CONCENTRATION, STORAGE, AND TRANSFER FACILITIES

DOCUMENTED SAFETY ANALYSIS

GENERAL TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Volume #</th>
<th>Chapter #</th>
<th>Chapter Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ES</td>
<td>EXECUTIVE SUMMARY</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>SITE CHARACTERISTICS</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>FACILITY DESCRIPTION</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>HAZARD AND ACCIDENT ANALYSES</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>SAFETY STRUCTURES, SYSTEMS, AND COMPONENTS</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>DERIVATION OF TECHNICAL SAFETY REQUIREMENTS</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>PREVENTION OF INADVERTENT CRITICALITY</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>RADIOLOGICAL PROTECTION</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>HAZARDOUS MATERIAL PROTECTION</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>RADIOACTIVE AND HAZARDOUS WASTE MANAGEMENT</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>INITIAL TESTING, IN-SERVICE SURVEILLANCE AND MAINTENANCE</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
<td>OPERATIONAL SAFETY</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>PROCEDURES AND TRAINING</td>
</tr>
<tr>
<td>5</td>
<td>13</td>
<td>HUMAN FACTORS</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>QUALITY ASSURANCE</td>
</tr>
<tr>
<td>5</td>
<td>15</td>
<td>EMERGENCY PREPAREDNESS PROGRAM</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>PROVISIONS FOR DECONTAMINATION AND DECOMMISSIONING</td>
</tr>
<tr>
<td>5</td>
<td>17</td>
<td>MANAGEMENT, ORGANIZATION, AND INSTITUTIONAL PROVISIONS</td>
</tr>
<tr>
<td>5</td>
<td>18</td>
<td>TANK 48 ACCIDENT ANALYSIS</td>
</tr>
</tbody>
</table>
CONCENTRATION, STORAGE, AND TRANSFER FACILITIES

DOCUMENTED SAFETY ANALYSIS

REVISION STATUS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>AFFECTED SECTIONS</th>
<th>REVISION</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
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## REVISION LOG

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<th>Description of Changes</th>
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<td>Revisited to include Type I/II Waste Tank Chemical Cleaning including resolution of the PISA against F-Tank Farm Type I Waste Tank Chemical Cleaning process</td>
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<td>All Chapters</td>
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| 16   | 6/2014 | ES, 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 13, 14, 16, 18, 18 | - Incorporated CRFs: HLW-CRF-14002, HLW-CRF-14003, HLW-CRF-14005, HLW-CRF-14006  
- Aligned Sub-Section titles to match DOE-STD-3009 where appropriate  
- Updated References  
- Clarified Unmitigated/Mitigated Progressions, Source Term derivations  
- Clarified Aerosolization events  
- Updated Table 5.9-1 for Administrative Controls  
- Added Waste Tank Overheating scenario for waste tank annulus  
- Deleted Waste Box Control Program  
- Revised Static Waste Tank Overheating scenario to Not Credible  
- Modified Process Area and Mode Applicabilities for jetting of sump  
- Added new Conditions to facilitate maintenance during cell cover removal in pump pits and ventilated diversion boxes  
- Updated list of external sources of liquid radioactive waste to the CSTF  
- Revised verification methodology to conform to current Manual 2S requirements  
- Made changes for resolution of PISA PI-2014-0001 |
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<tr>
<th>Rev.</th>
<th>Date</th>
<th>Chapters Affected</th>
<th>Description of Changes</th>
</tr>
</thead>
</table>
- Updated to new SRS Site Characteristics and Program Descriptions (SCPD) document  
- Added sub headings to Chapter 3  
- Modified to recognize consolidation of 242-1F and 241-74F Control Rooms  
- Removed Mechanical Cleaning for Type IV waste tanks  
- Updated References  
- Modified/clarified actions and supporting text for Event Response and Severe Weather Response  
- Changed the Preventive Maintenance Program to the Nuclear Maintenance Management Program  
- Updated portions of DSA Chapter 5 for TSR Methodology Manual Rev. 6 changes  
- Modified Requirements Section in DSA Chapters 1 and 7-17 for consistent approach  
- Added Prohibited Operation and clarified information regarding fuel powered vehicles/equipment (other than diesel powered) used within Building 299-H  
- Added isolation requirements to consider system “non-continuous makeup capability” (electrical or mechanical isolation shall contain two independent means of isolation)  
- Added information about accounting for analytical uncertainty  
- Updated Low-Rem transfer criteria for Type IV waste tanks  
- Modified Pump Run Program and Salt Dissolution/Interstitial Liquid Removal Program |
<table>
<thead>
<tr>
<th>Rev.</th>
<th>Date</th>
<th>Chapters Affected</th>
<th>Description of Changes</th>
</tr>
</thead>
</table>
| 18   | 3/2016 | ES, 2, 3, 4, 5, 6 | - Incorporated CRFs: HLW-CRF-15006, HLW-CRF-15007, HLW-CRF-15008, HLW-CRF-15009  
- Updated text associated with Tank 16 to recognize tank has been filled with grout  
- Updated Chapter 3 to recognize new Trapped Gas Release CHA  
- Revised text to recognize pump speed evaluation of the Transfer Control Program  
- Modified waste tank primary and annulus volumes based on changes to inputs  
- Defined terms “settled sludge” and “slurried sludge” per new input  
- Created new “Controls for Waste Tanks Undergoing Planned Gas Release Activities” subsection  
- Revised “Waste Tank Quiescent Time Program” subsection |
<table>
<thead>
<tr>
<th>Rev.</th>
<th>Date</th>
<th>Chapters Affected</th>
<th>Description of Changes</th>
</tr>
</thead>
</table>
| 19   | 6/2016 | ES, 1, 2, 3, 4, 5, 6, 18 | - Incorporated CRFs: HLW-CRF-16001, HLW-CRF-16002  
- Updated text associated with Tank 12 to recognize the tank has been closed and backfilled with grout.  
- Modified text to recognize permitted time delay relays for alarms associated with Conductivity Probes.  
- Revised text for clarifications associated with issues identified in the Extent of Condition review for the Waste Tank Siphon PISA.  
- Revised text to address changes made to the Mercury Management Program and addition of new controls (Evaporator Mercury Monitoring LCO). Added new Evaporator Modes. This change resolves PISA PI-2015-0001.  
- Updated References.  
- Added discussion pertaining to the Tank 50 to Z-Area events in the NPH DBA Sections of Chapter 3.  
- Added safety function for Very Slow Generation Tanks when receiving a steam jetted transfer. Modified LCO 3.8.1 for applicability of Very Slow Generation Tanks during receipt of a steam jetted transfer.  
- Modified LCO 3.7.4 (Valve Box, Drain Valve Box, and HPFP Leak Detection Instruments) and created new LCO 3.7.14 (Valve Box, Drain Valve Box, and HPFP Level) to address residual waste levels.  
- Revised basis discussion for restoring ventilation on pump tanks to account for the presence of the pump tank passive vent and dissolved hydrogen release from a steam jetted transfer from a source less than or equal to 1,200 gallons. |
<table>
<thead>
<tr>
<th>Rev.</th>
<th>Date</th>
<th>Chapters Affected</th>
<th>Description of Changes</th>
</tr>
</thead>
</table>
| 20   | 8/2017 | All Chapters      | - Incorporated CRFs: HLW-CRF-16003, HLW-CRF-17001, HLW-CRF-17002, HLW-CRF-17003  
     |        |                   | - Modified the status of the 242-16F Evaporator such that it is an “Inactive Location” per the DSA/TSR (does not require additional hazard/accident analysis).  
     |        |                   | - Modified the status of Valve Box 15/16 such that it is an “Inactive Location” per the DSA/TSR (does not require additional hazard/accident analysis).  
     |        |                   | - Updated ventilation system setpoints (and references) for closure of PISA PI-2016-0010 (Errors Associated with Waste Tank Purge Ventilation System “Degraded” Flow Calculation and Setpoints) and associated ESS (U-ESS-H-00012).  
     |        |                   | - Updated Work Product Disclaimer at the beginning of each DSA chapter to the new Disclaimer for AECOM N&E Technical Services, LLC.  
     |        |                   | - Clarified discussion pertaining to radiological versus chemical consequences and added new reference report (G-ESR-H-00232).  
     |        |                   | - Modified “non-waste” transfer definition/criteria with respect to chemical EGs.  
     |        |                   | - Clarified DSA use of radiolytic hydrogen generation rate for Type IV tanks.  
     |        |                   | - Added clarifying discussion to the Valve Box Explosion sub-DBA recognizing that a deflagration could occur for the Tank 40 VB and Tank 51 VB (when the waste material is ESP Sludge Slurry), but that the progression for this DBA (explosion with follow-on spill) is assumed to not occur for mitigated analysis and no consequences are attributed to a VB explosion.  
     |        |                   | - Modified reported “Tank 50” type consequence from the LPDT Cell explosion to the Tank 50 VB explosion.  
     |        |                   | - Added bases justifying why no change is necessary for “required setpoints” for ventilation flow related to in-leakage allowances permitted by Level 4 duct class. |
CONCENTRATION, STORAGE, AND TRANSFER FACILITIES

