrument Air Subsystem shall condition and distribute instrument air to the DST System components.

- a. RPP-5227, *Waste Feed Delivery Raw Water, Potable Water and Compressed Air Capacity Evaluation*, 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.
- 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.

Table 3-5. Instrument Air Requirements.

Tank Farm	Projected Maximum Demand		Required Minimum Pressure	
	L/s	ft ³ /min	kPa	(lbf/in ² gauge)
AN	14	30	172	25-30
AP	16	34	241	35-40
AW	10	21	207	30-35
AY	3	7	241	35-40
AZ	5	10	241	35-40
SY	0.5	1	207	30-35

3.2.2 Physical Characteristics

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

- 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.
- 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.
- 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.

3.2.3 Reliability

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

- a. The 480/277 V ac electrical distribution subsystem reliability shall comply with *Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems*, IEEE 493, to ensure a continuous power supply to systems and equipment designated as critical.
- b. All of the DST utility subsystems shall have a design life of 35 years.

3.2.4 Maintainability

The design shall consider the maintainability factors peculiar to the specific equipment to be used in the DST Utilities Subsystems.

- a. The DST Electrical Subsystem distribution should be designed such that required preventive maintenance or calibration can be performed outside of the tank farms.
- 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.
- c. The DST Raw Water Subsystem shall provide shut-off valves to isolate equipment, valves, or appurtenances for ease of maintenance.

3.2.5 Environmental Conditions

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

3.2.5.1 Natural Environments

This section defines the natural conditions (e.g., weather).

- a. The DST Utilities Subsystems shall be designed for the natural environmental conditions specified in *Natural Phenomena Hazards, Hanford Site Washington*, HNF-SD-GN-ER-501.
- b. The new DST Utilities Subsystems shall be designed to withstand the natural phenomena hazards as specified in *Engineering Design and Evaluation*, RPP-PRO-097.

3.2.5.2 Induced Environments

This section defines the induced environment impinging on the subsystems including waste chemistry and radiation.

3.2.5.2.1 Chemistry. Not applicable.

3.2.5.2.2 Radiation. Not applicable.

3.2.6 Transportability

Not applicable.

3.2.7 Flexibility and Expansions

The subsystems shall satisfy the following flexibility and expansion requirements.

- a. The DST Utilities Subsystems shall comply with the flexibility and expansion requirements of *General Design Criteria*, DOE Order 6430.1A, 0110-3.

3.3 DESIGN AND CONSTRUCTION

The DST Utilities Subsystems shall comply with DOE Order 6430.1A, Sections 1300-7 and 1323.

3.3.1 Materials, Processes, and Parts

This section defines DST Utilities Subsystems requirements governing the use of materials and processes.

3.3.1.1 General

- a. All general service DST Utilities Subsystem structures shall meet the applicable design, test, and construction requirements contained in *Building Code Requirements for Reinforced Concrete*, ACI 318.

3.3.1.2 DST Electrical Power Subsystem

- a. Indoor electrical equipment enclosures shall be NEMA Type 12.
- 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.
- c. The DST Electrical Power Subsystem distribution system modification shall comply with *National Electrical Code*, NFPA 70.
- d. Subsystem protection shall comply with *Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems*, IEEE 242.
- e. Switchgear (i.e., motor control centers and control panels) shall comply with *IEEE Standards Collection: Power and Energy – Switchgear, Circuit Breakers and Substations*, IEEE C37 Series.
- f. Exterior lighting system control shall use time clocks and/or photocells to provide illumination only when needed.
- g. Interior lighting shall make maximum use of florescent and/or high-intensity discharge lighting.
- h. Outdoor electrical equipment enclosures shall be NEMA Type 4 or Type 4x.
- 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.
- j. Any modifications to the Site electrical utilities distribution system, including the 13.8 kV ac – 480 V ac transformers, shall conform to the *National Electrical Safety Code*, ANSI C2.
- k. New or upgraded Electrical Utility transformers shall be sized and installed in accordance with *Distribution, Power, and Regulating Transformers Standards Collection*, IEEE C57.

- l. Electrical equipment, identified as Electrical Utilities-owned, shall be designed in accordance with Electrical Utilities Design Authority project design criteria.
- m. Electrical design and installation shall comply with the electrical safety installations requirements outlined in RPP-PRO-089, *Electrical Installation Safety*, Rev. 0.

3.3.1.3 Mechanical Utilities Subsystems.

- a. All valves shall meet the applicable design and fabrication requirements contained in *Valves-Flanged, Threaded, and Welding End*, ASME B16.34.
- 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.
- c. All water piping shall be designed in accordance with the *Uniform Plumbing Code* of the International Association of Plumbing and Mechanical Officials.
- 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 *Water System Design Manual*, DOH 331-123; "State Building Code," RCW 19.27; "Water System Operations," WAC-246-290; and *Criteria for Sewage Works Design*.
- 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.
- 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.
- g. Air compressors shall be skid mounted, self-contained units with built-in cooling capability.
- h. All piping shall be designed, constructed, installed, and tested per *Process Piping*, ASME B31.3.

3.3.2 Electromagnetic Radiation

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

3.3.3 Nameplates and Product Marking

This section defines marking and nameplate requirements of the various assemblies and subassemblies that make up the DST Utilities Subsystems.

