System Design Description of Electrical Distribution System for AN Tank Farm (DSA-Based)

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Abstract:  
This system design description of the electrical distribution system for the AN Tank Farms is intended to be a living compendium of design requirements, design bases, and system descriptions. The system design description includes references to relevant procedures, drawings, calculations, and supporting documents. It is written to the outline provided in DOE-STD-3024-98, *Content of System Design Descriptions*. All section headings from DOE-STD-3024-98 are included. If the information becomes available or required at a later time, it will be included to the extent possible.

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1.0 INTRODUCTION

This system design description (SDD) provides a technical explanation of the design and operation of the Electrical Distribution System (EDS), for the seven underground, double-shell tanks (DST) in the AN Tank Far in the 200 East Area at the Hanford Site (Figure 1-1). This SDD identifies the requirements and the basis for the requirements, and provides details of how the requirements have been implemented in the design and construction of the facility. It also provides general guidance for the surveillance, testing, and maintenance of this system.


Figure 1-1. Aerial Photo of the AN Tank Farm.

1.1 SYSTEM IDENTIFICATION

The EDS takes electrical power from the Bonneville Power Administration transmission grid through the Hanford Site Utility Contractor, hereafter referred to as the Utility. Power is taken from the Utility 13.8-kV line through a Utility disconnect switch to a Utility power transformer. The transformer and a Loadcenter Unit Substation are located on the same pad at the west boundary of the 241 AN Tank Farm outside the perimeter fence. A formal agreement exists
between the Utility and the Tank Farm Contractor establishing an interface of electrical responsibility at the secondary terminals of the power transformer.

The secondary voltage from the Utility power transformer is fed directly to a tank farm Loadcenter Unit Substation. The electrical power used throughout the tank farm is supplied from the loadcenter. This power is used for the operation of instrumentation, pumps, ventilation exhaust units, heat tracing, lighting, building heating, air conditioning, air compressors, and outlets for the remotely operated wrenches.

Another power source is derived from the overhead line via a fused switch and is transformed from 13.8 kV (ac) to 120/240 V (ac) by a pole-mounted transformer. The transformer is Utility-owned with no metering. The transformer serves AN Tank Farm Change Trailer T-154 through a disconnect switch.

### 1.2 LIMITATIONS OF THIS SYSTEM DESIGN DESCRIPTION

The SDD is a central coordinating link among the engineering design documents, the facility safety basis, and the implementing procedures. The SDD is a compilation of information intended primarily for use by facility operation, maintenance, and technical support personnel. The SDD is not a part of the safety basis.

The SDD is formatted to be consistent with DOE-STD-3024-98, *Content of System Design Descriptions*, and is based on the best available information, including interviews with knowledgeable personnel. This SDD is written based upon current system configuration designed and installed, and operational. It necessarily relies on historic information. If future users of the SDD discover, recover, or recreate the missing information, they should forward that information to the SDD owner for incorporation.

Chapter 3 of this SDD addresses the system requirements and bases, and provides an assessment of how the design meets the requirements. A formal assessment of how the actual, as-built structures, systems, and components (SSCs) in the field meet the requirements is beyond the scope of the SDD, even though some “walkdowns” were made during the preparation of the SDD.

This SDD includes all SSCs for the system that are actually installed in the field, whether or not they are or were ever in operation. Designated or planned facility modifications and additions for ongoing projects were not included in the SDD. The intent is to update or replace this SDD with new project information as part of the project turnover to Operations personnel for beneficial use.
1.3 OWNERSHIP OF THIS SYSTEM DESIGN DESCRIPTION

The owner of this document is the design authority for the system described herein who has been formally assigned responsibility by the Engineering Management organization of the Tank Operations Contractor. Any changes to this SDD document shall be approved by the assigned Design Authority.

The WRPS design authority assigned to the EDS called Electrical Power Distribution East and West is responsible for the accuracy and technical content of this SDD. Any questions on the system or content of this document shall be resolved through this person. The assigned individual is delegated by the Chief Engineer and tracked on the Engineering Web Page.

1.4 DEFINITIONS/GLOSSARY

Baseline, Technical. The complete set of documents/data, identified by the Design Authority used to identify, justify and demonstrate the physical, functional or operational requirements of configuration controlled structures, systems, and components.

Basis. The basis explains why a requirement exists and why it has been specified in a particular manner or at a particular value during engineering design. The basis considers such factors as facility mission, facility availability, facility efficiency, costs, schedule, maintainability, and safety.

Bonding. The permanent joining of metallic parts to form an electrically conductive path that ensures electrical continuity and the capacity to conduct safely any current likely to be imposed.

Branch Circuit. The conductors between the final over-current protection device and the utilization equipment.

Circuit Breaker. A reusable over-current protection device. After tripping to break the circuit, it can be reset to protect the circuit again.

Codes. Rules established by governing bodies for the proper and safe use and installation of electrical equipment.

Controlled Documents. Documents whose content is maintained uniform among the copies by an administrative control system.

Design Authority. Assigned person responsible to identify and approve design-basis information (TFC-PLN-03, Engineering Program Management Plan).

Design Information. The combination of requirements and the corresponding basis information, which is translated into an engineering design.
**Distribution Panelboard.** Low-voltage circuit breakers mounted within a common enclosure and sharing a common electrical bus that delivers electricity from a supply source to the loads.

**Fuse.** A non-reusable over-current protection device. After opening to break the circuit, it must be replaced to restore power to the circuit.

**Ground Fault.** A short circuit between one of the electrical power current-carrying conductors and ground.

**Grounding Path.** A conductive path for electricity to follow to ground.

**Main Circuit Breaker.** A reusable over-current protection device designed to protect an entire load center.

**National Electrical Code®.** A set of electrical design and installation standards adopted by local authorities throughout the United States and published by the National Fire Protection Association (NFPA) (NFPA 70®1, National Electrical Code1).

**One-Line Diagram.** A simplified EDS shown by graphical representation.

**Over-current.** A current higher than the current conductor or electrical component can safely handle.

**Requirements.** The identified functions that a system must meet to accomplish an identified goal. Requirements define design functions, capabilities, capacities, physical dimensions, limits, set points, etc., for an SSC.

**Safety Basis.** The documented safety analysis and hazard controls that provide reasonable assurance that a U.S. Department of Energy (DOE) nuclear facility can be operated safely in a manner that adequately protects workers, the public, and the environment (10 CFR 830.3, “Nuclear Safety Management,” “Definitions”).

**Safety Structure, System, and/or Component.** The set of safety-class SSCs and safety-significant SSCs for a given facility whose definitions are found in DOE-STD-3009-94, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports.

**Subsystem.** A subsystem resides within a system, but performs an independent function.

**Support System.** A system providing support to another system that is necessary for the entire complex system to function.

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1 NFPA 70 and National Electrical Code are registered trademarks of the National Fire Protection Association, Quincy, Massachusetts.
Switchboard. A floor-standing panel or assembly used to distribute electricity within a building, containing bussing, overcurrent protection devices fuses, and other protective devices.

Switchgear. A higher amperage panelboard that may include air-break, rack-out circuit breakers.

System. An interrelated set of structures, equipment, subsystems, modules, components, devices, parts, and/or interconnecting items that is capable of performing a specified function or set of functions to fulfill a purpose. Systems usually have defined boundaries and often depend on human interactions.

System Engineer. An engineer who is assigned the technical responsibility for a particular system and who coordinates its technical activities. The system engineer is technically knowledgeable of system requirements, design, operation, testing, and maintenance.

Technical Safety Requirements. The limits, controls, and related requirements necessary for the safe operation of a nuclear facility and, as appropriate for the work and the hazards identified in the documented safety analysis for the facility, includes safety limits, operating limits, surveillance requirement (SR), management and administrative controls (ACs), use and application provisions, and design features, as well as a bases appendix. For the tank farms at the Hanford Site, technical safety requirements are found in HNF-SD-WM-TSR-006, Tank Farms Technical Safety Requirements.

UL Listed. Equipment that has received an equipment certification from Underwriters Laboratories (UL), an independent laboratory that tests equipment to determine whether it meets safety standards.

Utility (when capitalized). The Hanford Site Utility Contractor, who is responsible for electric utilities.

Utilization Equipment. Equipment that uses electric energy.

1.5 ACRONYMS

AC Administrative Control
ALARA As Low As Reasonably Achievable
ANSI American National Standards Institute
CAM Continuous Air Monitor
DOE U.S. Department of Energy
dP Differential Pressure
DST Double Shell Tanks
EDS Electrical Distribution System
<table>
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<th>Acronym</th>
<th>Full Form</th>
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<td>HPS</td>
<td>Hanford Plant Standard</td>
</tr>
<tr>
<td>HVAC</td>
<td>Heating, Ventilation, And Air Conditioning</td>
</tr>
<tr>
<td>ICD</td>
<td>Interface Control Document</td>
</tr>
<tr>
<td>ICE</td>
<td>Instrumentation, Control, and Electrical</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>LCO</td>
<td>Limiting Condition for Operation</td>
</tr>
<tr>
<td>M</td>
<td>Motor Contactor</td>
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<tr>
<td>MCC</td>
<td>Motor Control Center</td>
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<tr>
<td>MPSS</td>
<td>Master Pump Shutdown System</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Electrical Manufacturers Association</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>PUREX</td>
<td>Plutonium-Uranium Extraction (Process)</td>
</tr>
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<td>System Design Description</td>
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<tr>
<td>SEL</td>
<td>Safety Equipment List</td>
</tr>
<tr>
<td>SR</td>
<td>Surveillance Requirement</td>
</tr>
<tr>
<td>SSC</td>
<td>Structure, System, and/or Component</td>
</tr>
<tr>
<td>UL</td>
<td>Underwriters Laboratories</td>
</tr>
<tr>
<td>UPS</td>
<td>Uninterruptible Power Supply</td>
</tr>
<tr>
<td>VFD</td>
<td>Variable Frequency Drive</td>
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<td>WRPS</td>
<td>Washington River Protection Solutions, LLC</td>
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**Units**

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<td>ft</td>
<td>foot</td>
</tr>
<tr>
<td>kVA</td>
<td>kilovolt-amperes</td>
</tr>
<tr>
<td>v</td>
<td>volt</td>
</tr>
<tr>
<td>VAC</td>
<td>volts (alternating current)</td>
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2.0 GENERAL OVERVIEW

2.1 SYSTEM FUNCTIONS

The EDS for the AN Tank Farm provides safe and adequate electrical service to equipment in the tank farm and support buildings. The system performs the following primary functions:

- Receive power from the Site electric Utilities supply
- Isolate power
- Protect personnel and equipment from power
- Transform power
- Distribute power (e.g., raceway, branch circuits)
- Provide lighting.

The one-line diagrams describe the EDS to the extent that power is electrically isolated and grouped at switchboards, distribution panelboards and MCCs with over-current and fault protection. Although diagrammatic, the one-line diagrams provide a road map to the electrical system. The one-line diagrams do not indicate the physical routing to the loads (distribution) nor do they show distinct system boundaries and subsystems. The one-line diagrams are depicted on Hanford Site Drawing H-14-030001, Sheets 1, 2, 3, and 4, Electrical (EDS) One Line Diagram.

In case of loss of electrical power from the Electric Utilities, another function of the EDS is to allow temporary power to operate those loads needed to prevent significant economic loss.

2.2 SYSTEM CLASSIFICATION

2.2.1 Nuclear Safety

RPP-13033, Tank Farms Documented Safety Analysis, designates the EDS as a non-safety-significant support system. There is currently no safety related equipment associated with the EDS system. For EDS support associated with the Waste Transfer System these are discussed in the Waste Transfer System SDDs.