DOCUMENTED SAFETY ANALYSIS

EXECUTIVE SUMMARY

Revision 20
August 2017
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This document was prepared by AECOM N&E Technical Services, LLC (N&E TS) under contract with Savannah River Remediation, LLC (SRR), subject to the warranty and other obligations of that contract and in furtherance of SRR’s contract with the United States Department of Energy (DOE). N&E TS’ findings represent its reasonable judgments within the time and budget context of its commission and utilizing the information available to it at the time. This document was prepared solely for the DOE for Contract DE-AC09-09SR22505.

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<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.3-1</td>
<td>Facility Hazard Categorization, DOE-STD-1027-92</td>
<td>ES-5</td>
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<tr>
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EXECUTIVE SUMMARY

E.1 FACILITY BACKGROUND AND MISSION

E.1.1 FACILITY BACKGROUND

In the early 1950s, 12 carbon steel-walled, concrete-encased, underground tanks were constructed in F- and H-Areas for the storage of aqueous, radioactive wastes produced in the Separations processing of fuel and target material from the nuclear production reactors at the Savannah River Site (SRS). Over the next 30 years, 39 additional tanks of similar but improved design were constructed to store wastes from SRS Separations and research facilities. These storage tanks are inter-connected by underground piping and transfer facilities to permit transferring wastes from tank to tank and from tank to process facility. Eight of the older storage tanks (Tanks 5, 6, 12, 16, 17, 18, 19, and 20) have been closed and backfilled with grout.

In 1958, the first steam-heated, water-cooled waste evaporator was installed to concentrate stored wastes and reduce liquid waste volume. Four additional evaporators were subsequently installed. Of the five total evaporators, the 242-F, 242-16F, and 242-H Evaporators have been removed from service for decommissioning. The remaining operating evaporators are the 242-16H and 242-25H Evaporators.

The original waste storage and processing concepts have evolved over the years. By applying improvements to the waste handling and waste management methods, these facilities in F-Area and H-Area have been modified and organized into an integrated waste treatment program. This program ties the waste storage and evaporation processes, decontamination processes (Concentration, Storage, and Transfer Facilities [CSTF]), and the solidification and vitrification processes (Defense Waste Processing Facility [DWPF]/Saltstone Facility) together.

E.1.2 FACILITY MISSION

The mission of the CSTF is to manage liquid, radioactive wastes from production and research facilities at the SRS. The management mission includes storage and processing of these wastes in a manner that prevents releases to the environment and minimizes exposure of site workers and the public to the wastes. The CSTF also processes the liquid wastes for solidification at the DWPF/Saltstone Facility. These two facilities are covered in their individual Safety Bases.

This facility mission is accomplished by the following F-Area and H-Area Tank Farm processes and facilities, which constitute the CSTF:

- Waste storage tanks
- Evaporators (242-16H and 242-25H)
- Transfer facilities and systems (including diversion boxes, pump pits, pump tanks, valve boxes)
- Interconnecting waste transfer lines (including the inter-area waste transfer line)
- Support services
• Waste Management Maintenance Facility, 299-H
• Actinide Removal Process (ARP) Facility, 241-96H
• Modular Caustic Side Solvent Extraction Unit (MCU), 241-278H

The term “CSTF” refers to the above processes and facilities, and is used throughout this DSA.

The CSTF supports the SRS mission discussed in the SRS Site Characteristics and Program Descriptions (SCPD) (Ref. 1), which includes safe maintenance of the tritium stockpile, interim storage of nuclear materials, waste management, environmental cleanup and restoration, support of arms control, nonproliferation activities, and some civilian issues.

E.2 FACILITY OVERVIEW

E.2.1 LOCATION

The CSTF is located near the geographic center of SRS, which occupies an area of approximately 300 square miles on the upper Atlantic Coastal Plain of South Carolina. SRS is bounded on the southwest by the Savannah River, is approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina. The location of SRS, relative to surrounding population centers, is described in Chapter 1.

The F-Tank Farm is located in the F-Separations Area and the H-Tank Farm and 299-H Maintenance Facility are within the H-Separations Area. Area plan views provided in Chapter 1 illustrate the location of the CSTF within the F and H Separations areas and depict the separations areas relative to the SRS boundary and the CSTF.

The SCPD (Ref. 1) describes SRS and the sitewide utilities, fire support, medical support, emergency services, and centralized management programs that support all of the SRS operating facilities.

E.2.2 CONCENTRATION, STORAGE, AND TRANSFER FACILITIES DESCRIPTION

The CSTF consists of the waste evaporators and 51 underground waste storage tanks that, together, perform the storage and handling functions of the liquid radioactive waste.

The waste evaporators remove excess water from the CSTF process. The other CSTF systems are the waste storage tanks and associated subsystems; the Waste Transfer Systems that interconnect the tanks; and provisions made for emergency transfer and spare tank capacity.

E.2.2.1 Tank Farms

Built between 1952 and 1981, the 51 underground waste storage tanks are constructed of carbon steel and set in reinforced concrete vaults. Twenty-nine of the tanks are located in H-Area and twenty-two are in F-Area. Eight of the older storage tanks (Tanks 5, 6, 12, 16, 17, 18, 19, and 20) have been closed and backfilled with grout.

The risk posed by operation of these systems is largely independent of location, so these systems are described in the Documented Safety Analysis (DSA) without regard to their physical
location. Chapter 2 contains more detail on the physical location, layout, and design of the Structures, Systems, and Components (SSCs).

E.2.2.2 Waste Evaporators

Radioactive liquid waste received in the CSTF can be reduced to about one-third of its original volume or immobilized as a saltcake by successive evaporation. To achieve this reduction in volume, evaporators are provided in each Tank Farm for the concentration of radioactive waste. There are two operating evaporators (242-16H and 242-25H). Three other evaporators (242-F, 242-16F, and 242-H) have been removed from service. Chapter 2 provides more details on the design and operation of the evaporators.