- a. The DST Utilities Subsystems 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.
- 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 *Standardized Equipment Labeling Program for Electric Utilities*, KEH-SD-LL-RD-004, and *Electrical Utilities Engineering Desk Instructions*, WHC-IP-0558, DI-52660-3.01.

3.3.4 Workmanship

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

3.3.5 Interchangeability

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

3.3.6 Safety

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

3.3.6.1 Personnel Safety

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

- a. The DST Utilities Subsystems shall be designed to keep personnel exposures as low as reasonable achievable (ALARA) in accordance with *ALARA Decision-Making Methods*, RPP-PRO-1621 and *Radiological Design Review Process*, RPP-PRO-1622.
- b. The DST Utilities Subsystems shall incorporate design features that comply with the requirements of *Tank Farms Health and Safety Plan*, HNF-SD-WM-HSP-002.
- 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.
- d. Required fire protection piping shall be in accordance with *Installation of Private Fire Service Mains and Their Appurtenances*, NFPA 24.

3.3.6.2 Equipment Protection

The DST Utilities Subsystems shall be designed to avoid damage to other components.

- a. The DST Utilities Subsystems shall incorporate corrosion prevention and control features in accordance with "Dangerous Waste Regulations," WAC 173-303-640(3); DOE Order 6430.1A, Section 0262; and *Radioactive Waste Management*, DOE Order 5820.2A, Chapter 1, Sec. 3.b (2)(g).
- b. Cathodic protection systems, if required, shall be designed in accordance with the guidelines provided in *Corrosion Control of Underground Storage Tank Systems by Cathodic Protection*, NACE RP 0285-95, and *Control of External Corrosion on Underground or Submerged Metallic Piping Systems*, NACE RP 0169-96.
- 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.
- d. Underground piping shall be protected from external chemical and electrolytic attacks caused by soil conditions.
- e. Lightning protection, if required, shall be designed in accordance with *Standards for the Installation of Lightning Protection Systems*, NFPA 780.

3.3.6.3 Environmental Safety

The DST Utilities Subsystems shall be designed to protect the public and the environment in accordance with the following requirements.

- a. The DST Utilities 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 *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, based on the guidelines in HNF-SD-WM-SAR-067, Section 3.0. Preliminary safety classifications are provided for reference in Appendix B.
- b. All equipment installed in areas in and around the tank that are subject to ignition controls shall be designed to meet the requirements of HNF-SD-WM-TSR-006, Section 5.10, "Ignition Controls." Areas requiring controls are delineated in HNF-SD-WM-SAR-067, Appendix K. The Flammable Gas Equipment Advisory Board shall be consulted whenever the application or interpretation of the requirements is unclear.
- c. 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.

3.3.7 Human Performance/Human Engineering

The subsystems shall be designed for ease of operation.

- a. Subsystem designs shall comply with DOE Order 6430.1A, Section 1300.12, "Human Factors Engineering."
- b. Control devices shall be designed in accordance with *Human-System Interface Design Review*, NUREG 0700, Section 6.4, and *Human Engineering Design Criteria for Military Systems, Equipment, and Facilities*, MIL-STD-1472C, Section 5.4.

3.3.8 Decontamination and Decommissioning

This section defines features found to enhance decontamination at the end of the life of the DST Utilities Subsystems.

- 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.

3.3.9 Radiation Area Security.

Not used.

3.4 DOCUMENTATION

This section defines the procedures that will control various documents associated with the DST Utilities Subsystems.

- 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 *Engineering Requirements*, RPP-PRO-709.
- b. DST Utilities Subsystem structures, systems, and components (SSC) shall be incorporated into the master equipment list in accordance with <TBD>.

3.5 LOGISTICS

This section identifies maintenance infrastructure support requirements.

3.5.1 Maintenance

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

- 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.
- 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.
- c. Backflow-preventers shall be easily accessible for annual testing and acceptance by a state-certified inspector.

3.5.2 Supply

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

3.5.3 Facility and Facility Equipment

Not applicable.

3.6 PERSONNEL AND TRAINING

Not applicable.

3.7 CHARACTERISTICS OF SUBELEMENTS

The major components of the DST Utilities Subsystems are as follows:

- DST Electrical Power Subsystem
- DST Raw Water Subsystem
- DST Potable Water Subsystem
- DST Instrument Air Subsystem
- DST Service Air Subsystem.

3.7.1 Double-Shell Tank Electrical Power Subsystem

The interface points between the central plateau electrical distribution infrastructure and the DST farm electrical distribution subsystem are typically on the secondary side of the DST farm service transformers. The exact interface points are negotiated between DYN and the DOE Office of River Protection. Guidelines for the establishment of these interface points are defined in *Electrical Utilities Interface Agreement with Facilities/Plants*, HNF-PRO-481.

The DST Electrical Power Subsystem consists primarily of 480/277 V load centers located throughout the DST farm complex. The 480/277 V load centers distribute power to motor control centers and circuit breaker panels for DST farm complex equipment. The DST Electrical Power Subsystem also distributes power to transformers that step down the 480 V power to the 240/120 V and 208/120 V circuit breaker panels for DST equipment requiring these lower voltages. The DST Electrical Power Subsystem consists of motor control centers, transformers, switches, and related equipment.

The DST farm backup power electrical distribution is required to maintain full operation of safety-class equipment (requiring electrical power to fulfill its safety function) upon loss of normal power. The DST Ventilation Subsystem contains a number of safety-class components that may require electrical power from the backup power electrical distribution subsystem or uninterruptible power supply upon loss of normal power.