Current DOE requirements for natural phenomena hazard mitigation for DOE sites and facilities are discussed in DOE-STD-1020-94, Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities, further definition for tank farm facilities is provided in TFC-ENG-STD-06, Design Loads for Tank Farm Facilities.

2.2.2 Vital Safety System and Mission Critical System

The EDS is designated a General Service System as defined in RPP-13033. The EDS is designated a safety support system supporting tank farm vital safety systems. It also is a mission-critical system as stated in Contract Number DE-AC27-08RV14800; “Current Listings of Vital Safety Systems and Mission Critical Systems.”
The EDS primarily supports the operational needs of other systems, therefore certain requirements are placed on the EDS. The ventilation tank primary ventilation system operation is vulnerable to drive-train malfunctions and loss of electrical power. Waste transfer pumps must be able to be shut off when a leak is detected in an associated pit to mitigate the spread of radioactive material. However, administrative controls are placed on the waste transfer pumps of the waste transfer system when they are not in operation in accordance with HNF-SD-WM-TSR-006, Tank Farms Technical Safety Requirements, Limiting Condition of Operation (LCO).

Operational safety requirements contained in RPP-13033, Chapter 11, “Operational Safety,” require lockouts and tagouts to be installed on isolating devices for personnel safety. The power-disconnecting means must be lockable. The lock and tag ensures that work cannot be performed until control is placed on the electrical isolation device, thus removing the potential for unexpected release of hazardous energy at the equipment. Hot electrical work is allowed under special conditions. This requirement is met administratively as prescribed in DOE-0336, “Hanford Site Lockout/Tagout.”

2.3 BASIC OPERATIONAL OVERVIEW

Figure 2-1 shows a simplified block diagram of the electrical system indicating power flow from source (electrical utility) to end equipment. The block diagram is typical, but does represent the power distribution in the tank farms.

The EDS for AN Farm receives power from the Hanford Site electric utility system. Electrical power is derived from the nearby distribution 13.8 kV pole line (Utility number [C8-L6]) via pole-mounted fused switch [C8X138]. See Hanford Site Drawing H-2-2126, Sheet 5, 200 Area Utility Switching Diagrams. Pad-mounted transformer T1 [C5712P] delivers 480-V power to the nearby 241-AN Loadcenter Unit Substation. The transformer is Utility owned and supplies the main source of power to the AN Tank Farm. However, the AN Tank Farm change trailer is powered separately by Utility pole-mounted transformer [C6032L] (via pole-mounted fused switch [C8X713]). The utility-facility responsibility interface point is at the secondary terminals of the pad-mounted transformer and at the weather head for the pole-mounted transformer (HNF-4492, Interface Control Document between the DST Tank Farm System and the Electrical Distribution System).

Electrical power is supplied from the secondary side of transformer T1 [C5712P] to the Loadcenter Unit Substation. Power is distributed from the 241-AN Loadcenter Unit Substation secondary main circuit breaker to MCCs for 480-V motor loads. Power to lower voltage devices is transformed to the appropriate voltage by facility transformers and supplied from loadcenters and distribution panelboards.
Power consumption is metered at transformer T1 [C5712P] and sent remotely to Site utilities for recording. Electricity consumption reports that show information such as average demand, maximum demand, and load factor for the facility being served are generated by the Site electric utility. Electrical reports are available on the Hanford Local Area Network (HLAN) from a program called KWM DATA that can be downloaded via HLAN Software Distribution.

Transformer isolation is implemented when needed for maintenance by opening fused switch [C8X138] and breaker AN241-EDS-BKR-100 [F8X402] at the Loadcenter Unit Substation. Ground-fault interruption protection is provided. The second power source is derived from overhead line C8-L6 via pole-mounted fused switch [C8X713] and is transformed from 13.8 kV to 120/240 V by pole-mounted transformer C6032L. The transformer is Utility owned with no metering. The only load for this service is the AN Tank Farm change trailer through disconnect switch AN241-EDS-DS-119.

The EDS supplies electrical power to EDS tank farm utilization equipment and other systems (e.g., Ventilation Tank Primary, cathodic protection systems). In typical cases, the boundary interface from EDS to the other system is at the load side of the panelboard branch circuit breaker. However, in cases of motor loads and large loads, the interface is considered to be at the terminals on the load where it receives power from the MCC (i.e., local disconnect switch/receptacle at motor).
The EDS also provides a solidly connected ground to the electrical ground grid required to maintain a safe environment. The ground system connects all in-ground tanks to a grid of bare steel cables buried in trenches across the tank farm. This ground grid provides a low-resistance path where unwanted hazardous electrical currents or lightning strikes can flow without harming personnel or equipment.

The Tank Farm Master Equipment List is a searchable database that contains a list of SSCs with equipment identification numbers, along with descriptive information and other reference data. Tank Farm Master Equipment List is maintained in the CHAMPS database.

NOTE: Service equipment and related devices at the Site Utility/EDS interface sometimes are assigned two equipment numbers to serve the identification needs of both the Utility and facility. The Tank Farm Contractor uses a number system for equipment identification as defined in HNF-IP-0842, Vol. 2, Section 6.1, supported by Hanford Site Drawing H-14-020000, as shown in Table 2-1.

**Table 2-1. Example of Facility and Utility Numbering Systems.**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Facility Number</th>
<th>Utility Number*</th>
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<tr>
<td>Utility Transformer T1 [C5712P]</td>
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<tr>
<td>Main Switchgear Circuit Breaker AN241-EDS-BKR-100 [F8X402]</td>
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<td>(Other utility transformer/ breaker)</td>
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*Utility number is shown in brackets for clarification.
3.0 REQUIREMENTS AND BASES

3.1 GENERAL REQUIREMENTS

This section provides the general requirements for the EDS for the AN Tank Farm. The initial requirements were given in the functional design criteria (FDC) baseline document ARH-CD-304, *Functional Design Criteria – Additional High-Level Waste Storage and Handling Facilities*, “General Utility Requirements.” The design criteria document requires the use of industry standards known as *national consensus codes and standards* as developed by other organizations. The design criteria documents later were translated into a definitive design, known as Project B-130. The final design drawings, specifications, and conceptual design report (ARH-CD-462) contain design parameters that establish the as-built condition of the facility.

The DOE implemented Hanford Plant Standard HPS-SDC-7.5, *Standard Electrical Design Criteria for Interior Power and Lighting Systems*, and DOE Order 6430.1A, *General Design Criteria*, which provided definition and guidance for applying national codes and standards to tank farm designs. The Tank Farm Contractor created further design criteria to supplement tank farm designs by producing the Level 2 specification, HNF-4157, *Double-Shell Tank Utilities Subsystem Specification*. HNF-4157, reflects the operating parameters of new tank farms and major upgrades only and will not be used retroactively to effect changes to previously established design criteria.

The electrical system was designed and built according to the design criteria and other appropriate standards (see Section 3.1.4) that supported the needs of tank farm utilization equipment. Specifications B-130-C1, *Construction Specification for the 241-AN Tank Farm Site Preparation Project B-130*; B-130-C7, *Construction Specification for the 241-AN Tank Farm Completion Project B-130*; B-130-P5, *Procurement Specification for 1,000 KVA Load Center Unit Substation Project B-130 241-AN Tank Farm*, and E-525-C02, *Construction Specification Project E-525 (Design Package 2) 241-AN and 241-AW COB Transfer Lines*, contain construction and procurement requirements developed by the architect/engineer that were imposed on the construction of the electrical systems in the AN Tank Farm. A list of original design drawings and specifications is provided in Appendix A.

The following sections provide tank farm functional requirements captured from the applicable criteria documents for AN Tank Farm. The requirements, listed individually, apply to both tank farms, unless otherwise noted, followed by the basis for the requirement and a brief description of how that requirement was met.

3.1.1 System Functional Requirements

Following are the system functional requirements, bases, and brief summaries of how the requirements are met.
Requirement: Electrical power shall be isolated for individual loads.

- **Basis:** NFPA 70, *National Electrical Code*, Article 210, and other associated articles.
- **How Requirement is Met:** NFPA 70 is invoked by Construction Specification B-130-C7, Sections 16100 and 16300, for electrical and power transmission.

Requirement: The EDS shall have the capacity to provide adequate electrical power to all equipment that uses normal electrical power.

- **Basis:** The FDC in ARH-CD-304
- **How Requirement is Met:** Construction Specification B-130-C7, Section 16300 for electrical and the design drawings indicate normal power source to the tank farm.

Requirement: Electrical distribution power primary voltage shall be derived from Site Utility 13.8 kV utility distribution line.

- **Basis:** Standard distribution voltage available from electric Utility at the Hanford Site.
- **How Requirement is Met:** Construction Specification B-130-C7, Section 16300, for power transmission, and the design drawings show 13.8 kV power.

Requirement: Normal power is required. Emergency power is not required.

- **Basis:** The FDC in ARH-CD-304.
- **How Requirement is Met:** Construction Specification B-130-C7, Sections 16100 and 16300, for electrical and power transmission, and the design drawings indicate normal power source to the tank farm.

Requirement: Power is transformed to the voltage required by the utilization equipment of other systems.

- **Basis:** Based on industry standards and practices described in National Electrical Manufacturers Association (NEMA) ST 1-4, *Outdoor Distribution Transformers 500kVA and Smaller, 15 kV and Under*.
- **How Requirement is Met:** Construction Specification B-130-C7, Sections 16100 and 16300, for electrical and power transmission, and the design drawings for the tank farm provide the design for voltage transformers, usually 480 V-120/240 V (ac).
**Requirement:** The EDS shall distribute electrical power to locations where it can be used by equipment of other systems.

- **Basis:** Power distribution is a commercial practice that must meet NFPA 70, Article 300, and other associated articles.
- **How Requirement is Met:** Construction Specification B-130-C7, Sections 16100 and 16300, for electrical and power transmission, and the design drawings for the tank farm show electrical conduit or raceway and branch circuits to loads.

### 3.1.2 Subsystems and Major Components

This section details the electrical requirements for the distribution, lighting, and grounding for the AN Tank Farm. Construction Specifications B-130-C1, and Procurement Specification B-130-P5, contain derived requirements developed by the architect/engineer from the original FDC document and conceptual design report. Derived requirements generally are introduced by the application of the appropriate national or Federal codes and standards when the architect/engineer translates original criteria and other requirements into a compliant engineering design.

#### 3.1.2.1 Normal Power

Normal electrical power is supplied, transformed, and distributed. Following are the system requirements, bases, and a brief summary of how the requirements are met.

**Requirement:** Outdoor electrical/electronic equipment shall be weatherproof.

- **Basis:** Derived requirement based on National Electrical Manufacturers Association (NEMA) 250, *Standard for Enclosures for Electrical Equipment (1,000 Volts Maximum)*.
- **How Requirement is Met:** Construction Specification B-130-C7, Section 16100 for electrical, specifies NEMA Type 3 enclosures in outdoor applications.

**Requirement:** Electrical/electronic equipment shall be Underwriters Laboratories Inc. (UL) listed and shall conform to NEMA standards.

- **Basis:** Derived requirement.
- **How Requirement is Met:** Construction Specification B-130-C7, Section 16100, Construction Specification E-525-C02, Section 46400, for electrical, imposes NEMA conformity, UL listing, or the mark of another nationally recognized testing laboratory.

**Requirement:** Panelboards, transformers, fuses, and other appurtenances shall comply with applicable national and industry standards.