E.2.2.3 Waste Transfer Systems

Waste is transferred to waste storage/receiving tanks within the CSTF using systems consisting of diversion boxes, valve boxes, pump tanks, and connecting transfer lines. These transfer systems are also used to transfer wastes between each Tank Farm. The diversion boxes act as confined junction boxes for interconnecting waste transfer lines. The pipelines are connected to one another by specifically designed pipes called jumpers. The jumpers have special connections (mostly Hanford connectors) that are tightened by a remotely operated impact wrench. Diversion boxes and transfer lines are buried for shielding purposes, except where the proper elevation of lines requires placement above grade.

Typical transfer lines are composed of double-walled pipe, with a stainless steel primary pipe inside a carbon steel secondary pipe. Leak detection is typically provided between the carbon and stainless steel pipes.

Pumps, jet eductors, and gravity (where relative elevations permit) are used for waste transfers. Several different pump types are employed for various pumping requirements. These include vertical pumps designed to operate in pump tanks and deep well pumps for evaporator feed. Various mixing devices (e.g., long-shaft slurry pumps, submersible mixer pumps) and telescoping transfer pumps are typically used for sludge processing and waste removal operations.

E.2.2.4 299-H Maintenance Facility

The Waste Management Maintenance Facility, Building 299-H, is used for the decontamination, repair, and modification of contaminated equipment associated with the SRS radioactive waste management program. This facility provides adequate resources for decontaminating and repairing recoverable equipment used in the CSTF, permits repair of equipment too large for other repair facilities, and reduces outdoor repairs of contaminated equipment.

E.2.2.5 241-96H Actinide Removal Process Facility

The 241-96H ARP Facility supports liquid waste salt processing by providing actinide removal capabilities. Salt wastes stored in the CSTF waste tanks contain insoluble sludge, soluble strontium, and actinides which may require removal to meet downstream acceptance criteria of
the waste. After achieving actinide adsorption the MST/salt solution is transferred to 512-S for filtration and sludge concentration.

E.2.2.6 241-278H Modular Caustic Side Solvent Extraction Unit Facility

The 241-278H MCU Facility supports liquid waste processing by providing removal/reduction of cesium from salt solution batches using Caustic Side Solvent Extraction (CSSX) technology. Processed batches of the low cesium salt solution are transferred to Tank 50 for feed to the Saltstone Facility, and batches with solutions of higher cesium concentration from the CSSX process are transferred to the DWPF.

E.3 FACILITY HAZARD CATEGORIZATION

An initial hazard categorization, performed for the CSTF in accordance with Department of Energy (DOE)-Standard (STD)-1027-92 (Ref. 2), determined the CSTF to be Hazard Category (HC) 2. As shown in Table E.3-1, the calculated curie amounts for each dominant radionuclide exceeds the HC 2 threshold of DOE-STD-1027-92 (Ref. 2). Based on the inventory of radionuclides and chemicals, the 241-96H ARP Facility is conservatively bounded by the maximum curie content and chemical constituents analyzed for 512-S and is categorized consistent with the CSTF as a Nonreactor HC 2 Nuclear Facility, as stated in the CSTF Consolidated Hazards Analysis. With HC 2 established based on radioactive material inventory, categorization based on chemical inventory was not pursued any further.

Two segments of CSTF (Building 299-H Maintenance Facility and 241-278H MCU Facility) do not contain significant radioactive material inventory or a chemical inventory that exceeds the HC 2 threshold. Based on the radionuclides of the analyzed stream, the 241-278H MCU Facility does not challenge the Offsite or Onsite Evaluation Guidelines. Nitric acid, boric acid, and sodium hydroxide quantities are such that they are screened from further evaluation. The quantities of solvent constituents are such that the maximum potential release could not result in chemical consequences that challenge Acute Exposure Guideline Limit (AEGL)-3, Emergency Response Planning Guideline (ERPG)-3, or Temporary Emergency Exposure Limit (TEEL)-3 limits. The TEEL-2 value could possibly be exceeded for the Facility Worker; however multiple engineered and procedural controls can prevent this and no safety related controls are required. AEGL, ERPG, and TEEL are now collectively referred to as Protection Action Criteria (PAC). PAC can be used interchangeably with AEGL, ERPG, and TEEL. Based on the above, MCU is categorized as HC 3, as stated in the CSTF Consolidated Hazards Analysis.

As permitted by DOE-STD-1027-92 (Ref. 2), facility segmentation has been applied and Building 299-H Maintenance Facility and 241-278H MCU Facility segments have been classified as HC 3, with the remainder of CSTF remaining HC 2. As part of the tank closure process, Waste Storage Tanks 5, 6, 12, 16, 17, 18, 19, and 20 have been closed and backfilled with grout. These waste tanks are “Radiological” facilities.
Table E.3-1  Facility Hazard Categorization, DOE-STD-1027-92

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<td>1.27x10^8</td>
<td>8.9x10^4</td>
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<td>Sr-90</td>
<td>1.22x10^8</td>
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<tr>
<td>Pu-238</td>
<td>1.96x10^6</td>
<td>62</td>
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</table>

E.4  SAFETY ANALYSIS OVERVIEW

The identification and classification of the potential hazards and accidents associated with the operation of the facilities that comprise the CSTF are discussed and evaluated in Chapter 3. This chapter identifies and assesses potential hazards associated with CSTF operation. The Hazards Analyses (HAs), presented in Section 3.3, are used as the basis for identification of Safety Significant SSCs and Administrative Controls to protect the onsite worker. The HAs were also used in the selection of the Design Basis Accidents (DBAs) for further detailed quantitative analysis. The DBA analyses, presented in Section 3.4, are used as the basis for identification of Safety Class and Safety Significant SSCs and Administrative Controls to protect the offsite public.

E.4.1  HAZARDS ANALYSIS

HAs were performed for the CSTF to characterize the level of intrinsic potential hazards associated with the facility in accordance with DOE-STD-3009-94 (Ref. 3). The HAs helped in selecting a limited set of bounding DBAs discussed in Section 3.4.

The HAs consist of three basic analytical activities: hazard identification, hazard classification, and hazard evaluation. In the process, the common industrial hazards and routinely accepted hazards, which the DOE graded approach excludes from the formal accident analysis process, were identified. The hazard evaluation methodology represents the initial phase of accident analysis and identified the accident scenarios that required consideration. These accidents were categorized as DBAs and Beyond Design Basis Accidents (BDBAs). BDBAs include those accidents deemed Beyond Extremely Unlikely.

E.4.2  ACCIDENT ANALYSIS

DBAs are credible accidents that may challenge the acceptance criteria for unmitigated scenarios and require controls to mitigate the consequences or prevent the occurrence of the accident. BDBAs are judged to be low frequency accidents (typically around 1E-06 events per year), but have the most severe consequence potential.

Section 3.4 of this DSA presents the analyses for the two classes of CSTF accidents. Mitigated consequences are also included for the DBAs. The DBAs consist of operational-related events, natural phenomenon events, and external events. The analysis for each DBA includes scenario
development, frequency determination, source term analysis, consequence analysis, comparison to guidelines, and a summary of Safety Class SSCs, Safety Significant SSCs, and Defense-in-Depth SSCs/Technical Safety Requirement (TSR) controls.

The BDBAs analyzed consist of operational-related events and natural phenomena events.