There is no known requirement for a universal dedicated UPS within the DST farms. Where UPS devices are supplied for individual equipment, they are considered part of the equipment.

3.7.2 Double-Shell Tank Raw Water Subsystem

The DST Raw Water Subsystem consists of piping, service pits, and related components that distribute strained raw water to DST farm complex equipment. Strained raw water is supplied to provide makeup water to the DST Diluent and Flush Subsystem, to flush the DST Transfer Piping Subsystem and various mixer pump components. Raw water service to the DST farms is received from a branch circuit from the main lines to the DST farm service point.

The DYN-operated raw and potable water systems typically interface with the DST Raw and Potable Water subsystems at a point 1.5 m (5 ft) outside the fence of the tank farm at the backflow prevention device. Design and installation of backflow prevention is the responsibility of the DST Raw Water Subsystem with periodic inspections performed by DYN.

3.7.3 Double-Shell Tank Potable Water Subsystem

Potable water is distributed to tank farms within the 200 West and 200 East Areas. The DYN-operated potable water system typically interfaces with the DST Potable Water Subsystem at a point 1.5 m (5 ft) outside the fence of the tank farm at the backflow prevention device. Installation of backflow prevention is the responsibility of the DST Raw Water Subsystem with periodic inspections performed by DYN. Potable water is used in safety showers and eyewash stations in the DST Diluent and Flush Subsystem.

3.7.4 Double-Shell Tank Instrument Air Subsystem

The DST Instrument Air Subsystems consist of an air treatment section with filters and air dryers (if required) and a pressure control and distribution section. Typically, instrument air is distributed at 207 kPa to 276 kPa (30 to 40 lbf/in² gauge) to the instrument air headers and at 103 to 138 kPa (15 to 20 lbf/in² gauge) at individual instruments. Instrument air is drawn from the service air receiver tanks, filtered, dried, refiltered, stepped down to instrument air pressure and distributed.

3.7.5 Double-Shell Tank Service Air Subsystem

The DST Service Air Subsystems typically consist of air compressors, an air treatment section with filters and air dryers, and a pressure control and distribution section. Typically service air is distributed at 586 to 621 kPa (85 to 90 lbf/in² gauge). Air is compressed, cooled, and stored in receiver tanks at 690 kPa (100 lbf/in² gauge). The service air is drawn from the receiver tank and stepped down to the service air pressure for distribution.

3.8 PRECEDENCE

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

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

- National consensus codes and standards.

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

3.9 SECURITY

The subsystems shall be designed such that access controls to radiation and high-radiation areas meet the requirements of *Hanford Radiological Control Manual*, DOE/RL-96-109.

3.10 COMPUTER RESOURCE RESERVE CAPACITY

Not applicable.

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4.0 QUALITY ASSURANCE PROVISIONS

Quality assurance for the DST Utilities Subsystems shall be performed in accordance with "Quality Assurance Program," HNF-IP-0842, Volume XI, Section 1.0.

4.1 GENERAL

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

4.1.1 Responsibility

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

4.1.2 Special Tests

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

- a. Electrical materials and equipment shall be qualification tested unless they are Underwriters Laboratories, Inc. (UL) listed, or Factory-Mutual Approved, with label attached, and for the purpose intended, whenever such products are available. Where no UL or listed Factory-Mutual Approved products are available, testing and certification by another Nationally Recognized Testing Laboratory may be acceptable, as long as the design agent documents acceptance of the testing organization.
- b. Control equipment shall comply with NEMA ICS standards and *UL Standard for Safety for Industrial Control Equipment*, UL 508.

4.2 DESIGN VERIFICATION

Design verification shall be performed on the DST Utilities Subsystems, as represented in design drawings, prototypes, engineering models, etc., for the purposes of verifying that the design

identified in RPP-PRO-1819, Section 2.9.1. Inspection of the subsystem design to ensure compliance with the requirements of Section 3.0 shall be performed by one or more of the following methods: qualification testing, reviews, and/or alternate calculations. The verification method(s) that applies to each specification requirement is identified in Appendix A. Definitions of qualification testing, reviews, and alternate calculations are as follows.

- a. Qualification testing is a design verification method consisting of tests on hardware representative of the design being verified. Qualification testing can be subdivided into methods that consist of checking functional operation (Demonstration) and methods that consist of measuring specific hardware inputs/outputs (Test) to verify compliance of the design with requirements.
 - i. Demonstration is a subcategory of the “qualification testing” design verification method. Demonstration is limited to readily observable functional operation to determine compliance with requirements. Demonstration does not require the use of special equipment or sophisticated instrumentation.
 - ii. Test is another subcategory of the “qualification testing” design verification method. Test employs technical means including, but not limited to, the evaluation of functional characteristics by use of special equipment or instrumentation and the application of established principles and procedures to determine compliance with requirements. The evaluation of data derived from test is an integral part of Test.
- b. Review is a design verification method that consists of an investigation of the existing design information. This can be done via a simple review of the design media (Examination) or a rigorous analysis of the design, as represented in the design media (Analysis).
 - i. Examination is a subcategory of the “review” design verification method. Examination consists of investigation without the use of special laboratory equipment or procedures to determine compliance with requirements. Examination can be performed on design media such as drawings, design reports, etc.
 - ii. Analysis is a subcategory of the “review” design verification method. Analysis takes the form of processing accumulated results and conclusions, intended to provide proof that verification of a requirement has been accomplished. The analytical results may comprise a compilation/interpretation of existing information or may be obtained from lower level examination, tests, demonstrations, or analyses.
- c. Alternate calculation is a verification of a calculation or analysis using alternate methods or procedures.