- **Basis:** Derived requirement.
• **How Requirement is Met:** Construction Specification B-130-C7, Section 16100, imposes Federal Specification W-P-115, Panel, Power Distribution, for panelboards; NEMA ST-20, Dry Type Transformers for General Applications, for transformers; ANSI C97.1, Low-Voltage Cartridge Fuses, for fuses; NEMA ICS, Industrial Control and Systems, for control devices; NEMA WD-1, General Requirements for Wiring Devices, for wiring devices; UL standards; and Federal specifications.

**Requirement:** Conduit, wireway, conductors, terminals, and terminal blocks shall comply with applicable national and industry standards.

• **Basis:** Derived requirement.

• **How Requirement is Met:** Construction Specification B-130-C7, Section 16100, Construction Specification E-525-C02, Section 16400 electrical imposes ANSI C80.1, Fittings for Rigid Metal Conduit ANSI C80.3, Electrical Metal Tubing, UL standards for conductors, terminals, and terminal blocks. Hanford plant standards also apply for installation.

**Requirement:** MCCs shall comply with industry standards.

• **Basis:** Derived requirement.

• **How Requirement is Met:** Construction Specification B-130-C7, Section 16100, imposes Hanford plant standards for installation of MCCs.

**Requirement:** To maintain control of the supply of electricity, the first downstream 480-V (ac) disconnect switch from the 13.8-kV/480-V transformer shall be labeled in conformance with the Site electrical utilities standardized labeling program.


• **How Requirement is met:** Hanford Site Drawing H-14-030001, Sheet 1, shows that the first downstream 480-V (ac) disconnect switch from the 13.8-kV/480-V transformer is labeled as F8X402.

3.1.2.2 Lighting

Site exterior lighting provides nighttime illumination for outdoor tank farm activities. Following are the system requirements, bases, and a brief summary of how the requirements are met.

**Requirement:** AN Tank Farm Lighting is required to support nighttime operations.
• **Basis:** The FDC in ARH-CD-304.

• **How Requirement is Met:** Construction Specification B-130-C7, Section 16100 and 16300, for electrical and power transmission, and the design drawings for the tank farms indicate outdoor lighting. Work experience over the past ten years has demonstrated less than adequate Tank Farm lighting.

3.1.2.3 Lightning/Surge Protection

Generally, lightning and surge protection are provided by existing structures and grounding. In addition, lightning arresters have been installed to protect fire alarm equipment as described in the following sections.

3.1.2.4 Grounding

The buried grounding grid is established throughout the AN Tank Farm. Following are the system requirements, bases, and a brief summary of how the requirements are met.

**Requirement:** System grounding and static grounding shall comply with applicable national and industry standards.

- **Basis:** NFPA 70, Article 250, and associated articles.

- **How Requirement is Met:** Construction Specification B-130-C7, Section 16100, Construction Specification E-525-C02, Section 16400 for electrical, imposes NFPA 70, Article 250, and Hanford plant standards for installation.

3.1.2.5 Power for Equipment

**Requirement:** The EDS shall provide normal, reliable power to support operation of safety SSCs.

- **Basis:** RPP-13033, Chapter 4, “Safety Structures Systems and Components.”

- **How Requirement is Met:** The system is designed to industry standards for commercial and industrial power systems. The site electrical outage history demonstrates that this design provides normal operational reliability typical of the normal electrical power systems in industrial plants.

3.1.3 Boundaries and Interfaces

The facility interface control document (ICD) for the 241-AN, EDS is HNF-4492 and HNF-4493.

The major facility interface control documents (ICD) are planned and set forth in HNF-4500, *Tank Farm System Interface Summary.*
The ICD HNF-4492 provides descriptions of the interfaces between the DST tank farm system EDS and the Electric Utility distribution system. This SDD and its companion SDDs provide a detailed set of boundaries and interfaces for the AN EDS and other systems in AN Tank Farm. The following describes the AN Tank Farm EDS interface requirement.

**Requirement:** Electrical power, at the proper voltage, shall be received at the facility service entrance equipment.

- **Basis:** HNF-4492.
- **How Requirement is Met:** Supply power is fed to the Load Center Unit Substation from the secondary side of the Utility transformer T1. The secondary terminations of transformer T1 are considered the interface point between Utility and facility in accordance with HNF-4492.

The EDS acts as a support system that supplies electrical power to various pieces of utilization equipment in other systems. Such equipment has specific power, voltage, and duty-cycle requirements of the electrical system for normal operation. Following are the system functional requirements, bases, and a brief summary of how the requirements are met.

**Requirement:** Waste Transfer System transfer pumps require 480-V, 3-phase power and are sized for the appropriate horsepower.

- **Basis:** Motive force needed to drive pumps is required by another system.
- **How Requirement is Met:** One-line diagram H-14-030001, Sheets 1, 2, 3, and 4.

The VTP Exhaust System has EDS equipment located on the exhauster skids. The EDS equipment has been labeled with a VTP identification because it is a part of the exhauster skid, hence no information about that equipment is contained in this document. Reference the AN VTP System Design Description (RPP-15119) for a description of the EDS equipment on these skids.

**Requirement:** Instrumentation needs 120-V power at appropriate power levels.

- **Basis:** Operations needs to see the system status, including displays and alarms, of instrumentation on other systems.
- **How Requirement is Met:** (AN Tank Farm) Electrical panelboard schedules on Hanford Site Drawing H-14-030001, Sheets 6 through 28.

**Requirement:** Waste Storage Tank system mixer pumps require 480-V, 3-phase power and are sized for the appropriate horsepower.

- **Basis:** Motive force needed to drive pumps is required by another system.
• **How Requirement is Met:** Project W-211 and the one-line diagrams are depicted on Hanford Site Drawing H 14-030001, Sheet 1.

**Requirement:** Ventilation tank primary and ventilation tank annulus system electric heaters require 480-V, 3-phase power and are sized for the appropriate heat load.

• **Basis:** Electrical energy needed for the heating coils is required by another system.

• **How Requirement is Met:** One-line diagram H-14-030001, Sheet 3.

**Requirement:** Ventilation tank primary and ventilation tank annulus system heating, ventilation, and air conditioning (HVAC) fans require 480-V, 3-phase power and are sized for the appropriate horsepower.

• **Basis:** Motive force needed to drive fans is required by another system.

• **How Requirement is Met:** One-line diagram H-14-030001, Sheet 3.

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Figure 3-1. Tank Farm System Major Facility Interfaces.

DST = double-shell tank.  
PFP = Plutonium Finishing Plant.  
HLW = high-level waste.  
SST = single-shell tank.  
LAW = low-activity waste.  
WESF = Waste Encapsulation and Storage Facility.
3.1.4 Codes, Standards, and Regulations

The electrical system is designed and constructed in accordance with regulations, codes, standards, and guides defined in the FDC. The actual design is left to the designer using the following national consensus codes and standards.

- Underwriters Laboratories Inc.
- NEMA standards (various)
- ANSI standards (various)
- ERDA Manual Chapter 6301, *General Design Criteria* (date unknown)
- DOE 6430.1, *General Design Criteria Manual*
- DOE 6430.1A
- IEEE 142, *Recommended Practice for Grounding of Industrial and Commercial Power Systems*
- IEEE 242, *Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems*
- IEEE 399, *Recommended Practice for Power System Analysis (IEEE Brown Book)*
- Hanford Plant Standards (cancelled by DOE on September 20, 1994)
  - HPS-SDC-7.5, Standard Electrical Design Criteria for Interior Power and Lighting System
  - HPS-330-E, Motor Control Centers – 600 Volts
  - HPS-E-2-1, Vertical Clearances of Services on Poles and Horizontal Clearance to Railroads
  - HPS-E-2-5, Minimum Vertical Clearances from Overhead Wires to Grade and Buildings
  - HPS-E-2-6, Minimum Vertical Clearances between Overhead Wire Crossings
  - HPS-E-3-2, Distribution and Telephone Grounding Assembly with Galvanized Ground Rods
  - HPS-E-10-1, Concrete Encased Underground Ducts – One and Two Conduits
  - HPS-E-10-2, Concrete Encased Underground Ducts – Three and Four Conduits
  - HPS-E-10-3, Concrete Encased Underground Ducts – Six and Eight Conduits
  - HPS-E-10-5, Marker Flag and Post for Underground Cable Runs
  - HPS-E-10-10, Riser and Drain – Encased, Underground Nonmetallic Conduit
  - HPS-E-10-20, Direct Burial Cable Details – 600 Volts and Under
  - HPS-E-12-1, Typical Electrical System Groundings for Buildings
  - HPS-E-12-2, Auxiliary Bonding of Electrical Equipment and Frames
  - HPS-E-12-5, Typical Grounding Grid and Connections for Buildings
  - HPS-E-12-6, Grounding Plate Installations in Building
  - HPS-E-12-10, System and Equipment Grounding – Basic Requirements and Conductors
  - HPS-E-12-11, System and Equipment Grounding – Services, Panels, and Conduits
  - HPS-E-12-12, System and Equipment Grounding – 120/240 and 208Y/120 Volt Systems
  - HPS-E-12-13, System and Equipment Grounding – 480 and 480 Y/277 Volt Systems
  - HPS-E-12-14, System and Equipment Grounding – Ground Conductor Connections
  - HPS-E-14-1, Building and Process Wire and Cable – 600 Volt
  - HPS-E-14-15, Equipment Nameplates
  - HPS-E-14-20, Fluorescent Fixture Hanger Assemblies.
3.1.5 Operability

System Operability is based on the facility authorization basis, including RPP-13033, HNF-SD-WM-TSR-006, along with OSD’s for this farm.

The AN Tank Farm EDS has no Operability requirements specified in these authorization basis documents. The EDS is designated as a non-safety support system. The EDS provides power to several safety significant systems, but loss of power to any of those systems will not result in an unsafe condition. All Safety Significant components fail to a safe condition.

3.2 SPECIAL REQUIREMENTS

3.2.1 Radiation and Other Hazards

No special requirements exist for the AN Tank Farm EDS relating to radiation or other hazards beyond those typically accepted in an industrial workplace covered by the 29 USC 651, Occupational Safety and Health Act of 1970. Components exposed to radiation and other hazards must be rated to operate with the hazard.

3.2.2 As Low As Reasonably Achievable (ALARA) Standards

Requirement: The AN Tank Farm EDS should be designed in accordance with ALARA principles, such that required preventive maintenance or calibration can be performed outside the tank farm.

- Basis: HNF-4157 Section 3.2.4.a.
- How Requirement is Met: Hanford Site Drawing H-2-71932, Sheet 1, Electrical Instrument Plans, and others show that all equipment possible has been located outside the tank farm. This policy is considered as-low-as-reasonably-achievable (ALARA) practice.

Procedure HNF-IP-0842, Vol. 7, ALARA Program, Section 12.1, “ALARA Management Commitment and Policy,” is applicable to work done at the tank farms.

3.2.3 Nuclear Criticality Safety

No special requirements exist relating to nuclear criticality safety for the AN Tank Farm EDS.

3.2.4 Industrial Hazards

Electrical systems normally present some level of hazard for electrical shock to the industrial worker. Engineering and administrative controls provide a system of protection to the worker. The primary engineering control is adherence to safe practices during installation by ensuring compliance with NFPA 70; the Washington Administrative Code; ANSI C2; UL standards; and
related electrical safety codes such as the *Occupational Safety and Health Act of 1970; NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces;* and the *Washington Industrial Safety and Health Act*. Maintenance personnel practice safety when performing work on electrically driven equipment. An example of this is the use of lockouts and tagouts.