E.4.3 ANALYSIS APPLICATION

Additional information regarding the Safety Class and Safety Significant SSCs for each potential accident (event) identified in Section 3.4 is provided in Chapter 4. These same SSCs and the administrative requirements are also discussed in Chapter 5, “Derivation of Technical Safety Requirements,” and incorporated as necessary into TSR controls.

E.5 ORGANIZATIONS

The following discussion (and the organization descriptions found throughout this DSA) is representative of the CSTF organizational structure, but may not be accurate in presenting current group and/or individual titles.

E.5.1 LIQUID WASTE CONTRACTOR

Management and operation of SRS is currently the responsibility of the Management and Operations (M&O) contractor and the Liquid Waste (LW) contractor. The LW contractor relies on support from the M&O contractor to perform specific tasks supporting the LW mission. The following organizations support the LW contractor:

- Savannah River National Laboratory (M&O contractor)
- Infrastructure and Project Support (M&O contractor)
- Environmental, Safety, Health, and Quality Assurance (M&O contractor and LW contractor)

LW is the parent organization of the CSTF. The LW organization is managed by the LW contractor President and Project Manager. LW is composed of the following project organizations:

- Engineering
- Closure Projects (part of CSTF)
- Operations
  - DWPF Project
  - Tank Farms Project (part of CSTF)
  - Saltstone Project
  - Effluent Treatment Project
E.5.2 CONCENTRATION, STORAGE, AND TRANSFER FACILITY ORGANIZATION

The Tank Farms Operations Director has overall responsibility for managing the safe operation and maintenance of the CSTF. The Tank Farms Operations Director and Tank Farms Facility Manager are responsible for CSTF compliance with Standards as mandated in the Safety, Quality Assurance, Security, Radiological Control, Industrial Hygiene, and Procedures Manuals. The Tank Farms Facility Manager reports directly to the Tank Farms Operations Director. The LW organization is supported by Engineering, Maintenance, Quality Assurance and other support groups as necessary to safely manage the radioactive waste that is stored in the CSTF.

E.5.3 OUTSIDE SUPPORT ORGANIZATIONS

CSTF uses the M&O contractor for certain supporting activities and SRS security contractor for site security services. URS Professional Solutions LLC provides safety analysis services and other related safety activities as directed by LW.

E.6 SAFETY ANALYSIS CONCLUSIONS

This DSA supports the conclusion that the CSTF can be operated without undue risk to the public, to SRS workers, or the environment. Chapter 3 provides complete and detailed tabulations of accident analysis results, including event frequency, as well as maximum offsite and onsite radiological and chemical exposure consequences for all postulated accident scenarios.

E.7 DOCUMENTED SAFETY ANALYSIS ORGANIZATION

The DSA structure and content complies with the format and content specified in DOE-STD-3009-94 and 10 CFR 830 (Ref. 3, 4). The graded approach discussed in DOE-STD-3009-94 (Ref. 3) has been applied extensively in the following “programmatic” chapters:

- Chapter 7, “Radiological Protection”
- Chapter 8, “Hazardous Material Protection”
- Chapter 10, “Initial Testing, In-Service Surveillance and Maintenance”
- Chapter 11, “Operational Safety”
- Chapter 12, “Procedures and Training”
- Chapter 14, “Quality Assurance”
- Chapter 17, “Management, Organization, and Institutional Provisions”

This graded approach was done by referencing the details of the equivalent sitewide programs, and limiting the descriptions in this DSA to the identification of the interfaces between the CSTF and site programs and procedures. Additionally, Chapter 18 has been added to reflect the safety analysis and discussion of Tank 48 based on the guidance provided in the Safety Strategy for the CSTF DSA (Ref. 5).
Procedure Manual PS, Procedure PS-TS-AP-3001 (Ref. 6) controls content and changes to the site-level procedures to ensure that an updated listing is maintained of procedures needed for compliance with the Standards/Requirements Identification Document (S/RID) requirements and that procedure coordinators verify in writing that any revisions to applicable company-level policies and procedures remain in compliance with associated S/RID requirements.
E.8 REFERENCES


CONCENTRATION, STORAGE, AND TRANSFER FACILITIES

DOCUMENTED SAFETY ANALYSIS

CHAPTER 1
SITE CHARACTERISTICS

Revision 20
August 2017
DISCLAIMER

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## CONTENTS

1.0 SITE CHARACTERISTICS FOR THE CONCENTRATION, STORAGE, AND TRANSFER FACILITIES ................................................................................................................................. 1.1-1

1.1 INTRODUCTION .................................................................................................................. 1.1-1

1.1.1 Objective .................................................................................................................. 1.1-1

1.1.2 Scope ....................................................................................................................... 1.1-1

1.2 REQUIREMENTS ............................................................................................................. 1.2-1

1.3 SITE DESCRIPTION ..................................................................................................... 1.3-1

1.3.1 Geography .............................................................................................................. 1.3-1

1.3.1.1 Location ............................................................................................................ 1.3-1

1.3.1.2 Exclusion Area .............................................................................................. 1.3-1

1.3.2 Demography ........................................................................................................... 1.3-4

1.3.2.1 Permanent Population and Distribution ..................................................... 1.3-4

1.3.2.2 Transient Population Variations ................................................................. 1.3-4

1.3.3 Uses of Nearby Land and Waters ........................................................................... 1.3-4

1.4 ENVIRONMENTAL DESCRIPTION ........................................................................... 1.4-1

1.4.1 Meteorology .......................................................................................................... 1.4-1

1.4.2 Geology ................................................................................................................. 1.4-1

1.4.2.1 Regional Geology (320 km [200 Mile] Radius) ........................................ 1.4-1

1.4.2.2 Tectonic Features ......................................................................................... 1.4-1

1.4.3 Hydrology ............................................................................................................. 1.4-1

1.4.3.1 Surface Hydrology ....................................................................................... 1.4-1

1.4.3.2 Regional Hydrogeology (Within 75 Mile Radius) ......................................... 1.4-3
CONTENTS (continued)

<table>
<thead>
<tr>
<th>1.4.4</th>
<th>Seismology</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4.4.1</td>
<td>Earthquake History of the General Site Region</td>
<td>1.4-3</td>
</tr>
<tr>
<td>1.4.4.2</td>
<td>Relationship of Geologic Structure to Seismic Sources in the General Site Region</td>
<td>1.4-3</td>
</tr>
<tr>
<td>1.4.4.3</td>
<td>Development of Design Basis Earthquake</td>
<td>1.4-3</td>
</tr>
<tr>
<td>1.4.4.4</td>
<td>Design Response Spectra</td>
<td>1.4-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.5</th>
<th>NATURAL EVENT ACCIDENT INITIATORS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5.1</td>
<td>Floods</td>
<td>1.5-1</td>
</tr>
<tr>
<td>1.5.1.1</td>
<td>Flood History</td>
<td>1.5-1</td>
</tr>
<tr>
<td>1.5.1.2</td>
<td>Flood Design Considerations</td>
<td>1.5-1</td>
</tr>
<tr>
<td>1.5.1.3</td>
<td>Effects of Local Intense Precipitation</td>
<td>1.5-1</td>
</tr>
<tr>
<td>1.5.1.4</td>
<td>Probable Maximum Flood on Streams and Rivers</td>
<td>1.5-2</td>
</tr>
<tr>
<td>1.5.1.5</td>
<td>Potential Dam Failures (Seismically Induced)</td>
<td>1.5-3</td>
</tr>
<tr>
<td>1.5.1.6</td>
<td>Probable Maximum Surge and Seiche Flooding</td>
<td>1.5-4</td>
</tr>
<tr>
<td>1.5.1.7</td>
<td>Ice Flooding</td>
<td>1.5-4</td>
</tr>
<tr>
<td>1.5.1.8</td>
<td>Water Canals and Reservoirs</td>
<td>1.5-4</td>
</tr>
<tr>
<td>1.5.1.9</td>
<td>Channel Diversions</td>
<td>1.5-4</td>
</tr>
<tr>
<td>1.5.1.10</td>
<td>Flooding Protection Requirements</td>
<td>1.5-4</td>
</tr>
<tr>
<td>1.5.1.11</td>
<td>Low Water Considerations</td>
<td>1.5-4</td>
</tr>
<tr>
<td>1.5.1.12</td>
<td>Future Control</td>
<td>1.5-4</td>
</tr>
<tr>
<td>1.5.2</td>
<td>Earthquakes</td>
<td>1.5-5</td>
</tr>
<tr>
<td>1.5.3</td>
<td>Tornadoes</td>
<td>1.5-5</td>
</tr>
</tbody>
</table>
## CONTENTS (continued)