Field verification of DST Utilities Subsystem performance/design features and acceptance inspection of construction is called out in Section 2.9.2 of RPP-PRO-1819.

5.0 PREPARATION FOR DELIVERY

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

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6.0 NOTES

6.1 DEFINITIONS

Administrative Lock—A locking device that prevents an inadvertent equipment start. Administrative locks ensure that the equipment or systems(s) being isolated and/or controlled cannot be operated (e.g., removing the motive force of a transfer pump such as electrical power, steam, water, or air and installing an administrative lock so that the transfer pump cannot be activated) until the administrative lock is removed.

General Service (GS) SSC – An SSC not classified as either safety class or safety significant.

Manifold—A remotely installed rigid piping system inside a pit that transfers waste and flush water between nozzles.

Physically Connected—Refers only to piping, tanks, structures, and their associated instrumentation per HNF- SD-WM-TSR-006.

- Physically connected piping is any piping that is part of, or connected to, the transfer route. Piping need not be considered connected to the transfer route if it is physically disconnected by a removal of piping (i.e., air gap) or isolated with a blind flange/process blank. Note that closed valves do not physically disconnect piping. An operable service water pressure detection system is considered to physically disconnect piping on either side of the detection system. The east/west cross-site transfer line is considered physically connected piping only when cross-site waste transfers are in progress. The replacement cross-site transfer line is the piping between the 241-SY-A and 241-SY-B valve pits and the 244-A lift station.
- Physically connected structures are those structures through which physically connected piping runs, or structures that could be subject to leakage from physically connected piping.
- Physically connected tanks are tanks connected to the transfer route, tanks connected to the physically connected piping, and tanks designed to receive leakage from physically connected piping through a drain path.

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

Safety Significant (SS) SSC – An SSC that prevents or mitigates releases of radiological materials to onsite workers and toxic chemicals to the offsite public and onsite workers. Safety Significant also describes worker safety SSCs that protect the facility worker from serious injury

(or fatality) caused by hazards not controlled by institutional safety programs. Facility SSCs that are major contributors to defense-in-depth are identified as Safety-Significant SSCs (HNF-SD-WM-SAR-067, Section 4.1).

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

Shall – Denotes a requirement.

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

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

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

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

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

6.2 LIST OF TERMS

ACI	American Concrete Institute
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
DOE	U.S. Department of Energy
DST	double-shell tank
DYN	DynCorp of Tri-Cities Services Inc.
GS	general service
HLW	high-level waste
ICS	Industrial Controls and Systems
IEEE	Institute of Electrical and Electronics Engineers
LAW	low-activity waste
MIL-STD	military standards
MOU	memorandum of understanding
NACE	National Association of Corrosion Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers' Association
NFPA	National Fire Protection Association
NUREG	U.S. Nuclear Regulatory Commission Regulation
RAM	reliability, availability and maintainability
RPP	River Protection Project
SC	safety class
SS	safety significant
SSC	structures, systems, and components
TBD	to be determined
TBR	to be refined
UL	Underwriters Laboratories
WAC	<i>Washington Administration Code</i>
WFD	waste feed delivery

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7.0 REFERENCES

- DOE Order 5480.23, 1994, *Nuclear Safety Analysis Reports*, U.S. Department of Energy, Washington, D.C.
- HNF-1939, Rev. 0a, 1999, *Waste Feed Delivery Technical Basis*, Vol. II, Addendum 1-1, "Waste Feed Delivery Flow Sheet for Tank 241-AZ-101," Numatec Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.
- HNF-1939, Rev. 0b, 1999, *Waste Feed Delivery Technical Basis*, Vol. II, Addendum 2-1, "Waste Feed Delivery Flow Sheet for Tank 241-AN-105," Numatec Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.
- HNF-1939, Rev. 0c, 1999, *Waste Feed Delivery Technical Basis*, Vol. II, Addendum 3-1, "Waste Feed Delivery Flow Sheet for Tank 241-AN-104," Numatec Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.
- HNF-5136, 2000, *Functional Analysis for Double-Shell Tank Subsystems*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.
- HNF-SD-WM-SP-012, 1999, *Tank Waste Remediation System Operation and Utilization Plan to Support Waste Feed Delivery*, Rev. 1, Numatec Hanford Corporation, Lockheed Martin Hanford Corporation, and COGEMA Engineering Corporation for Fluor Daniel Hanford Inc., Richland, Washington.
- HNF-SD-WM-TRD-007, 2000, *System Specification for the Double-Shell Tank System*, Draft 0, COGEMA Engineering Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.
- KEH-SD-LL-RD-004, 1994, *Standardized Equipment Labeling Program for Electric Utilities*, ICF Kaiser Hanford Company, Richland, Washington.
- RPP-5227, 2000, *Waste Feed Delivery Raw Water, Potable Water, and Compressed Air Capacity Evaluation*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.
- RPP-5228, 2000, *Assessment of the Electrical Power Requirements for Continued Safe Storage and Waste Feed Delivery, Phase One*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.
- WHC-IP-0558, 1998, *Electrical Utilities Engineering Desk Instructions*, DI-52660-3.01, Rev. 3, Fluor Daniel Hanford, Inc., Richland, Washington.