The Hanford Electrical Safety Program provides continuing reviews of electrical safety issues that may arise. The Hanford Electrical Safety Program interprets and advises DOE on matters concerning electrical safety and *National Electrical Code* compliance. The Hanford Workplace Electrical Safety Board reviews issues relating to worker safety and provides guidance in the form of safety interpretations, bulletins, and meeting aids. The Hanford Electrical Codes Board is made up of Hanford Site contractor representatives and deals with *National Electrical Code* compliance issues. Each board’s chairman is the Hanford Site electrical authority having jurisdiction for his or her respective area of responsibility.

3.2.5 Operating Environment and Natural Phenomena

The EDS components are designed to function under worst case internal and external environmental conditions, such as temperature extremes and weather. No structural calculations have been located to support natural phenomena events. Conduits, enclosures, motor control centers, panels, and load center unit substations are installed as they are in other tank farms. The EDS is protected from high winds by its location in the AN Tank Farm structures or placement in enclosure boxes that are NEMA qualified for placement in severe environments. Flood protection is provided by the location of the AN Tank Farm. The facility has incorporated lightning and surge protection with protection devices tied to the AN Tank Farm grounding grid.

3.2.6 Human Interface Requirements

Human interface is required under some operating modes. When large loads are energized, human interaction is accommodated with indicator lights, operator controls, metering, and proper physical location of equipment. In the event of an emergency, operations personnel may operate isolation devices designed for safe operation. NFPA 70 mandates installation and clearance requirements for safe access to electrical equipment, which ensures electrical worker safety.

Industry color guidelines have been applied at the Hanford Site to define and identify safe and unsafe states for electrical lights, pushbuttons, cathode-ray tube displays, and power wiring.

3.2.7 Specific Commitments

No specific commitments to or requirements by the DOE or other regulatory agencies exist for the EDS, other than those mentioned in this document.
3.3 ENGINEERING DISCIPLINARY REQUIREMENTS

3.3.1 Civil and Structural

Structural requirements for the mounting of conduit, equipment, and boxes follow general requirements of the *Uniform Building Code* and the *International Building Code*.

3.3.2 Mechanical and Materials

The materials chosen shall be suitable for the environment and shall be able to withstand the structural loads imposed.

3.3.3 Chemical and Process

None.

3.3.4 Electrical Power

Standard and preferred nominal voltages are specified with their associated tolerances. Tolerances to voltage limits are specified by a range of voltages around the nominal value. The nominal voltage is the normal operating voltage. The maximum system voltage is the highest root-mean-square voltage that occurs under normal operating conditions. Low-voltage class voltages are those from 120 V up to 600 V and are used to supply utilization equipment. Standard frequency for alternating current power is 60 Hz. In the United States, these voltages and specifications are based on IEEE 141-1986. The specified voltages are adopted by ANSI C84.1, *Voltage Ratings for Electric Power Systems and Equipment (60Hz)*. The following nominal voltages used throughout the AN Tank Farms:

- 480 V
- 480 Y/277 V
- 120 V
- 120/240 V.

Electrical systems are grounded to earth for many reasons, the foremost of which is safety. Solid grounding refers to the connection of the neutral bus of a generator or power transformer directly to station ground or to earth. The objective is to allow over-current devices to operate properly and divert ground-fault currents safely to ground, thereby minimizing electric shock hazards to personnel. IEEE 142 defines methods for grounding power systems for efficient and effective operations. Although obsolete, Hanford plant standards for grounding (HPS-E-12-1, HPS-E-12-5, HPS-E-12-6, and HPS-E-12-10 through 14) prescribe multiple grounding techniques for the initial construction of AN Tank Farm. The AN Tank Farm is solidly grounded.

3.3.5 Instrumentation and Control

None.
3.3.6 Computer Hardware and Software

None.

3.3.7 Fire Protection

120-V(ac) branch circuit breakers for fire protection equipment (e.g., detection panels, sensors) are painted RED. The interface point is at the load side of the circuit breaker.

3.4 TESTING AND MAINTENANCE REQUIREMENTS

3.4.1 Testability

Construction specifications require inspections and testing of completed electrical installation. The tests shall be conducted with calibrated instruments. The tests shall be documented and witnessed by a government inspector, as applicable. Electrical inspections and acceptance tests were required for the following: motors, wiring systems, lighting systems and panelboards, MCCs, heat trace, loadcenter transformer, and switchgear. Details of the specified tests are contained in Construction Specification B-130-C7.

3.4.2 Technical Safety Requirement-Required Surveillances

No special requirements for EDS.

3.4.3 Non-Technical Safety Requirement Inspections and Testing

No special requirements exist relating to inspections and testing for the AN Tank Farm EDS.

3.4.4 Maintenance

Routine or preventive maintenance work will be based on manufacturers’ recommendations and will be performed using approved procedures.

3.5 OTHER REQUIREMENTS

3.5.1 Security and Special Nuclear Material Protection

None.

3.5.2 Special Installation Requirements

None.
3.5.3 Reliability, Availability, and Preferred Failure Modes

The EDS shall provide electrical power with standard commercial reliability process and supporting equipment.

The required failure mode is de-energized.

3.5.4 Quality Assurance

No specific quality assurance requirements exist for the AN Tank Farm EDS.

3.5.5 Miscellaneous

None.
4.0 SYSTEM DESCRIPTION

4.1 CONFIGURATION

The EDS for the AN Tank Farm provides electrical service to equipment in the tank farm and support buildings. The EDS major components, except for some distribution panelboards, are described in this section and are depicted on the one-line diagrams in Appendix E. Section 4.4.1 refers to the panelboards and the panelboard schedules.

4.1.1 Description of System, Subsystems, and Major Components

The electrical system comprises four subsystems; normal power, tank farm lighting, lightning/surge protection, and grounding.

4.1.1.1 Normal Power

The EDS receives power from the Hanford Site Utility System. Electrical power is derived from aerial line [C8-L6]. An alternative normal power source is available from the Site Utility. See Hanford Site Drawing H-2-2126 Sheet 5, for alternative power sources. The overhead pole line voltage is 13.8 kV, 3-phase, 3-wire, which is the predominant utility distribution voltage at the Hanford Site. Pole-mounted lightning arrestors and fused switch [C8X138] are placed on the incoming power to provide protection for transformer T1 [C5712P].

Utility Transformer T1

Power is transformed by Utility-owned, oil-filled, pad-mounted transformer T1 [C5712P], which is close coupled to the 241-AN Loadcenter Unit Substation. The transformer is sized at 1,000 kVA, 3 phase, 60 Hz. Its primary side voltage is 13.8 kV delta connected with ±2-2.5% no-load manual voltage taps. The secondary is 480 Y/277 V (ac), 4 wire, solidly grounded; this allows for voltage selection of 480 V 3 phase, 480 V single phase, or 277 V single phase. The Utility/facility responsibility interface point is at the secondary terminations of the transformer (HNF-4492).

Loadcenter

Electrical power is supplied from the secondary side of the utility transformer T1 [C5712P] to the Loadcenter Unit Substation AN241-EDS-ENCL-100 (Figures 4-1 and 4-2). This secondary switchgear is metal clad and outdoor rated and is a single-wide, 3-row-high compartmentalized unit. The transformer and loadcenter are manufactured together (see certified vendor information #020205 in Appendix C).

Compartment A1 is the metering compartment containing ammeter, voltmeter, and watt-hour/demand meter. Power consumption at transformer T1 is metered locally and sent remotely to Site Utilities via the field data acquisition system telephone link at midnight. The data can be used for preparation of electricity consumption and cost reports. The ground-fault interruption protection, with test switch, also is contained in the main breaker AN241-EDS-BKR-100.
15A primary and 25A secondary fuses for the 5 kVA transformer also are contained in this compartment. This transformer feeds distribution panel AN241-EDS-DP-100 panel schedule identified on H-14-030001 Sheet 6.

Transformer secondary and feeder over-current protection is provided by the 1,200 A breaker AN241-EDS-BKR-100 [F8X402 ] at compartment A2 in the Loadcenter Unit Substation. Transformer isolation is attained when needed by breaking power at fused switch [C8X138] and this breaker. The breaker trip settings are listed and controlled in the CHAMPS maintenance data base.

Compartment A3 contains small 5-kVA transformer AN241-EDS-XFMR-100 and panelboard AN241-EDS-DP-100. See the panelboard schedule on Hanford Site Drawing H-14-030001, Sheet 6. The transformer and panelboard supplies 120/240 V, single-phase, 60-Hz power to miscellaneous loads in the Loadcenter Unit Substation (Figure 4-1) such as lighting, receptacles, heater, and the field data acquisition system data logger.

For further design information relating to the Loadcenter Unit Substation, see the drawings listed in Appendix A, Construction Specification B-130-C7, and Procurement Specification B-130-P5.

Figure 4-1. Photograph of Loadcenter Unit Substation AN241-EDS-ENCL-100.
Figure 4-2. Photographs of Electrical Distribution Equipment
AN Tank Farm Change Trailer

Another power source is derived from line [C8-L6] via fused switch [C8X713] and is transformed from 13.8 kV to 120/240 V by pole-mounted transformer [C6032L]. The transformer is Utility-owned and provides 10 kVA, single-phase, 60-Hz power to the AN Tank Farm change trailer (Figure 4-3). Power to the trailer is directed through a 100-Amp, outside, rack-mounted, fused disconnect switch AN241-EDS-DS-119. Change trailer panelboard AN241-EDS-DP-127 isolates power to the various loads (e.g., HVAC, lights, receptacles). See the panelboard schedule on Hanford Site Drawing H-14-030001, Sheet 18.

Figure 4-3. AN Tank Farm Change Trailer Entrance Equipment

Motor Control Centers

Generally, individual loads are isolated at the MCC with the insertion of over-current protection, either a fuse or a circuit breaker, at the MCC compartment connected to the bus bars. Multiple and combination devices are installed in the MCC compartment and are visible on the compartment door. On the one-line diagrams (Appendix E), compartment numbers appear below the bus connection point, devices (e.g., control transformers, starters, lights) appear on the line extended downward from the connection point, and the load descriptions or additional field devices appear at the lowest level. The value of the load is an important quantity (e.g., kilowatts, horsepower), because it is used primarily in sizing the related equipment.

The MCC AN271-EDS-MCC-001 is the principal distribution point for supplying 480-V power to AN Tank Farm loads from the 241-AN-271 Instrument Control Building. Facility transformers also are connected to the MCC. AN271-EDS-MCC-001 is 14 in. deep and floor mounted against the South wall. A wire gutter located in the floor beneath the MCC is used as a means for routing conductors. The MCC is compartmentalized into vertical sections and rows known as compartments. The compartments are sequentially numbered by section and row (e.g., the main breaker compartment is referred to as compartment A1). Internal power bus bars, rated at 1,200 A each phase, are connected to the load side of 1,000 A main breaker BKR-101. Horizontal bus bars traverse between sections, where each is connected to vertical bus bars. Vertical Sections A and B are shown on Appendix E, Figure E-1. MCC compartment feed
downstream transformers to 120/240-V panelboards or feed 480-V loadcenters directly. Alternatively, compartments originate the branch circuits for pump motor loads directly. Vertical Sections C and D, an extension of AN271-EDS-MCC-001, are shown on Appendix E, Figure E-3, in. The transfer pump motor-load currents are monitored with limit alarm modules. After a time delay allowing for the motor to reach full speed, the motor contactor opens if the load current exceeds the low or high setpoints.