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6</td>
<td>MAN-MADE EXTERNAL ACCIDENT INITIATORS</td>
<td>1.6-1</td>
</tr>
<tr>
<td>1.6.1</td>
<td>Transportation</td>
<td>1.6-1</td>
</tr>
<tr>
<td>1.6.1.1</td>
<td>Roads and Highways</td>
<td>1.6-1</td>
</tr>
<tr>
<td>1.6.1.2</td>
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<td>1.6-1</td>
</tr>
<tr>
<td>1.6.1.3</td>
<td>Airports and Air Traffic</td>
<td>1.6-1</td>
</tr>
<tr>
<td>1.6.1.4</td>
<td>Airspace Restrictions</td>
<td>1.6-2</td>
</tr>
<tr>
<td>1.6.1.5</td>
<td>Waterborne Transportation</td>
<td>1.6-2</td>
</tr>
<tr>
<td>1.6.2</td>
<td>Missiles and Blast Effects</td>
<td>1.6-2</td>
</tr>
<tr>
<td>1.7</td>
<td>NEARBY FACILITIES</td>
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</tr>
<tr>
<td>1.7.1</td>
<td>Nuclear Facilities</td>
<td>1.7-1</td>
</tr>
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</tr>
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<td>REFERENCES</td>
<td>1.9-1</td>
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## TABLES

<table>
<thead>
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<td>Cumulative Probable Maximum Precipitation for a 10-Square-Mile Area Surrounding the H-, S-, Z- and M-Areas</td>
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---

1-iv
<table>
<thead>
<tr>
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</tr>
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<tr>
<td>Figure 1.3-1 Savannah River Site Map</td>
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<tr>
<td>Figure 1.3-2 SRS Map Showing Key Facilities</td>
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<td>Figure 1.3-4 F-, H-, S- and Z- Area Map</td>
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<tr>
<td>Figure 1.3-5 F-Area Map</td>
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<tr>
<td>Figure 1.3-6 Topographic Map of F-Area and Surrounding Area</td>
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<td>Figure 1.3-7 H-Area Map</td>
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<tr>
<td>Figure 1.3-8 Topographic Map of H-Area</td>
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<td>Figure 1.5-1 River and Stream Cross Sections and Peak Water Level Stages at Probable Maximum Flood Conditions</td>
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ACRONYMS AND ABBREVIATIONS

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<td>cubic feet per second</td>
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</tr>
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</tr>
<tr>
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<td>Standards/Requirements Identification Document</td>
</tr>
<tr>
<td>SAR</td>
<td>Safety Analysis Report</td>
</tr>
<tr>
<td>SCE&amp;G</td>
<td>South Carolina Electric and Gas</td>
</tr>
<tr>
<td>SCPD</td>
<td>SRS Site Characteristics and Program Descriptions</td>
</tr>
<tr>
<td>SDC</td>
<td>Seismic Design Category</td>
</tr>
<tr>
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<td>Savannah River Remediation LLC</td>
</tr>
<tr>
<td>SRS</td>
<td>Savannah River Site</td>
</tr>
<tr>
<td>SSCs</td>
<td>Structures, Systems, and Components</td>
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<tr>
<td>SWMF</td>
<td>Solid Waste Management Facility</td>
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<tr>
<td>USFS-SR</td>
<td>United States Forest Service – Savannah River</td>
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<tr>
<td>UTRC</td>
<td>Upper Three Runs Creek</td>
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<td>VEGP</td>
<td>Vogtle Electric Generating Plant</td>
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1.0 SITE CHARACTERISTICS FOR THE CONCENTRATION, STORAGE, AND TRANSFER FACILITIES

1.1 INTRODUCTION

1.1.1 OBJECTIVE

The purpose of this chapter is to provide information that satisfies the requirements of Code of Federal Regulations 10 CFR 830 Subpart B for a Documented Safety Analysis (DSA) (Ref. 1).

1.1.2 SCOPE

This chapter describes site characteristics and facility environs that are important to the safety basis of the Concentration, Storage, and Transfer Facilities (CSTF). Information is provided to support and clarify assumptions used in the hazard and accident analyses to identify and analyze potential external accident initiators and accident consequences external to the facility (Chapter 3). Products of this chapter include the following:

- Description of the location of CSTF areas within the site, within the areas, and the proximity to the public and to other facilities
- Quantification of those characteristics of the surrounding environment that influence the design, procedures, and safety of CSTF operations
- Identification of the design or evaluation basis of external limits to be examined
- Historical bases for characteristics in meteorological and geophysical phenomena applied in the hazard and accident analyses (Chapter 3)
- Description of onsite worker and transient populations relative to area and facility boundaries

Chapter 1 of the Savannah River Site (SRS) Site Characteristics and Program Descriptions (SCPD) describes the site characteristics for the SRS (Ref. 2). The SCPD describes the characteristics listed above for the entire site, most of which is the same for the CSTF, and is referenced frequently in this chapter.

When detailed information is provided in another chapter of this DSA, that chapter is referenced to limit repetition. Where policies, programs, and practices important to safe operation are described in detail in other site documents, the pertinent features are summarized in this chapter and the documents are referenced.
1.2 REQUIREMENTS

The Standards/Requirements Identification Document (S/RID) (Ref. 3) states the codes, standards, and regulations governing the operation of the CSTF. Programmatic compliance assessments are performed against the S/RID and documented as specified in Procedure Manual 8B (Ref. 4). The Standards Management/Compliance Section maintains records of the programmatic compliance assessments.
1.3 SITE DESCRIPTION

1.3.1 GEOGRAPHY

1.3.1.1 Location

The CSTF areas are located within the SRS, which occupies 310 square miles (198,344 acres) on the upper Atlantic Coastal Plain of South Carolina. SRS is approximately 25 miles southeast of Augusta, Georgia; 100 miles from the Atlantic Coast; and about 110 miles south-southeast of the North Carolina border. The SRS is bounded along 17 miles of its southwest border by the Savannah River (Figure 1.3-1). The SCPD contains additional details describing SRS (Ref. 2).

The F-Area portion of CSTF is located in Aiken County, South Carolina, near the center of SRS, east of Road C and north of Road E (Figure 1.3-2). The nearest site boundary to F-Area is approximately 5.8 miles (9.4 km) to the west.