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SOURCE DOCUMENTS AND TEST METHODS

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SOURCE DOCUMENTS AND TEST METHODS (13 SHEETS)

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method				
				E x a m p l e	D T A	A i t N	/	C a i c
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.	DYN MOU-002	Section 3.5.1					X
3.1.2.1.2.a	The DST Raw Water Subsystem shall be designed to operate within the values in Table 3-2.	RPP-5227						
3.1.2.1.3.a	The DST Potable Water Subsystem shall be designed to operate within the values in Table 3-3.	RPP-5227						
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.							
3.1.2.1.5.1.a	The DST Instrument Air Subsystem shall be designed to operate with 240/120 V ac 60 Hz.							
3.1.2.1.5.2.a	The DST Instrument Air Subsystem shall be designed to operate with 240/120 V ac 60 Hz.	RPP-5227						
3.2.1.1.a	The DST farm electrical distribution subsystem shall have a leading or lagging power factor of greater than 85 percent.	DOE Order 6430.1A, Section 1630-1.2						X
3.2.1.1.1.a	RPP-5228, <i>Assessment of the Electrical Power Requirements for Continued Safe Storage and Waste Feed Delivery Support (SSTs/DSTs)</i> 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>, <i>Tank Farm Contractor Electrical Load Study</i> .	<TBD>						X
3.2.1.1.1.b	The DST Electrical Power Subsystem distribution shall provide voltage regulation in compliance with <i>Voltage Ratings for Electric Power Systems and Equipment (60 Hz)</i> , ANSI C84.1.	DOE Order 6430.1A, Section 1605-1					X	
3.2.1.1.2.a	Exterior and interior lighting shall comply with <i>The IESNA Lighting Handbook</i> .	DOE Order 6430.1A, Section 1650-1					X	
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.	ANSI C84.1					X	

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				E D T A	E x e m	D e m o	A n a l i	l c
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.	DOE Order 6430.1A, Section 1660-1; HNF-SD-WM-SAR-067, Chapter 4, Section 4.5.1					X	
3.2.1.2.a	RPP-5227, <i>Waste Feed Delivery Raw Water, Potable Water and Compressed Air Capacity Evaluation</i> , 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>, <i>Tank Farm Contractor Water Load Study</i> .	<TBD>						
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 lb/in ² gauge) <TBR> to the DST Maintenance and Recovery Subsystem.	DOE Order 6430.1A, Section 1540-13.1					X	
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>.	<TBD>						X
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.	HNF-4553, Table A			X			
3.2.1.3.a	RPP-5227, <i>Waste Feed Delivery Raw Water, Potable Water and Compressed Air Capacity Evaluation</i> , 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>, <i>Tank Farm Contractor Water Load Study</i> .	RPP-5227						

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				E x a m p l e	D T A	T e n C	A t N	A l c
3.2.1.4.a	RPP-5227, <i>Waste Feed Delivery Raw Water, Potable Water and Compressed Air Capacity Evaluation</i> , 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.	RPP-5227				X		
3.2.1.5.a	RPP-5227, <i>Waste Feed Delivery Raw Water, Potable Water and Compressed Air Capacity Evaluation</i> , includes a detailed assessment projected demand for Instrument Air required for Waste Feed Delivery. The results of this assessment are included in Table 3-5. Actual tank farm loads shall be as determined by detail design.	RPP-5227				X		
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.	RPP-5227				X		
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.	DOE Order 6430.1A, Section 0203-1.2		X				
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.	DOE Order 6430.1A, Section 0203-1.2		X				
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.	DOE Order 6430.1A, Section 270-1.3		X				
3.2.3.a	The 480/277 V ac electrical distribution subsystem reliability shall comply with <i>Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems</i> , IEEE 493, to ensure a continuous power supply to systems and equipment designated as critical.	DOE Order 6430.1A, Section 1640-1.4						

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				E x a m p l e	D T A	A l t	N / A		
3.2.3.b	All of the DST utility subsystems shall have a design life of 35 years.	HNF-SD-WM-SP-012	Phase 2 retrieval operations are scheduled to be completed in the year 2034						
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.	RPP-PRO-1621		X					
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.	RPP-PRO-1621		X					
3.2.4.c	The DST Raw Water Subsystem shall provide shut-off valves to isolate equipment, valves, or appurtenances for ease of maintenance.								
3.2.5.1.a	The DST Utilities Subsystems shall be designed for the natural environmental conditions specified in <i>Natural Phenomena Hazards, Hanford Site Washington</i> , HNF-SD-GN-ER-501.	HNF-SD-GN-ER-501				X			
3.2.5.1.b	The new DST Utilities Subsystems shall be designed to withstand the natural phenomena hazards as specified in <i>Engineering Design and Evaluation</i> , RPP-PRO-097.	RPP-PRO-097; DOE Order 6430.1A				X			
3.2.5.2.1	Chemistry	N/A						X	
3.2.5.2.2	Radiation	N/A						X	
3.2.6	Transportability	N/A						X	
3.2.7.a	The DST Utilities Subsystems shall comply with the flexibility and expansion requirements of <i>General Design Criteria</i> , DOE Order 6430.1A, 0110-3.	DOE Order 6430.1A, Section 0110-3		X					
3.3	The subsystems shall comply with DOE Order 6430.1A, Sections 1300-7 and 1323.	DOE Order 6430.1A, Sections 1300-7 and 1323							
3.3.1.1.a	All general service DST Utilities Subsystem structures shall meet the applicable design, test, and construction requirements contained in <i>Building Code Requirements for Reinforced Concrete</i> , ACI 318.	RPP-PRO-097, Table B-1							