The MCC AN241-EDS-MCC-002 is the distribution point for supplying 480-V power to AN Tank Farm central exhauster loads. Facility transformers also are connected to the MCC. AN241-EDS-MCC-002 is 14 in. deep, NEMA Type 3. The MCC is located geographically near the central exhauster loads. The MCC also is compartmentalized. The compartments are sequentially numbered by section and row (e.g., the incoming power compartment is called compartment A2). AN241-EDS-MCC-002 does not have a main breaker; rather, over-current protection is provided by AN271-EDS-MCC-001, BKR-104. Internal power bus bars, ampere rating, are connected to the load side of main breaker BKR-116. Horizontal bus bars traverse between sections, where each is connected to vertical bus bars. Vertical Sections A, B, and C are shown on Appendix E, Figure E-4. MCC compartments feed downstream transformers to 120/240-V panelboards. Compartments contain a transformer and loadcenter. Alternatively, compartments originate the branch circuits for pump motor loads (see Figure 4-2).

For further design information relating to MCCs, see the drawings in Appendix A and Construction Specification B-130-C7, Section 2.03.

Generally, transformers are sized to serve the power needs of the utilization equipment. 480-V (ac) power is fed to the primary side of transformers. After voltage transformation, the power is fed from the secondary side to distribution panelboards:

- Transformer AN241-EDS-XFMR-100 (located at the Loadcenter Unit Substation, compartment A3), rated 5 kVA, 480-120/240 V (ac), 1 phase, fed from (fuse) 15A FU, supplies power to Loadcenter Unit Substation loads
- Transformer AN241-EDS-XFMR-101, rated 25 kVA, 480-120/240 V (ac), 1 phase, fed from AN271-EDS-MCC-001, BKR-102, supplies power to 241-AN-271 Instrument Control Building loads
- Transformer AN241-EDS-XFMR-102, rated 37.5 kVA, 480-120/240 V (ac), 1 phase, fed from AN271-EDS-DP-103, BKR-32, supplies power to AN241-EDS-DP-105
- Transformer AN241-EDS-XFMR-105, rated 10 kVA, 480-120/240 V (ac), 1 phase, fed from AN241-EDS-MCC-002, BKR-117, supplies power to AN241-EDS-DP-114
- Transformer AN241-EDS-XFMR-106, rated 25 kVA, 480-120/240 V (ac), 1 phase, fed from AN241-EDS-MCC-002, BKR-120, supplies power to AN241-EDS-DP-108
- Transformer AN241-EDS-XFMR-107, rated 15 kVA, 480-120/240 V (ac), 1 phase, fed from AN271-EDS-MCC-001, compartment A1, through fused disconnect switch AN271-EDS-DS-117 and panelboard AN274-EDS-DP-109, supply power to AN274-EDS-DP-110
• Transformers AN241-EDS-XFMR-108 through AN241-EDS-XFMR-114, rated 5 kVA each, 480—120 V (ac) 1 phase, fed from AN271-EDS-MCC-001, BKR-106 via panelboard AN241-EDS-DP-103, supply power to pole-mounted floodlights

• Transformers that are part of minipower zones, rated 10 kVA, 480-120/240 V (ac), 1 phase, fed from AN241-EDS-MCC-002, BKR-132, supplies power to two mini-power centers.

For further design information relating to transformers, see drawings H-14-030001 Sheet 6 thru 28.

**Distribution Panelboards**

Distribution panelboards are located throughout the AN Tank Farm facility near the loads served. Panelboards are arranged and sized to accommodate multiple circuit breakers and are required to have directories. Panelboard information also appears on panelboard schedule drawings listed in Appendix A and Construction Specification B-130-C7, Section 2.04.

AN Tank Farm panelboards see H-14-030001 Sheet 5 for index:

- AN241-EDS-DP-100, 120/240 V (ac), NEMA 1, 100 A bus, main lug only
- AN271-EDS-DP-101, 120/240 V (ac), NEMA 1, 100 A bus, 100 A main breaker
- AN271-EDS-DP-102, 120/240 V (ac), NEMA 1, 125 A bus, main lug only
- AN241-EDS-DP-103, 480 V (ac), NEMA 3, 225 A bus, 225 A main breaker
- AN241-EDS-DP-105, 120/240 V (ac), NEMA 3, 225 A bus, 200 A main breaker
- AN820-EDS-DP-106, 120/240 V (ac), NEMA 1, 100 A bus, main lug only
- AN241-EDS-DP-107, 120/240 V (ac), NEMA 1, 125 A bus, main lug only
- AN241-EDS-DP-108, 120/240 V (ac), NEMA 3R, 100 A bus, 100 A main breaker
- AN274-EDS-DP-109, 480/277 V (ac) NEMA 1, 225 A bus, 225 A main breaker
- AN274-EDS-DP-110, 120/240 V (ac), NEMA 1, 100 A bus, 100 A main breaker
- AN241-EDS-DP-111, 120/240 V (ac), NEMA 1, 100 A bus, 50 A main breaker
- AN241-EDS-DP-112, 120/240 V (ac), NEMA 1, 100 A bus, 50 A main breaker
- AN296-EDS-DP-114, 120/240 V (ac), NEMA 1, 100 A bus, 100 A main breaker
- AN241-EDS-DP-127, 120/240 V (ac), NEMA 1, 100 A bus, 100A main breaker.
- SALW-EDS-DP-H101, 120/240V(ac), NEMA 3R, 225 A bus, 60 A Secondary main breaker
- AN241-EDS-DP-128, 120/240V(ac), NEMA 1, 100 A bus, 50 A main breaker
- AN271-EDS-DP-126, 120/240V(ac), NEMA 1, 100 A bus, 50 A main breaker
• AN241-VTP-DP-351, 120/240V(ac), NEMA 3R, 100 A bus, 60 A main breaker
• AN241-VTP-DP-451, 120/240V(ac), NEMA3R, 100 A bus, 60 A main breaker
• AN241-EDS-DP-130, 480/277V(ac), NEMA 3R, 400 A bus, 400 A main breaker
• AN241-EDS-DP-129, 120/240V(ac), NEMA 4X, 100 A bus, 50 A main breaker
• AN241-EDS-DP-122, 480/277(ac), NEMA 1, 100 A bus, 70 A main breaker
• AN241-EDS-DP-121, 480V(ac), NEMA 3R, 225 A bus, 225A main breaker
• AN241-EDS-DP-131, 120/240V(ac), NEMA 3R, 100 A bus, 25 A main breaker
• AN241-EDS-DP-125, 120/240V(ac), NEMA 3R, 100 A bus, 80A main breaker.

The Safety Equipment List for Tank Farms is tracked in the Safety Equipment Compliance Database (SECD) which identifies no electrical components as Safety Significant.

4.1.1.2 Tank Farm Lighting

The tank farm is equipped with an outdoor lighting system. The lamps are located on wooden poles that are grounded to the tank farm ground grid by bare ground wires. The surveillance light system provides low-level illumination (5 lumens/foot²) of the bare ground surface and outdoor structures. Fluorescent and incandescent lamps provide interior lighting. For light pole locations and general outdoor light fixture layout, see Hanford Site Drawing H-2-71925, Sheet 2, Electrical Power and Control Plan and Details.

The light fixtures are floodlights with clear mercury-vapor lamps. The 480-V distribution panelboard AN241-EDS-DP-103 supplies power to the outdoor tank farm lights.

The lighting transformers were previously listed as transformers AN241-EDS-XFMR-108 through AN241-EDS-XFMR-114, fed from AN271-EDS-MCC-001, BKR-106. Each transformer supplies power to a light pole (pole #1 through pole #7) via 15-A fused switches AN241-EDS-DS-103, AN241-EDS-DS-104, AN241-EDS-DS-105, AN241-EDS-DS-106, AN241-EDS-DS-107, AN241-EDS-DS-108, and AN241-EDS-DS-118.

The light poles are 50 ft long and are made of wood (Figure 4-4). Guys, anchors, and other pole hardware are furnished. Cross-arms are attached for mounting light fixtures.
4.1.1.3 Grounding and Bonding

Tank farm grounding is an important safety item in the electrical system. The tank foundation consists of reinforcing steel within concrete, which is bonded to other foundations with the bare steel cables (direct buried or placed in concrete). The cables are 5/8-in.-diameter, 7-strand steel wires, made of special low carbon grade, with class B zinc coating per ASTM A475, *Standard Specification for Zinc-Coated Steel Wire Strand*. The ground grid also is bonded to building steel and is connected to the service entrance point at Loadcenter Unit Substation AN241-EDS-ENCL-100. The ground grid was formed by bonding the seven in-ground tanks with the support buildings, fence, and electrical substation during initial construction. The fence and the substation are grounded in accordance with Hanford plant standards. The buildings in and around AN Tank Farm also conform to the Hanford plant standards. See the list of Hanford plant standard grounding standards in Section 3.1.4 (HPS-E-121, -2, -5, -6, -10 through –14). All grounds are required to be interconnected.
This low-resistance ground path will serve lightning strikes, voltage surges, and electrical faults to ground. The solid ground system is provided for safety. In the event of an electrical failure resulting in a short circuit or a lightning strike with a high-fault current, the ability of that current to flow to ground through a low-resistance circuit provides an element of personal safety to the electrical worker or others in the area of influence. The ground system generally is designed to comply with the recommendations of IEEE 142-1991 and IEEE 80, *AC Substation Grounding, Safety*. The grounding system is installed in accordance with NFPA 70. NFPA 70 is a safety code used by the electrical worker to install electrical equipment and by the inspector to inspect the quality of work and certifications of the installed electrical equipment. Lighting protection is controlled by NFPA 780, *Installation of Lightning Protection Systems*.

Extensive ground resistance measurements were conducted in the 200 Areas; these data are reported on Hanford Site Drawing H-13-000040, *Electrical Resistance Tomography Testing*.

Instrumentation grounding differs from a grounding system for electrical equipment. Grounding conductors for power equipment are run between grounding electrodes, electrical devices, racks, building steel, and so on, resulting in an equipment grounding network that includes many electrical loops. However, instrumentation circuit grounding systems consist of insulated ground buses interconnected with insulated cable to form radial systems (no loops). These are then isolated from other grounding subsystems except for the interconnection at a single point, often the service entrance. This type of ground often is referred to as single-point grounding. Instrumentation circuits are grounded in this way to minimize electrical noise on these relatively low-voltage circuits.

4.1.1.4 Lightning and Voltage Surge Protection

A lightning protection system prevents or minimizes damage to structures or equipment by providing a suitable alternative path for the lightning strike current. At the Hanford Site, lightning is a low-occurrence event. Normal electrical grounding and bonding of electrical components and associated metal items provides adequate voltage surge protection. Lighting protection is controlled by NFPA 780, *Installation of Lightning Protection Systems*.

The AN Tank Farm has limited over-voltage surge protection provided by lightning arrestors located on the 13.8-kV overhead power line serving the tank farm. Low-voltage surge protection also is provided through a surge protector that is electrically connected to the fire alarm circuit breaker.

4.1.2 Boundaries and Interfaces

This section summarizes external interfaces and boundaries of the AN Tank Farm EDS. Appendix F contains system boundary sketches that depict specific interfaces to other systems. The purpose of showing the interfaces graphically is to provide the precise location of all the specified interfaces, thus avoiding lengthy description of those interfaces. Consolidating the interfaces into a functional group forms the boundary. Figures F-2 through F-4 shows the boundaries from the EDS to other systems.
A formal agreement exists between the Utility and the Tank Farm Contractor, establishing an interface for electrical responsibility at the secondary terminations of the power transformer; upstream belongs to the Utility and downstream belongs to the tank farm. Supply power is fed to the Loadcenter Unit Substation from the secondary side of transformer T1. The interface point between Utility and facility is in accordance with HNF-4492.

In typical cases, the boundary interface between the EDS and the other AN Tank Farm systems is at the load side of the panelboard branch circuit breaker. However, in cases of motor loads and large loads, the interface is considered to be at the terminals on the large load where it receives power from the MCC (i.e., local disconnect switch/receptacle at the motor).