The H-Area portion of CSTF is located in Aiken and Barnwell Counties, South Carolina, near the center of SRS (Figure 1.3-2), to the east of F-Area. The nearest site boundary to H-Area is approximately 7.2 miles (11.5 km) to the north. H-Area is flanked to the north by Upper Three Runs Creek (UTRC) and to the south by Four Mile Branch. Surface drainage from H-Area is through tributaries of these two streams.

1.3.1.2 Exclusion Area

GENERAL SITE

SRS, which is owned by the U.S. Government, was set aside in 1950 as a controlled area for the production of nuclear materials for national defense. The Department of Energy (DOE) and its contractors are responsible for the operation of SRS. The exclusion area, public roads, railroads and controls for these are described in the SCPD, as well as the locations of the administrative, laboratory production and production support areas within the site (Ref. 2).

The topography at SRS varies from gently sloping to moderately steep. The topography of SRS and the surrounding vicinity is described in detail in the SCPD (Ref. 2).

Surface wind patterns and the occurrence of strong winds and tornadoes are described in the SCPD (Ref. 2).

Surface drainage and major river systems surrounding SRS are described in the SCPD (Ref. 2).

The road system within SRS is described in the SCPD (Ref. 2). SRS has its own railroad system, which services all major facilities. For further details refer to the SCPD (Ref. 2).

The electrical grid on SRS operates at 115 kilovolt (kV) and draws power from one transmission line on its right-of-way from South Carolina Electric and Gas (SCE&G) Urquhart Station and a second line from the 230-kV tie-line between the Summer and Canadys stations of SCE&G. The
site 115-kV distribution system is discussed in the SCPD (Ref. 2). There are no natural gas or oil pipeline networks at SRS.

F-AREA

F-Area is centrally located within the SRS boundary (Figure 1.3-2). Figure 1.3-4 shows F-Area and the surrounding areas including the E-Area. A detailed area map for F-Area is shown in Figure 1.3-5.

Topography near F-Area is shown in Figure 1.3-6. F-Area is drained by several tributaries of UTRC, approximately 2,200 feet to the north and west and by Four Mile Branch approximately 2,000 feet to the south. Surface elevations across F-Area range approximately from 200 to 320 feet mean sea level (msl).

F-Area's main processing facility was F-Canyon, which has been shut down.

F-Area analytical laboratories support F-Area and H-Area reprocessing and waste treatment/storage activities.

The F-Area Waste Tank Farm consists of 22 large underground storage tanks (6 tanks have been closed from radioactive service) that store high-level aqueous radioactive waste and evaporated saltcake (see Chapter 2).

The E-Area Solid Waste Management Facility (SWMF) occupies 195 acres between the F-Area and H-Area.

H-AREA

H-Area is located east of the SWMF near the center of SRS as shown in Figures 1.3-2 and 1.3-4. A detailed area map for H-Area is shown in Figure 1.3-7.

Topography near H-Area is shown in Figure 1.3-8. A topographic high runs through SWMF and into H-Area. H-Area is located near a water-table divide between UTRC and Four Mile Branch. Near-surface groundwater from the southern part of H-Area discharges to an unnamed tributary of Four Mile Branch, approximately 1,000 feet south of H-Area. Near-surface groundwater from the northern part of H-Area discharges to one of two tributaries (Crouch Branch or McQueen Branch) of UTRC, which are approximately 1,500 and 4,000 feet north of H-Area, respectively. H-Area covers approximately 395 acres; surface areas across H-Area range from approximately 270 to 315 feet msl.

H-Area's main processing facility is H-Canyon, which is comprised of chemical separations and processing plants and associated waste storage facilities. The radioactive and chemical wastes are stored in the CSTF high-level waste storage tanks.

The Tritium Facilities are also located in H-Area and are designed and operated to process tritium. For further details refer to the SCPD (Ref. 2).
The Receiving Basin for Offsite Fuel (RBOF) is also located in H-Area. All nuclear fuel and targets have been removed from the RBOF basins. Nitric acid and resin have been removed from the facility. The current mission of the RBOF is to transition the facility from operations in preparation for ultimate disposition.

The Effluent Treatment Project (ETP) is located on the south side of H-Area. ETP collects and treats routine process wastewater, contaminated canyon facility cooling water, and waste tank farm storm water from F-Area and H-Area (see Chapter 2).

The H-Area Waste Tank Farm consists of 29 large underground storage tanks that store and process high-level aqueous radioactive waste and evaporated saltcake (see Chapter 2).

SITE BOUNDARY

Activities conducted within SRS that are not under the control of the operating contractors, and are not related to production are performed by the following organizations: General Services Administration, SRS security contractor, USDA Forest Service – Savannah River (USFS-SR), Savannah River Ecology Laboratory, South Carolina Department of Natural Resources, University of South Carolina Institute of Archaeology and Anthropology, and the Soil Conservation Service. Additional information about these organizations is provided in the SCPD (Ref. 2).

BOUNDARIES FOR ESTABLISHING EFFLUENT RELEASE LIMITS

The outer perimeter fence line of SRS is used as the basis for specification limits on the release of gaseous and liquid effluents from all SRS facilities. The outer perimeter of SRS is shown in Figure 1.3-9. The figure also shows Emergency Planning Zone boundaries with respect to rivers and streams. The outer perimeter is fenced and access is controlled by the SRS security contractor so that access by the public can be restricted as the need arises. The roads that pass through or near the perimeter can be blocked by SRS security contractor personnel or with the assistance of local law enforcement personnel. For additional discussion on the boundaries for establishing effluent release limits, including the limits of exposure of the public and the onsite worker see the SCPD (Ref. 2).

ACCESS CONTROL

The outer perimeter of SRS is fenced; access is controlled by the SRS security contractor. General access to the plant site, with the exception of public transportation corridors, is limited to badged personnel. The roads that pass through or near the perimeter can be blocked by SRS security contractor personnel or with the assistance of local law enforcement personnel.

Employee access within the F-Area and H-Area Tank Farm fences is limited to badged personnel. More restrictive facilities within F-Area and H-Area have additional access requirements.
EFFlUENT MONITORING PROGRAM

The Environmental Services Section maintains an active permit inventory for National Pollutant Discharge Elimination System (NPDES) permitted outfalls and Clean Air Act permitted air emission sources. The annual Environmental Data Report contains a discussion of the radiological and non-radiological air and liquid effluent monitoring activities conducted at SRS to demonstrate compliance with applicable standards and regulations. The annual Environmental Report for SRS also contains an updated summary of all construction and operating permits held by SRS. Discussions of other principal compliance requirements under various state and federal legislation such as the Federal Facility Agreement Compliance Act and the National Environmental Policy Act are contained in the annual Environmental Report.

RELEVANT SPECIAL FEATURES

SRS is a self-contained site that provides its own security, fire protection, medical, maintenance, and other services (Ref. 2). To enhance the safety of the facility, a large support staff provides services such as radiological protection, industrial hygiene, and safety.

A large supply of specialized equipment is available from regional DOE offices, in addition to the onsite resources, which include specialized equipment for tracking tritium releases, meteorological assessment systems, and monitoring equipment. State agencies in South Carolina and Georgia, Vogtle Electric Generating Plant (VEGP), Fort Gordon, and other nearby sources can also provide monitoring equipment, medical facilities, and laboratory facilities in emergencies. Also, several municipal emergency organizations are located within 25 miles of SRS. These resources and details on emergency preparedness are discussed in Chapter 15.