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				E x a m p l e	D T A	A l t	N / A
3.3.1.2.a	Indoor electrical equipment enclosures shall be NEMA Type 12.	NFPA 70, <i>National Electrical Code</i>		X			
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.	DOE Order 6430.1A, Section 1640-1.5					
3.3.1.2.c	The DST Electrical Power Subsystem distribution system modification shall comply with NFPA 70.	DOE Order 6430.1A, Section 1605-1					
3.3.1.2.d	Subsystem protection shall comply with <i>Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems</i> , IEEE 242.	RPP-PRO-097, Table B-1					
3.3.1.2.e	Switchgear (i.e., motor control centers and control panels) shall comply with <i>IEEE Standards Collection: Power and Energy – Switchgear, Circuit Breakers and Substations</i> , IEEE C37 Series.	DOE Order 6430.1A, Section 1630-2.1					
3.3.1.2.f	Exterior lighting system control shall use time clocks and/or photocells to provide illumination only when needed.	DOE Order 6430.1A, Section 1650-1					
3.3.1.2.g	Interior lighting shall make maximum use of fluorescent and/or high-intensity discharge lighting.	DOE Order 6430.1A, Section 1655-2					
3.3.1.2.h	Outdoor electrical equipment enclosures shall be NEMA Type 4 or Type 4x.	NFPA 70, <i>National Electrical Code</i> ; RPP-PRO-097, Table B-1		X			
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. <ul style="list-style-type: none"> • Load Flow Calculation • Coordination Study Calculation • Short Circuit Fault Study. 						

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				E x a m p l e	D e s i g n	T e s t i n g	A n a l y s i s	I n s t a l l a t i o n
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 <i>National Electrical Safety Code</i> , ANSI C2.							
3.3.1.2.k	New or upgraded Electrical Utility transformers shall be sized and installed in accordance with IEEE C57, Distribution, Power, and Regulating Transformers Standards Collection.	RPP-PRO-097, Table B-1		X				
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.	Electrical Utilities Design Authority		X				
3.3.1.2.m	Electrical design and installation shall comply with the electrical safety installations requirements outlined in RPP-PRO-089, <i>Electrical Installation Safety</i> , Rev. 0.							
3.3.1.3.a	All valves shall meet the applicable design and fabrication requirements contained in <i>Valves-Flanged, Threaded, and Welding End</i> , ASME B16.34.	RPP-PRO-097, Table B-1						
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 (Chapter 19.27 RCW 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 <i>Manual of Cross-Connection Control</i> published by the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California, and the <i>Cross-Connection Control Manual, Accepted Practice and Procedure</i> published by the Pacific Northwest Section of the American Water Works Association.	WAC 246-290						
3.3.1.3.c	All water piping shall be designed in accordance with the <i>Uniform Plumbing Code</i> of the International Association of Plumbing and Mechanical Officials.	RPP-PRO-097, Table B-1						

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				E D T A	x c e n	a m s a	m o t i	A i t N / A
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 <i>Water System Design Manual</i> , DOH 331-123; "State Building Code," RCW 19.27; "Water System Operations," WAC-246-290; and <i>Criteria for Sewage Works Design</i> .	DYN MOU-002;						
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.	DYN MOU-002; HNF-SD-WM-TSR-006, AC 5.21						
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.	DYN MOU-002; HNF-SD-WM-TSR-006, AC 5.21						
3.3.1.3.g	Air compressors shall be skid mounted, self-contained units with built-in cooling capability.	WAC 246-290						
3.3.1.3.h	All piping shall be designed, constructed, installed, and tested per <i>Process Piping</i> , ASME B31.3.							
3.3.2	The subsystems shall comply with electromagnetic radiation emission requirements set forth in <i>A List of EMI/EMC Requirements</i> , HNF-2962.	HNF-2962						
3.3	The DST Utilities Subsystems shall comply with DOE Order 6430.1A, Sections 1300-7 and 1323.							

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS (13 SHEETS)