The EDS (System #00) interfaces with the other systems in the AN Tank Farm. The numbers shown here relate to system numbers defined on Hanford Site Drawing H-14-020000, Sheet 1, and implemented by procedure HNF-IP-0842, Vol. 2, Operations, Section 6.1, “Tank Farm Operations Equipment Labeling.” Interfacing systems are as follows:

- Ventilation tank primary system (VTP #01)
- Ventilation tank annulus system (VTA #02)
- Service air (SA #03)
- Waste storage tank system annulus (WSTA #05)
- Waste storage tank system (WST #06)
- Glycol cooling (GLY #07)
- Waste transfer system (WT #08)
- Ventilation (general) system (VT #13)
- Radiation monitoring system (VT #14)
- Cathodic protection system (CATH#15)
- Raw water system (RW #18).

4.1.3 Physical Location and Layout

Electrical systems generally are laid out in radial fashion from the source to the loads. Although power is internally bussed, electrical power from the MCC or distribution panelboard is distributed radially from the centralized location to the physical point where the utilization equipment is located. In many cases, the load is within the tank farm perimeter fence, which is a radiological controlled area. The distribution medium may be either direct-buried power cables or power cables enclosed in an approved raceway.

Loadcenter Unit Substation AN241-EDS-ENCL-100 is located outdoors along the west fence line outside of AN Tank Farm.
Transformer T1 [C5712P] is located outdoors, adjacent to Loadcenter Unit Substation AN241-EDS-ENCL-100, sharing the same equipment pad. It is located less than 50 ft from the utility power pole that feeds power from the overhead source.

AN271-EDS-MCC-001 is located indoors, in the 241-AN-271 Instrument Control Building. This equipment is less than 50 ft from the Loadcenter Unit Substation. The ventilation MCC (AN241-EDS-MCC-002) is located outdoors near the AN Tank Farm central exhauster.

Transformers are located as follows.

- AN241-EDS-XFMR-100 is located in the Loadcenter Unit Substation
- AN241-EDS-XFMR-101 is located inside the 241-AN-271 Instrument Control Building
- AN241-EDS-XFMR-102, the location is not defined
- AN820-EDS-XFMR-104 is rack mounted near AN Tank Farm Change Trailer MO-820
- AN241-EDS-XFMR-105 is located at AN241-EDS-MCC-002 in compartment A3
- AN241-EDS-XFMR-106, the location is not defined
- AN241-EDS-XFMR-108 through AN241-EDS-XFMR-114 are located at the bases of their respective light poles (see Figure 7).

Distribution panelboards are located as follows.

- AN241-EDS-DP-100 is located in the Loadcenter Unit Substation
- AN271-EDS-DP-101 is located inside the 241-AN-271 Instrument Control Building
- AN271-EDS-DP-102 is located inside the 241-AN-271 Instrument Control Building
- AN241-EDS-DP-103 is located at the power distribution station near Tank 241-AN-103
- AN241-EDS-DP-105 is located at the power distribution station near Tank 241-AN-103
- AN820-EDS-DP-106 is located at 241-AN Change Trailer MO-820
- AN241-EDS-DP-107 is located at MCC-002 in compartment A3
- AN241-EDS-DP-108 is located at Elec. Distribution rack by tank AN105
- AN274-EDS-DP-109 is located at the 241-AN-274 Caustic Addition Building
- AN274-EDS-DP-110 is located at the 241-AN-274 Caustic Addition Building
- AN241-EDS-DP-111 is located at AN Tank Farm Change Trailer T-154
- AN241-EDS-DP-112 is located near Tank 241-AN-104
- AN296-EDS-DP-114 is located at annulus vent exhaust stack enclosure AN296-VTA-ENCL-900
- AN241-EDS-DP-127 is located at AN Tank Farm Change Trailer T-154
• SALW-EDS-DP-H101, is located at 241-AN-106 Pump Pit
• AN241-EDS-DP-128, outside of 241-AN-271
• AN271-EDS-DP-126, in building 241-AN-271
• AN241-VTP-DP-351, on the HVAC ventilation skid, Train A
• AN241-VTP-DP-451, on the HVAC ventilation skid, Train B
• AN241-EDS-DP-130, near the HVAC Skid
• AN241-EDS-DP-129, located on Power Distribution Rack just inside the farm
• AN241-EDS-DP-122, located on west side of AN Farm
• AN241-EDS-DP-121, located in 241-AN Caustic Area
• AN241-EDS-DP-131, located near Chemical metering area
• AN241-EDS-DP-125, located near 241-AN Caustic Area.

4.1.4 Principles of Operation

The principles of operations are described in detail in Section 4.1.1.

4.1.5 System Reliability Features

The electrical power system provides electrical power with standard commercial reliability to Safety-Significant and Safety-Class SSCs. An alternative power source for the AN Tank Farm can be determined by the Utility should a power outage occur.

4.1.6 System Control Features

This system does not contain any unique control features. The EDS switches, circuit breakers, and starters are normally controlled manually. The system circuit breakers, fuses, and limit alarm module units monitor the current flow of normally energized loads. When an over-current (limit alarm modules also monitor for under-current) is detected, these devices will operate to deenergize their load. A qualified person is to investigate the cause of the event and subsequently reclose the device.

4.2 OPERATIONS

WRPS Procedures – see list on web page under Technical Procedures.

The procedure for operating the AN Tank Farm is covered in the following and additional operations procedures:

• OSD-T-151-00007, Operating Specifications for the 241-AN, AP, AW, AY, AZ & SY Tank Farms.
4.2.1 Initial Configuration (Prestartup)

Pre-startup does not apply to the EDS in its present configuration. The system was started up at the completion of construction and at the end of each modification in a systematic manner to verify electrical system integrity.

4.2.2 System Startup

Normally, the EDS is operating continuously. When a modification or special configuration is required, the startup procedures will be documented in a test specification.

4.2.3 Normal Operations

During normal operation, the power distribution system interfaces with all systems that require power and grounding for normal operations. If a utilization component draws more current than its rating, overload relays or the thermal overload element of a branch circuit breaker will remove the load from operation. Then the device must be manually restarted. Should a fault occur, the over-current protection devices, circuit breakers, or fuses will attempt to clear the fault by tripping and thereby isolating the failed component. The over-current protection devices are required to be coordinated in a manner that allows the over-current protective device closest to the fault to trip and allow electrical energy to flow to the balance of the tank farm. Lighting provides the illumination necessary to provide a safe working environment.

4.2.4 Off-Normal Operations

Normal power failure at the incoming line is the only off-normal mode. The AN Tank Farm does not have emergency or back-up power. In the event of major power loss, the following procedure is invoked: RPP Tank Farms Emergency Response Procedure TF-ERP-010, Total Loss of Electrical Power.

4.2.5 System Shutdown

Operating procedures for periodic maintenance of the electrical system at the AN Tank Farm are found in Tank Farm Plant Operating Procedure TO-220-100, Perform Scheduled Electrical Power Outage on 241-AN Tank Farm.

4.2.6 Safety Management Programs and Administrative Controls

The following Safety Management Programs and Administrative Controls specified in HNF-SD-WM-TSR-006, Tank Farms Technical Safety Requirement, may apply to the equipment described in this SOD.

- AC 5.8.2 Flammable Gas Control for Waste-Intruding Equipment (SAC).
4.3 TESTING AND MAINTENANCE

WRPS Maintenance Procedures are tracked on the WRPS Procedures web page subsection Maintenance Procedures. Periodicity for performance of maintenance procedures is tracked in the CHAMPS Database.

4.3.1 Temporary Configurations

The EDS currently has no temporary configurations in place.

4.3.2 Technical Safety Requirement-Required Surveillances

For a description of SRs and the how the requirements are met, see Section 3.4.2.

4.3.3 Non-Technical Safety Requirement Inspections and Testing

The routine maintenance procedures for major components are listed in Appendix B.

4.3.4 Maintenance

Maintenance procedures have been developed and are listed in Appendix B for tank farm maintenance. Maintenance is conducted in accordance with these procedures.
5.0 REFERENCES


E-525-C02, *Construction Specification for Project E-525 (Design Package 2) 241-AN and 241-AW COB Transfer Lines*.


**Hanford Site Drawings**

- H-2-2126, Sheet 5, 200 Area Utility Switching Diagram
- H-2-71925, Sheet 2, Electrical Power and Control Plan and Details
- H-2-71932, Sheet 1, Electrical Instrument Plans
- H-13-000040, Sheet 1, Electrical Resistance Tomography Testing
- H-14-020000, Sheets 1-4, Tank Farm System P&ID Structure Legend
- H-14-030001, Sheets 1-4, Electrical (EDS) One Line Diagram.

**Hanford Plant Standards**

• HPS-E-2-1, *Vertical Clearances of Services on Poles and Horizontal Clearance to Railroads*, Rockwell Hanford Operations, Richland, Washington.


• HPS-E-3-2, *Distribution and Telephone Grounding Assembly with Galvanized Ground Rods*, Rockwell Hanford Operations, Richland, Washington.

• HPS-E-10-1, *Concrete Encased Underground Ducts – One and Two Conduits*, Rockwell Hanford Operations, Richland, Washington.


• HPS-E-12-6, *Grounding Plate Installations in Building*, Rockwell Hanford Operations, Richland, Washington.


NEMA ST-20, *Dry Type Transformers for General Applications*, National Electrical Manufacturers Association, Rosslyn, Virginia.


*Occupational Safety and Health Act of 1970*, 29 USC 651 et seq.


TO-220 AN Farm Operations, Washington River Protection Solutions, LLC, Richland, Washington.


APPENDIX A
DRAWINGS AND DOCUMENTS NECESSARY TO MAINTAIN CONFIGURATION CONTROL OF DESIGN BASELINE

This appendix contains lists of documents and drawings that provide the reader with technical information regarding the design of the Electrical Distribution System for the AN Tank Farm. Drawings and documents may be accessed via DMCS.

Table A-1 list the Essential drawings for the system. These baseline drawings will be maintained under configuration control per applicable procedures (the design authority responsible for the system must approve any changes to these drawings). This list is based upon the definition of “essential drawings” as defined in TFC-ENG-DESIGN-C-09, ENGINEERING DRAWINGS; “A category of engineering drawings that depict active facility (e.g., nuclear and chemical storage facilities) systems, structures, and components (SSCs) and are necessary to support emergency response actions.”

Table A-1. AN Tank Farms Electrical Distribution System Essential Drawings

<table>
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<tr>
<th>Hanford Site Drawing Number</th>
<th>Sheet Number</th>
<th>Title</th>
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<tr>
<td>H-14-030001</td>
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<td>Electrical (EDS) One Line Diagram and Panelboard Schedules</td>
<td>Essential</td>
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<tr>
<td>H-14-030101</td>
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<td>AN241-VTP (W-314) Exhauster Train A One Line Diagram</td>
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<tr>
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<td>Electrical AN241-EDS-DP-121 One Line Diagram</td>
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<tr>
<td>H-14-102552</td>
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<td>Electrical Caustic Area Section, Detail &amp; Schedule</td>
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</tbody>
</table>
The drawings and documents listed in Table A-2 supplement the design baseline for the system. These drawings and documents must be maintained under configuration control. The design authority must approve any changes to these drawings and documents. This list is based upon the definition of “support drawings,” as defined in TFC-ENG-DESIGN-C-09, ENGINEERING DRAWINGS; “A category of drawings that, in addition to Essential, provides Engineering, Maintenance, and Operations the details necessary for plant operations.”

Table A-2. AN Tank Farms Electrical Distribution System Support Drawings.