1.3.2 DEMOGRAPHY

1.3.2.1 Permanent Population and Distribution

The residential population for the counties adjoining and within approximately 50 miles of the SRS is approximately 690,000. Offsite population is discussed in the SCPD (Ref. 2). The areas within the 1- through 5-mile radii of F-Area and H-Area are DOE-owned properties within SRS; the population for these areas consists of SRS workers only.

1.3.2.2 Transient Population Variations

Transient population variations (e.g., industrial, school, recreational, health care, and casual) for the general SRS are addressed for the area within approximately 5 miles of the SRS boundary and are discussed in the SCPD (Ref. 2).

1.3.3 USES OF NEARBY LAND AND WATERS

For more reference information regarding the use of nearby land and waters outside the boundaries of the SRS, see the SCPD (Ref. 2).
1.4 ENVIRONMENTAL DESCRIPTION

1.4.1 METEOROLOGY

For details on regional climatology and local meteorology, see the SCPD (Ref. 2).

1.4.2 GEOLOGY

1.4.2.1 Regional Geology (320 km [200 Mile] Radius)

Regional geology is discussed in the SCPD (Ref. 2).

1.4.2.2 Tectonic Features

Plate tectonic is the concept that the earth's crust is broken into large blocks with portions of each block being continually renewed or destroyed. Plate tectonics within the 320-km (200 mile) radius of the SRS would provide the description of the major structural or deformational features of the region, as well as the origins, evolution, and interrelatedness of these features. The implementation of Natural Phenomena Hazards (NPH) mitigation requires that the tectonic elements of the site region should be understood and described in sufficient detail to allow an evaluation of the safety of a proposed or existing facility (Ref. 5). The major issue with respect to the tectonic framework and site suitability is concern for tectonic features influencing the seismicity of the region.

Based on previous studies at SRS and elsewhere, there are no known capable or active faults within the 320-km radius of the site that influence the seismicity of the region with the exception of the blind, poorly constrained faults associated with the Charleston seismic zone (Ref. 2).

1.4.3 HYDROLOGY

1.4.3.1 Surface Hydrology

Much of SRS is located on the Aiken Plateau. The plateau slopes to the southeast approximately 5 ft/mile and is dissected by streams that drain into the Savannah River. The major tributaries that occur on SRS are UTRC, Four Mile Branch, Pen Branch, Steel Creek, and Lower Three Runs Creek (Figure 1.3-1). For more information on the regional hydrologic description see the SCPD (Ref. 2).

Based on available information, the following sections describe surface hydrology in reference to the CSTF.

F-AREA

A topographic map showing surface drainage of F-Area is shown in Figure 1.3-6. The F-Canyon building site is at an elevation of over 300 feet above msl. The nearest significant stream is UTRC, which is located about 0.7 miles north and west of the F-Canyon facility and flows at
elevations below 150 feet. The mean annual flow at a gauging station approximately 3 miles from F-Canyon is 215 cubic feet per second (cfs). The measured maximum flow for the period 1974 to 1986 was about 950 cfs. For more information on the F-Area hydrologic descriptions see the SCPD (Ref. 2). The storm water collection and runoff systems are discussed in Chapter 2.

H-AREA

A topographic map showing surface drainage near H-Area is shown in Figure 1.3-8. The nearest significant stream is UTRC. UTRC flows at elevations of less than 150 feet above msl. The mean annual flow at a gauging station approximately 3 miles from H-Area is 215 cfs. The measured maximum flow for 1974 to 1986 was about 950 cfs. For more information on the H-Area hydrologic description see the SCPD (Ref. 2). The storm water collection and runoff systems are discussed in Chapter 2.

HYDROSPHERE - SAVANNAH RIVER SITE AREAS

The location, size, shape, and other hydrological characteristics of streams, rivers, lakes, shore regions, and groundwater environments that influence the general site are described in the SCPD (Ref. 2).

F-Area

F-Area is on a near-surface groundwater divide between UTRC and an unnamed tributary of Four Mile Branch. The near-surface groundwater from the southern part of F-Area discharges to an unnamed tributary of Four Mile Branch, approximately 2,000 feet to the south. The near-surface groundwater from the northern part of F-Area discharges to one of many tributaries of UTRC, approximately 1,500 feet to the north.

H-Area

H-Area is located near a water-table divide between UTRC and Four Mile Branch. Near-surface groundwater from the southern part of H-Area discharges to an unnamed tributary of Four Mile Branch, approximately 1,000 feet south of H-Area. Near-surface groundwater from the northern part of H-Area discharges to one of two tributaries of UTRC, which are approximately 1,500 and 4,000 feet north of H-Area, respectively.

HYDROSPHERE SURFACE WATERS

The hydrosphere surface waters at SRS are described in the SCPD (Ref. 2).

ENVIRONMENTAL ACCEPTANCE OF EFFLUENTS

There are active NPDES permitted outfalls within the SRS. These are discussed in the SCPD (Ref. 2).
1.4.3.2 Regional Hydrogeology (Within 75 Mile Radius)

For reference information regarding hydrology of the SRS, see the SCPD (Ref. 2).

1.4.4 SEISMOLOGY

1.4.4.1 Earthquake History of the General Site Region

The SCPD provides a broad description of the historic seismic record (non-instrumental and instrumental) of the southeastern United States and SRS (Ref. 2). Aspects that are of particular importance to SRS include the following:

- The Charleston, South Carolina, area is the most significant seismogenic zone affecting the SRS.
- Seismicity associated with the SRS and surrounding region is more closely related to South Carolina Piedmont-type activity. This activity is characterized by occasional small shallow events associated with strain release with small-scale faults, intrusive bodies, and the edges of metamorphic belts of Piedmont-type seismicity.

1.4.4.2 Relationship of Geologic Structure to Seismic Sources in the General Site Region

In the eastern United States, it is not generally known what relationship exists between observed tectonic structures and the current earthquake activity that may be associated with those structures. Therefore, in most instances, the seismic sources are inferred rather than demonstrated by strong correlation with geologic structures. In the region of SRS, reflection seismic data have defined the depth of the seismogenic zone to be about 12 km, which may limit the size of a local earthquake to $M_w$ 5.5. For additional background information, refer to the SCPD (Ref. 2).

1.4.4.3 Development of Design Basis Earthquake

Technical Report WSRC-TR-97-0085 describes the development of the Design Basis Earthquake (DBE) and the recommended SRS spectra (Ref. 7). Subsequent reviews have resulted in modifications directed by DOE. The SRS Engineering Standards Manual, Standard 1060, contains the preliminary Performance Category (PC)-3 design spectrum for SRS (Ref. 14). This spectrum supersedes the results and the previous values derived in reports of prior investigations and studies. More detail regarding the evolution of the SRS design basis is found in the SCPD (Ref. 2).

1.4.4.4 Design Response Spectra

Five Performance Categories for NPH resistance are specified, from PC-0, for Structures, Systems, and Components (SSCs) that require no hazard evaluation, to PC-4, a desired performance level comparable to commercial nuclear power plants. The category for CSTF Safety Class is PC-3 and Safety Significant SSCs is PC-2 or PC-3. The current preliminary SRS design basis spectra for PC-3 is found in Reference 14. This spectrum is considered
“preliminary” because of the potential for variation of soil properties outside of what was measured and used for development of the design basis spectrum. To eliminate the open item and use the spectrum as “confirmed” for a given facility, the soil parameters at the specific site or facility must be reviewed for consistency with the soil parameters used during development of the SRS spectrum. The SRS design basis spectrum is intended for simple response analysis and is not appropriate for soil-structure interaction analysis or geotechnical assessments. If simple response analysis is not acceptable and a more complex approach is required, detailed direction must be obtained from Site Geotechnical Services, who will review the soil parameters available at the specific site or facility where the design spectrum is being used (Ref. 7).