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method				
				E x a m p l e	D e m o	T e s t	A n a l y s i s	A l t e r n a t i v e
3.3.3.a	The DST Utilities Subsystems 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 <i>RPP Administration</i> , "Tank Farm Operations Equipment Labeling," HNF-IP-0842, Volume II, Section 6.1.	HNF-IP-0842, Volume II, Section 6.1		X				
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 <i>Standardized Equipment Labeling Program for Electric Utilities</i> , KEH-SD-LL-RD-004, and <i>Electrical Utilities Engineering Desk Instructions</i> , WHC-IP-0558, DI-52660-3.01.	KEH-SD-LL-RD-004; WHC-IP-0558						
3.3.4	Reserved. The requirements for workmanship are to be addressed in lower level project design documentation (drawings, procurement specifications, etc.).	N/A						X
3.3.5	All like equipment and parts shall be interchangeable/standardized to the maximum extent practical.	DOE Order 6430.1A, Sections 0110-3 and 1100; HNF-4553, Section 7.3		X				
3.3.6.1.a	The DST Utilities Subsystems shall be designed to keep personnel exposures as low as reasonable achievable (ALARA) in accordance with <i>ALARA Decision-Making Methods</i> , RPP-PRO-1621 and <i>Radiological Design Review Process</i> , RPP-PRO-1622.	RPP-PRO-1621; RPP-PRO-1622				X		
3.3.6.1.b	The DST Utilities Subsystems shall incorporate design features that comply with the requirements of <i>Tank Farms Health and Safety Plan</i> , HNF-SD-WM-HSP-002.	HNF-SD-WM-SAR-067, Section 11.3.1.2						X
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.	HNF-IP-0842, Vol. II, Section 4.9.1		X				

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				E x a m p l e	D e m o	T e s t	A n a l y s i s	A l t e r n a t i v e
3.3.6.1.d	Required fire protection piping shall be in accordance with <i>Installation of Private Fire Service Mains and Their Appurtenances</i> , NFPA 24.	RPP-PRO-097, Table B-1						
3.3.6.2.a	The DST Utilities Subsystems shall incorporate corrosion prevention and control features in accordance with "Dangerous Waste Regulations," WAC 173-303-640(3); DOE Order 6430.1A, Section 0262; DOE Order 5820.2A, Chapter 1, Sec. 3.b (2)(g).	WAC 173-303-640(3); DOE Order 6430.1A, Section 0262; DOE Order 5820.2A, Chapter 1, Sec. 3.b (2)(g).		X			X	
3.3.6.2.b	Cathodic protection systems, if required, shall be designed in accordance with the guidelines provided in <i>Corrosion Control of Underground Storage Tank Systems by Cathodic Protection</i> , NACE RP 0285-95, and <i>Control of External Corrosion on Underground or Submerged Metallic Piping Systems</i> , NACE RP 0169-96.	WAC 173-303-640(3); NACE RP 0285-95; NACE RP 0169-96					X	
3.3.6.2.c	The equipment used for installation and maintenance shall not exceed the DST dome loading constraints given in <i>Tank Farms Operations Administrative Controls</i> , HNF-IP-1266.	HNF-SD-WM-TRD-007, Section 3.3.6.2.4					X	
3.3.6.2.d	Underground piping shall be protected from external chemical and electrolytic attacks caused by soil conditions.	WAC 173-303-640(3); DOE Order 6430.1A, Section 0262; DOE Order 5820.2A, Chapter 1, Sec. 3.b (2)(g).					X	
3.3.6.2.e	Lightning protection, if required, shall be designed in accordance with <i>Standards for the Installation of Lightning Protection Systems</i> , NFPA 780.	RPP-PRO-097, Table B-1		X				

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				E x a m p l e	D e m o	T e s t	A n a l y s i s	A l t e r n a t i v e
3.3.6.3.a	The DST Utilities 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 <i>Safety Analysis and Technical Safety Requirements</i> , RPP-PRO-700; <i>Safety Analysis Process - Facility Change or Modification</i> , RPP-PRO-702; <i>Safety Analysis Process - New Project</i> , RPP-PRO-703; and <i>Hazard and Accident Analysis Process</i> , 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.	HNF-SD-WM-SAR-067, Section 3.0; RPP-PRO-700; RPP-PRO-702; RPP-PRO-703; RPP-PRO-704				X		
3.3.6.3.b	All equipment installed in areas in and around the tank that are subject to ignition controls shall be designed to meet the requirements of HNF-SD-WM-TSR-006, Section 5.10, "Ignition Controls." Areas requiring controls are delineated in HNF-SD-WM-SAR-067, Appendix K. The Flammable Gas Equipment Advisory Board shall be consulted whenever the application or interpretation of the requirements is unclear.	HNF-SD-WM-TSR-006, Section 5.10; HNF-SD-WM-SAR-067, Appendix K				X		
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.	HNF-SD-WM-TSR-006		X				
3.3.7.a	Subsystem designs shall comply with DOE Order 6430.1A, Section 1300.12, "Human Factors Engineering."	DOE Order 6430.1A, Section 1300-12		X				
3.3.7.b	Control devices shall be designed in accordance with <i>Human-System Interface Design Review</i> , NUREG 0700, Section 6.4, and <i>Human Engineering Design Criteria for Military Systems, Equipment, and Facilities</i> , MIL-STD-1472C, Section 5.4.	DOE Order 6430.1A, Section 1300-12.4.7						X
3.3.8.a	All components that may become contaminated with radioactive or other hazardous materials under normal or abnormal operating conditions shall be designed to incorporate measures to simplify future decontamination and decommissioning in accordance with DOE Order 6430.1A, Section 1300-11.	DOE Order 6430.1A, Section 1300-11.2.						X