<table>
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<td>H-2-68330</td>
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<td>Support</td>
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<td>H-2-64349</td>
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<td>Electrical Wire Run List (100 Series-Sheet 1)</td>
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<tr>
<td>H-2-71117</td>
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<td>Electrical Misc. Plan and Details</td>
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<tr>
<td>H-2-71560</td>
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<td>Elec/Instr. Substation C connection diagram</td>
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<td>Electrical Details</td>
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<td>Electrical Power and Controls Elementary Diagrams</td>
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<td>Electrical Leak Detection Plan &amp; Details</td>
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<td>H-2-71931</td>
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<td>Electrical Leak Detection Elementary Diagrams</td>
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<td>H-2-71932</td>
<td>1</td>
<td>Electrical Instrument Plan</td>
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<td>Wire Run Lists</td>
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<td>H-14-106530</td>
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<td>Waste Retrieval System Interconnection Block Diagram</td>
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<td>AN156-WT-ENCL-106 Arrangement/Wiring</td>
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<td>AN156-WT-ENCL-107 Arrangement/Wiring</td>
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</table>
The drawings listed in Table A-3 make up the historical design baseline for the system. The System Engineer responsible for the system must approve any changes to these drawings. These drawings will be maintained under configuration control. However, the drawings should be used with caution because they may not reflect current field configuration.

Table A-3. AN Tank Farm Electrical Distribution System Design-Basis Documents Shared with Other Systems.

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<tr>
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<tr>
<td>H-2-2126</td>
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<td>200 Area Utility Switching Diagram</td>
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</table>

The drawings and documents listed in Table A-4 are neither active nor maintained under configuration control. The drawings and documents are considered to contain information that is relevant and helpful to understanding the system. They should be used with caution, because they may not reflect current field configuration.

Table A-4. AN Tank Farm Electrical Distribution System Design Baseline Documents

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<td>H-2-71117</td>
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<td>Electrical Miscellaneous Plans and Details</td>
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<tr>
<td>H-2-71560</td>
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<td>Elec/Instr Substation “C” Connection Diagrams</td>
<td></td>
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<tr>
<td>H-2-71561</td>
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Table A-4. AN Tank Farm Electrical Distribution System Design Baseline Documents

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<td>H-14-104119</td>
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<td>DST Annulus Pumping Utility Wiring Diagram</td>
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The drawings and documents listed in Table A-5 are for historical purposes only and are not maintained under configuration control. The drawings and documents are considered to contain information that is relevant and helpful to understanding the system. They should be used with caution, because they may not reflect current field configuration.

**Table A-5. AN Tank Farm Electrical Distribution System Archived Informational Documents.**

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<td>Electrical Site Preparation Wiring Diagram</td>
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<td>B-130-C1</td>
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<td>Construction Specification for the 241-AN Tank Farm Site Preparation Project B-130, Vitro Engineering Corporation, Richland, Washington</td>
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<td>B-130-C7</td>
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<td>Construction Specification for the 241-AN Tank Farm Completion Project B-130, Vitro Engineering Corporation, Richland, Washington</td>
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<td>B-130-P5</td>
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<td>Procurement Specification for 1,000 KVA Load Center Unit Substation Project B-130 241-AN Tank Farm, Vitro Engineering Corporation, Richland, Washington</td>
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APPENDIX B
SYSTEM PROCEDURES

Table B-1 is a list of applicable operating procedures and documents that may provide the reader with technical information regarding the Electrical Distribution System for the AN Tank Farm. Operating procedures are available via the RPP Policies and Procedures web site. Documents may be accessed via Records Management Information System (RMIS) View/Print.

Table B-1. Electrical Distribution System Maintenance and Operating Procedures and Documents.

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<th>Procedure Number</th>
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<td>3-EDS-180</td>
<td>Inspections and Test of Ground Fault Circuit Interrupter Receptacles and Circuit Breakers, Tank Farm Maintenance Procedure, Washington River Protection Solutions, LLC, Richland, Washington</td>
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<td>3-EDS-615</td>
<td>Variable Frequency Drive Inspecting, Cleaning and Energizing Tank Farm Maintenance Procedure, Washington River Protection Solutions, LLC, Richland, Washington</td>
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<td>PLC Inspection, Cleaning and Energizing Tank Farm Maintenance Procedure, Washington River Protection Solutions, LLC, Richland, Washington</td>
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<td>3-EDS-661</td>
<td>Assured Grounding Electrical Cord Inspection Tank Farm Maintenance Procedure, Washington River Protection Solutions, LLC, Richland, Washington</td>
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<td>5-EDS-050</td>
<td>Electric Motor Inspection Tank Farm Maintenance Procedure, Washington River Protection Solutions, LLC, Richland, Washington</td>
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<td>5-EDS-146</td>
<td>Low Voltage Electrical Distribution System Inspection and Testing, Tank Farm Maintenance Procedure, Washington River Protection Solutions, LLC, Richland, Washington</td>
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<tr>
<td>TF-OR-DR-AN</td>
<td>AN Tank Farm Daily Rounds, Tank Farm Plant Operating Procedure, Washington River Protection Solutions, LLC, Richland, Washington</td>
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Table B-1. Electrical Distribution System Maintenance and Operating Procedures and Documents.

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<td>TF-OR-QR-AN</td>
<td><em>AN Tank Farm Quarterly Rounds</em>, Tank Farm Plant Operating Procedure, Washington River Protection Solutions, LLC, Richland, Washington</td>
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<td><em>Power Operator Rounds</em>, Tank Farm Plant Operating Procedure, Washington River Protection Solutions, LLC, Richland, Washington</td>
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<td>TO-220-100</td>
<td><em>Perform Scheduled Electrical Power Outage on 241-AN Tank Farm</em>, Tank Farm Plant Operating Procedure, Washington River Protection Solutions, LLC, Richland, Washington</td>
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<td>HNF-2938, Rev. 0</td>
<td><em>Evaluation of 241 AN Tank Farm Supporting Phase 1 Privatization Waste Feed Delivery</em>, prepared by Numatec Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington</td>
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<td>HNF-4492, Rev. 3</td>
<td><em>Interface Control Document Between the DST Tank Farm System and the Electrical Distribution System</em> CH2M HILL Hanford Group, Inc., Richland, Washington</td>
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<td>RPP-5228, Rev. 2</td>
<td><em>Assessment of the Electrical Power Requirements for Continued Safe Storage and Waste Feed Delivery- Phase One</em>, Washington River Protection Solutions, LLC, Richland, Washington</td>
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APPENDIX C
VENDOR INFORMATION FILES

Table C-1 contains a description of certified vendor information that may provide the reader with technical information regarding the design of the Electrical Distribution System for AN Tank Farm. Certified vendor information records can be searched using the Insight database system, but the information is available only by hardcopy from document control.

Table C-1. Certified Vendor Information.

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<td>Loadcenter 1,000 kVA</td>
<td>Layout drawings with parts list</td>
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<td>Schematic wiring drawing</td>
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<td>Production test procedure</td>
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<td>Instruction Book</td>
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<td>Power transformer</td>
<td>Instruction book</td>
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APPENDIX D
PARAMETERS LIST

Protective Equipment Settings are maintained in the CHAMPS database:
Figure E-1. One-Line Diagram – Loadcenter Unit Substation and Motor Control Center MCC-001.
Figure E-2. One-Line Diagram – 480 V Panelboard AN241-EDS-DP-103.
Figure E-3. One-Line Diagram – Motor Control Center MCC-001
(continued from Figure E-1).
Figure E-4. One-Line Diagram – Motor Control Center MCC-002.
Figure E-5. One-Line Diagram – AN Tank Farm Change Trailer T-154 and Caustic Addition Building 241-AN-274.
APPENDIX F
CROSS-REFERENCE TO TANK FARM FACILITY SYSTEM DESIGN DESCRIPTIONS CONTROLLED BY DESIGN ENGINEERING

The information in Table F-1 will help the reader understand how this system design description (SDD) document relates to SDDs of other tank farm systems and facilities.

The tank farms’ mission has changed from safely storing Hanford Site radioactive hazardous waste to delivering waste feed to the Waste Treatment Plant. Many changes to the tank farms facilities will be needed to support this new mission. Understanding the existing facility designs and their bases is crucial to efficiently designing and implementing changes. To this end, a list was compiled during fiscal year 2002 of all of the SDDs necessary to describe the tank farm nuclear facilities design and their bases. In general, the scopes of the SDDs were based on the systems defined by the ongoing labeling scheme in the tank farms, or logical geographic, or engineering discipline groupings of those systems. The labeling scheme is summarized on Hanford Site Drawing H-14-20000, Tank Farms Systems P&ID Structures Legend. Table F-1 lists the SDDs that were envisioned when the initiative began and includes an abstract of each SDD’s scope.

Table F-1. Cross-Reference to Tank Farm Facility System Design Descriptions. (7 Sheets)

<table>
<thead>
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<th>Document Scope</th>
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<td>15136</td>
<td>System Design Description for the Replacement Cross-Site Transfer System Between 200 West and 200 East Tank Farms</td>
<td>Includes lift stations, vent/siphon stations, pumps, valves, pipe, jumpers, manifolds, heat trace, leak detection, master pump shutdown system, clean-out boxes, flush and dilution water supply from some interface, and process instrumentation (controllers, data acquisition, flow rate, pressure, temperature, mass balance) from Valve Pit SY-A to Valve Pit 244-A, not including the pits.</td>
<td>supersedes RPP-9811</td>
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<tr>
<td>Document Number (RPP)</td>
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<tr>
<td>15137</td>
<td>System Design Description for 200 East Area Double-Shell Tank Waste Transfer System</td>
<td>Includes lift stations, vent/siphon stations, pumps, valves, pipe, jumpers, manifolds, heat trace, leak detection, master pump shutdown system, clean-up boxes, flush and dilution water supply from some interface, and process instrumentation (controllers, data acquisition, flow rate, pressure, temperature, mass balance) for intra-farm and inter-farm waste transfers for double-shell tank farms in 200 East Area downstream of Pit 244-A, including Pit 244-A.</td>
<td>supersedes RPP-10638</td>
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<tr>
<td>15138</td>
<td>Includes lift stations, vent/siphon stations, pumps, valves, pipe, jumpers, manifolds, heat trace, leak detection, master pump shutdown system, clean-up boxes, flush and dilution water supply from some interface, and process instrumentation (controllers, data acquisition, flow rate, pressure, temperature, mass balance) for intra-farm and inter-farm waste transfers for SY Tank Farm, upstream of Pit SY-A, including the pit.</td>
<td>supersedes RPP-10682</td>
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<td>15141</td>
<td>System Design Description of Electrical Distribution System for AN Tank Farm</td>
<td>Electrical distribution system less than 480 volts to some breaker downstream</td>
<td>supersedes RPP-9262</td>
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<tr>
<td>15142</td>
<td>System Design Description of Electrical Distribution System for AP Tank Farm</td>
<td>Electrical distribution system less than 480 volts to some breaker downstream</td>
<td>supersedes RPP-9263</td>
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<tr>
<td>15143</td>
<td>System Design Description of Electrical Distribution System for SY Tank Farm</td>
<td>Electrical distribution system less than 480 volts to some breaker downstream</td>
<td>supersedes RPP-9261</td>
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<td>15144</td>
<td>System Design Description of Electrical Distribution System for AW Tank Farm</td>
<td>Electrical distribution system less than 480 volts to some breaker downstream</td>
<td>supersedes RPP-15145</td>
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<td>15145</td>
<td>System Design Description of Electrical Distribution System for AY/AZ Tank Farm</td>
<td>Electrical distribution system less than 480 volts to some breaker downstream</td>
<td>supersedes RPP-9266</td>
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<td>15118</td>
<td>System Design Description for AN Tank Farm Ventilation Tank Annulus System</td>
<td>The annulus ventilation system includes ventilation system inlet stations, filtration, valves, and ductwork from the atmosphere to the tank inlet riser flange. Also includes exhaust dueling, valves, deentrainment equipment, conditioning equipment, condensate collection subsystems, filter trains, fans, and stack gaseous emission sampling and monitoring systems from the tank exhaust riser flange to the top of the exhaust stack.</td>
<td>supersedes RPP-9997</td>
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Table F-1. Cross-Reference to Tank Farm Facility System Design Descriptions. (7 Sheets)