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				Ex	D	T	A	A
				a	m	s	a	i
				m	o	t	i	c
3.4.a	Records, documents, and drawing control pertinent to design functions shall be in accordance with <i>Quality Assurance Records Standards</i> , RPP-PRO-222, and <i>Document Control Program Standards</i> , RPP-PRO-224. Engineering document development shall be in accordance with <i>Engineering Requirements</i> , RPP-PRO-709.	RPP-PRO-222; RPP-PRO-224; RPP-PRO-709; RPP-PRO-1819.		X				
3.4.b	All DST Utilities Subsystem structures, systems, and components (SSC) shall be incorporated into the master equipment list in accordance with <TBD>.	<TBD>	New master equipment list procedure currently under development.					X
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.	DOE Order 6430.1A, Section 1300-6.3						X
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.	DOE Order 6430.1A, Section 1300-6.3						X
3.5.1.c	Backflow-preventers shall be easily accessible for annual testing and acceptance by a state-certified inspector.	HNF-SD-WM-SEL-040		X				
3.5.2	The subsystem designs shall use readily available commercial parts and components to the greatest extent practical.	DOE Order 6430.1A	Section 1100 Equipment - General	X				
3.6	Personnel and Training	N/A						X
3.7.1	Double-Shell Tank Electrical Power Subsystem	N/A	Existing system information					X
3.7.2	Double-Shell Tank Raw Water Subsystem	N/A	Existing system information					X
3.7.3	Double-Shell Tank Potable Water Subsystem	N/A	Existing system information					X
3.7.4	Double-Shell Tank Instrument Air Subsystem	N/A	Existing system information					X
3.7.5	Double-Shell Tank Service Air Subsystem	N/A	Existing system information					X

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				E x a m	D e m o	T e s t	A n a	A l i c
3.8	<p>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:</p> <ul style="list-style-type: none"> Federal requirements (e.g., <i>Code of Federal Regulations</i>, DOE orders) State requirements (e.g., Revised Code of Washington, as specified in the <i>Washington Administrative Code</i>) Local ordinances RPP procedures National consensus codes and standards. <p>The hierarchy is useful in establishing the relative order of precedence of the requirements documents levied in this specification.</p> <p>The subsystems shall be designed such that access controls to radiation and high-radiation areas meet the requirements of <i>Hanford Radiological Control Manual</i>, DOE/RL-96-109.</p>	N/A						X
3.9	Computer Resource Reserve Capacity	DOE/RL-96-109						X
3.10	Quality assurance for the DST Utilities Subsystems shall be performed in accordance with "Quality Assurance Program," HNF-IP-0842, Volume XI, Section 1.0.	N/A						X
4.0		HNF-SD-WM-SAR-067, Section 14.3.1						X

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				E x a m p l e	D T A	T e s t	A n a l y	A i t N / A
4.1.2 a	Electrical materials and equipment shall be qualification tested unless they are Underwriters Laboratories, Inc. (UL) listed, or Factory-Mutual Approved, with label attached, and for the purpose intended, whenever such products are available. Where no UL or listed Factory-Mutual Approved products are available, testing and certification by another Nationally Recognized Testing Laboratory may be acceptable, as long as the design agent documents acceptance of the testing organization.	DOE Order 6430.1A, Section 1605-1		X				
4.1.2 b	Control equipment shall comply with NEMA ICS standards and <i>UL Standard for Safety for Industrial Control Equipment</i> , UL 508.							
4.2	Design Verification	RPP-PRO-1819; HNF-IP-0842, Volume IV, Section 4.24.		X				

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APPENDIX B

PRELIMINARY SAFETY CLASSIFICATIONS

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APPENDIX B

PRELIMINARY SAFETY CLASSIFICATIONS

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

Table B-1. Safety Classification of Double-Shell Tank
Utilities Subsystem Components.

Component	GS	SS	SC
DST electrical power	✓		
241-AY portable generator			✓
241-AY/AZ breakers			✓
241-SY electrical power supply system			✓
241-AN K relay in AN 241-EDS-MCC-002 for EF-003 (Train A)			✓
241-AN K relay in AN 241-EDS-MCC-002 for EF-004 (Train B)			✓
241-AP K relay in EDS-MCC-002 for EF-003 (Train A)			✓
241-AP K relay in EDS-MCC-002 for EF-004 (Train B)			✓
Raw water	✓		
Potable water	✓		
Service air	✓		
Instrument air – when supporting Tank 241-SY-101 pressure monitoring systems			✓
Backflow prevention devices		✓	
204-AR back flow prevention			✓
Service water pressure switches			✓
Instrument air – other applications	✓		

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

REFERENCE

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

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Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
M. G. Al-Wazani	R3-83	X			
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G. E. Bingham	R3-73	X			
J. F. Bores	R2-89	X			
V. C. Boyles	R2-11	X			
S. R. Briggs	R3-47	X			
C. B. Bryan	R2-58	X			
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R. A. Dodd	R3-72	X			
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W. J. Eischens	R3-75	X			
B. G. Erlandson	R1-51	X			
D. P. Fassett	R3-73	X			
J. E. Ferguson	H7-06	X			
A. H. Friberg	R1-56	X			
J. L. Gilbert	R3-25	X			
T. G. Goetz	R1-49	X			
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C. C. Haass	H6-64	X			
J. H. Hache	S2-12	X			
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L. T. Pederson	R3-83	X			
R. S. Popielarczyk	R2-58	X			
J. A. Ranschau	S7-86	X			
C. A. Rieck	R3-47	X			
C. P. Shaw	R3-74	X			
W. J. Stokes	R2-89	X			
W. T. Susiene (3)	B4-69	X			
T. L. Sweet	T2-11	X			
J. E. Van Beek	S2-48	X			
W. L. Willis	R3-73	X			