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<td>15119</td>
<td>System Design Description for AN Tank Farm Ventilation Tank Primary System</td>
<td>The primary ventilation system includes ventilation system inlet stations, filtration, valves, and ductwork from the atmosphere to the tank inlet riser flange. Also includes exhaust dueling, valves, deentrainment equipment, conditioning equipment, condensate collection subsystems, filter trains, fans, and stack gaseous emission sampling and monitoring systems from the tank exhaust riser flange to the top of the exhaust stack.</td>
<td>supersedes RPP-9996</td>
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<tr>
<td>15120</td>
<td>System Design Description for AW Tank Farm Ventilation Tank Annulus System</td>
<td>The annulus ventilation system includes ventilation system inlet stations, filtration, valves, and ductwork from the atmosphere to the tank inlet riser flange. Also includes exhaust dueling, valves, deentrainment equipment, conditioning equipment, condensate collection subsystems, filter trains, fans, and stack gaseous emission sampling and monitoring systems from the tank exhaust riser flange to the top of the exhaust stack.</td>
<td>supersedes RPP-10092</td>
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<td>15121</td>
<td>System Design Description for AW Tank Farm Ventilation Tank Primary System</td>
<td>The primary ventilation system includes ventilation system inlet stations, filtration, valves, and ductwork from the atmosphere to the tank inlet riser flange. Also includes exhaust dueling, valves, deentrainment equipment, conditioning equipment, condensate collection subsystems, filter trains, fans, and stack gaseous emission sampling and monitoring systems from the tank exhaust riser flange to the top of the exhaust stack.</td>
<td>supersedes RPP-10091</td>
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<td>15123</td>
<td>System Design Description for AP Tank Farm Ventilation Tank Annulus System</td>
<td>The annulus ventilation system includes ventilation system inlet stations, filtration, valves, and ductwork from the atmosphere to the tank inlet riser flange. Also includes exhaust dueling, valves, deentrainment equipment, conditioning equipment, condensate collection subsystems, filter trains, fans, and stack gaseous emission sampling and monitoring systems from the tank exhaust riser flange to the top of the exhaust stack.</td>
<td>supersedes RPP-10665</td>
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Table F-1. Cross-Reference to Tank Farm Facility System Design Descriptions. (7 Sheets)

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<td>System Design Description for AN Tank Farm Ventilation Tank Primary System</td>
<td>The primary ventilation system includes ventilation system inlet stations, filtration, valves, and ductwork from the atmosphere to the tank inlet riser flange. Also includes exhaust ducting, valves, deentrainment equipment, conditioning equipment, condensate collection subsystems, filter trains, fans, and stack gaseous emission sampling and monitoring systems from the tank exhaust riser flange to the top of the exhaust stack.</td>
<td>supersedes RPP-9996</td>
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<td>15120</td>
<td>System Design Description for AW Tank Farm Ventilation Tank Annulus System</td>
<td>The annulus ventilation system includes ventilation system inlet stations, filtration, valves, and ductwork from the atmosphere to the tank inlet riser flange. Also includes exhaust ducting, valves, deentrainment equipment, conditioning equipment, condensate collection subsystems, filter trains, fans, and stack gaseous emission sampling and monitoring systems from the tank exhaust riser flange to the top of the exhaust stack.</td>
<td>supersedes RPP-10092</td>
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<td>15121</td>
<td>System Design Description for AW Tank Farm Ventilation Tank Primary System</td>
<td>The primary ventilation system includes ventilation system inlet stations, filtration, valves, and ductwork from the atmosphere to the tank inlet riser flange. Also includes exhaust ducting, valves, deentrainment equipment, conditioning equipment, condensate collection subsystems, filter trains, fans, and stack gaseous emission sampling and monitoring systems from the tank exhaust riser flange to the top of the exhaust stack.</td>
<td>supersedes RPP-10091</td>
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<tr>
<td>15123</td>
<td>System Design Description for AP Tank Farm Ventilation Tank Annulus System</td>
<td>The annulus ventilation system includes ventilation system inlet stations, filtration, valves, and ductwork from the atmosphere to the tank inlet riser flange. Also includes exhaust ducting, valves, deentrainment equipment, conditioning equipment, condensate collection subsystems, filter trains, fans, and stack gaseous emission sampling and monitoring systems from the tank exhaust riser flange to the top of the exhaust stack.</td>
<td>supersedes RPP-10665</td>
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Table F-1. Cross-Reference to Tank Farm Facility System Design Descriptions. (7 Sheets)

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<tr>
<th>Document Number (RPP)</th>
<th>Document Title</th>
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<tr>
<td>15124</td>
<td>System Design Description for AP Tank Farm Ventilation Tank Primary System</td>
<td>The primary ventilation system includes ventilation system inlet stations, filtration, valves, and ductwork from the atmosphere to the tank inlet riser flange. Also includes exhaust ducting, valves, deentrainment equipment, conditioning equipment, condensate collection subsystems, filter trains, fans, and stack gaseous emission sampling and monitoring systems from the tank exhaust riser flange to the top of the exhaust stack.</td>
<td>supersedes RPP-10664</td>
</tr>
<tr>
<td>15125</td>
<td>System Design Description for SY Tank Farm Ventilation Tank Annulus System</td>
<td>The annulus ventilation system includes ventilation system inlet stations, filtration, valves, and ductwork from the atmosphere to the tank inlet riser flange. Also includes exhaust ducting, valves, deentrainment equipment, conditioning equipment, condensate collection subsystems, filter trains, fans, and stack gaseous emission sampling and monitoring systems from the tank exhaust riser flange to the top of the exhaust stack.</td>
<td>supersedes RPP-10667</td>
</tr>
<tr>
<td>15126</td>
<td>System Design Description for SY Tank Farm Ventilation Tank Primary System</td>
<td>The primary ventilation system includes ventilation system inlet stations, filtration, valves, and ductwork from the atmosphere to the tank inlet riser flange. Also includes exhaust ducting, valves, deentrainment equipment, conditioning equipment, condensate collection subsystems, filter trains, fans, and stack gaseous emission sampling and monitoring systems from the tank exhaust riser flange to the top of the exhaust stack.</td>
<td>supersedes RPP-10666</td>
</tr>
<tr>
<td>15127</td>
<td>System Design Description for AY/AZ Tank Farm Ventilation Tank Primary System</td>
<td>The primary ventilation system includes ventilation system inlet stations, filtration, valves, and ductwork from the atmosphere to the tank inlet riser flange. Also includes exhaust ducting, valves, deentrainment equipment, conditioning equipment, condensate collection subsystems, filter trains, fans, and stack gaseous emission sampling and monitoring systems from the tank exhaust riser flange to the top of the exhaust stack.</td>
<td>supersedes RPP-10668</td>
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### Table F-1. Cross-Reference to Tank Farm Facility System Design Descriptions. (7 Sheets)

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<tbody>
<tr>
<td>15128</td>
<td>System Design Description for AY/AZ Tank Farm Ventilation Tank Annulus System</td>
<td>The annulus ventilation system includes ventilation system inlet stations, filtration, valves, and ductwork from the atmosphere to the tank inlet riser flange. Also includes exhaust ducting, valves, deentrainment equipment, conditioning equipment, condensate collection subsystems, filter trains, fans, and stack gaseous emission sampling and monitoring systems from the tank exhaust riser flange to the top of the exhaust stack.</td>
<td>supersedes RPP-10669</td>
</tr>
<tr>
<td>15129</td>
<td>System Design Description for Standard Single-Shell Tank Farm Ventilation Systems</td>
<td>Includes the ventilation tank primary systems, both active and passive, for all the single-shell tanks in the 200 East and 200 West Areas.</td>
<td></td>
</tr>
<tr>
<td>15130</td>
<td>System Design Description for Double-Contained Receiver Tank Ventilation and Purge Air Systems</td>
<td>Includes the ventilation tank primary and annulus systems and that portion of the Waste Storage Tank system that is referred to as the purge air system for double-Contained receiver tanks. Does not include tank structure, pump pits, mixer or transfer pumps, gas monitoring, or cameras.</td>
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<tr>
<td>15131</td>
<td>System Design Description for AW Tank Farm Double-Shell Tank Waste Storage System</td>
<td>Includes primary and secondary tank structure, central pump pit, annulus pump pit, leak detector pit, mixer pumps, monitoring equipment (level, temperature, pressure, leak (continuous air monitors [CAM] used for annulus leak detection). Does not include ventilation, tank integrity, gas monitoring, cameras.</td>
<td>supersedes RPP-9173</td>
</tr>
<tr>
<td>15132</td>
<td>System Design Description for AN Farm Double Shell Tank Waste Storage System (DSA Based)</td>
<td>Includes primary and secondary tank structure, central pump pit, annulus pump pit, leak detector pit, mixer pumps, monitoring equipment (level, temperature, pressure, leak (CAMs used for annulus leak detection). Does not include ventilation, tank integrity, gas monitoring, cameras.</td>
<td>supersedes RPP-10658</td>
</tr>
<tr>
<td>15133</td>
<td>System Design Description for AP Farm Double Shell Tank Waste Storage System (DSA Based)</td>
<td>Includes primary and secondary tank structure, central pump pit, annulus pump pit, leak detector pit, mixer pumps, monitoring equipment (level, temperature, pressure, leak (CAMs used for annulus leak detection). Does not include ventilation, tank integrity, gas monitoring, cameras.</td>
<td>supersedes RPP-9850</td>
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<tr>
<td>15134</td>
<td>System Design Description for SY Farm Double Shell Tank Waste Storage System (DSA Based)</td>
<td>Includes primary and secondary tank structure, central pump pit, annulus pump pit, leak detector pit, mixer pumps, monitoring equipment (level, temperature, pressure, leak (CAMs used for annulus leak detection). Does not include ventilation, tank integrity, gas monitoring, cameras.</td>
<td>supersedes RPP-10659</td>
</tr>
<tr>
<td>15135</td>
<td>System Design Description for AY/AZ Tank Farm Double-Shell Tank Waste Storage System</td>
<td>Includes primary and secondary tank structure, central pump pit, annulus pump pit, leak detector pit, mixer pumps, monitoring equipment (level, temperature, pressure, leak (CAMs used for annulus leak detection). Does not include ventilation, tank integrity, gas monitoring, cameras.</td>
<td>supersedes RPP-10660</td>
</tr>
<tr>
<td>15146</td>
<td>System Design Description for Tank Farms Double-Shell Tank Emergency Annulus Pumping System</td>
<td>All auxiliary equipment that is not already part of the double-shell tank (DST) waste storage tank and waste storage tank annulus that is needed to pump all DST annuli</td>
<td>supersedes RPP-9174</td>
</tr>
<tr>
<td>15147</td>
<td>System Design Description for Tank Farms Tank Monitor and Control System</td>
<td>All River Protection Project (RPP)facilities where Tank Monitoring and Control System equipment is installed</td>
<td>supersedes RPP-10684</td>
</tr>
</tbody>
</table>