For the purposes of the DSA, seismic design criteria for SSCs are stated as Performance Categories (e.g., PC-2, PC-3) versus Seismic Design Categories (e.g., SDC-2, SDC-3). Some new/replacement SSCs use the equivalent SDC. Refer to References 14 and 15 for the relationship/equivalency between Performance Categories and Seismic Design Categories.
1.5 NATURAL EVENT ACCIDENT INITIATORS

This section identifies and describes natural events considered to be potential accident initiators at specific SRS facilities.

1.5.1 FLOODS

1.5.1.1 Flood History

All the floods represented by the data in this section were the result of excess precipitation runoff and the associated creek or stream flooding. There have been no floods caused by surge, seiche, dam failure, or ice jams. For additional information on the flood history of the Savannah River, UTRC and Tims Branch, see the SCPD (Ref. 2).

1.5.1.2 Flood Design Considerations

All safety-related structures are located on topographic high points and are well inland from the coast. The only significant impoundments, Par Pond and L Lake, are relatively small and sufficiently lower than any of the safety-related structures that there is no safety threat to safety-related structures from high water.

As discussed in Section 1.5.1.4, F-Area and H-Area are located on relatively elevated regions of the SRS. Therefore, flooding from surface streams is not a credible hazard.

1.5.1.3 Effects of Local Intense Precipitation

Flood design considerations are described below in reference to specific local facilities. The descriptions are based on available information.

F-AREA

The 6-hour, 10-square-mile Probable Maximum Precipitation (PMP) is 31 inches with a maximum intensity of 15.1 inches in 1 hour (Ref. 8). This rainfall was adjusted to a point PMP of 19 inches in 1 hour, as shown by Reference 9, and used to generate the Probable Maximum Flood (PMF) for the small watershed of the unnamed tributary near the site. Incremental rainfall for 1-hour periods adjacent to the PMP was also determined as shown in Table 1.5-1 (Ref. 10). The peak stage corresponding to the PMF is 224.5 feet above msl or 75 feet below the F-Canyon site grade. Because F-Area lies near a watershed divide, incident rainfall naturally drains away from the facilities.

H-AREA

The 6-hr cumulative PMP for a 10-square-mile area surrounding H-Area is 31 inches (Table 1.5-2) (Ref. 8). This rainfall was adjusted to a point PMP of 19 inches in 1 hour, as shown by Reference 9, and used to generate the PMF for the small watershed of Crouch Branch
near the site. A synthetic hydrograph was used to determine peak flow. The peak stage corresponding to the PMF is 224.5 feet above msl or 83 feet below the area grades.

1.5.1.4 Probable Maximum Flood on Streams and Rivers

The PMF values for streams and rivers near H-Area are discussed in the SCPD (Ref. 2)

PROBABLE MAXIMUM PRECIPITATION

The PMP is defined as the “greatest possible theoretical depth of precipitation for a given duration and drainage area.” The PMP for 10 square miles and 1 hour is 15.7 inches, and for 6 hours is 31.0 inches.

For additional information on heavy rainfalls see the SCPD (Ref. 2)

PRECIPITATION LOSSES

For conservatism, precipitation losses were assumed to be zero in development of the PMF and PMP for all watersheds on the SRS.

RUNOFF MODEL

Using runoff and flood routing routines developed by the U.S. Army Corps of Engineers (including HEC-1), the PMF at VEGP was determined to be 895,000 cfs, assuming no valley storage effect. Because the VEGP runoff model PMF is about 10% less than the PMF of 1,001,000 cfs for the Savannah River reported in Regulatory Guide 1.59, the larger PMF was used in this analysis (Ref. 11).

The PMF flood peak for UTRC was calculated using the simplified method in Regulatory Guide 1.59 (Ref. 11). The PMF was plotted using the figures in Appendix B of Regulatory Guide 1.59 for drainage areas ranging from 100 to 20,000 square miles; then interpolation of the logarithmic plot provided the PMF for the 163-square-mile watershed of UTRC.

PROBABLE MAXIMUM FLOOD FLOW

Regulatory Guide 1.59 Appendix B reported the PMF to be 1,001,000 cfs for the Savannah River at VEGP, corresponding to an elevation of 138.5 feet above msl (Ref. 11). The VEGP Final Safety Analysis Report (FSAR) estimates a PMF peak discharge of 895,000 cfs, ignoring the effect of valley storage of floodwater, and a PMF of 540,000 cfs if valley storage upstream from the site is considered. The maximum flood wave elevations determined in the VEGP FSAR were 41.5 feet msl and 38.4 feet msl, respectively.

The PMF determined from Regulatory Guide 1.59 for the Savannah River does not consider failure of any upstream dams (Ref. 11). All dam failure scenarios are considered in Section 1.5.1.5.
WATER LEVEL DETERMINATIONS

For the Savannah River, the PMF stage of 138.5 feet above mean sea level (msl) computed for this analysis was compared to the PMF stages generated in the VEGP FSAR and found to be conservative. Figure 1.5-1 shows the cross-section at each location where the stage was computed and the maximum stage during PMF.

The computed PMF for UTRC is shown in Figure 1.5-1 and discussed in Section 1.5.1.4.

COINCIDENT WIND WAVE ACTIVITY

For Savannah River and UTRC, the extent of flooding is far removed from site facilities in both distance and elevation. Thus, it is inconceivable that wind-induced waves would affect safety-related facilities at the site (Ref. 2).

1.5.1.5 Potential Dam Failures (Seismically Induced)

RESERVOIR DESCRIPTION

The only significant dams or impoundment structures that could affect the safety of SRS are large dams on the Savannah River and its tributaries upstream of Augusta, Georgia. The SCPD contains information on these structures (Ref. 2). The Stephens Creek Dam is owned by SCE&G. All other dams on the Savannah River are owned by the U.S. Army Corps of Engineers. The dams on the Tugaloo and Tallulah rivers are owned by Georgia Power Company. The dams on the Keowee and Little Rivers are owned by Duke Power Company.

DAM FAILURE PERMUTATIONS

A domino failure of the dams on the Savannah River and its tributaries upstream of VEGP was analyzed in the VEGP FSAR. The worst possible case resulted from the Jocassee Dam failing during a combined standard project flood and earthquake, with the resulting chain reaction.

Using conservative assumptions, this worst dam failure would yield a peak flow of 2,400,000 cfs at Strom Thurmond Dam. This rate, undiminished in magnitude, was transferred to below Augusta, Georgia. However, because of the great width of the flood plain, routing of the dam failure surge to the VEGP site (Savannah River Mile 151) resulted in a peak discharge of 980,000 cfs, with a corresponding stage of 141 feet above msl.

UNSTEADY FLOW ANALYSIS OF POTENTIAL DAM FAILURES

No dams are located near SRS Areas. Therefore, this section does not apply.

WATER LEVEL AT FACILITY SITE

The peak water surface elevation of the Savannah River that corresponds to wave run-up of a wind-induced wave, superimposed upon the passage of a flood wave resulting from a sequence of dam failures, is discussed in the SCPD (Ref. 2).
1.5.1.6 Probable Maximum Surge and Seiche Flooding

No large water bodies exist near the site; therefore, this section does not apply.

1.5.1.7 Ice Flooding

Because of regional climatic conditions, the formation of significant amounts of ice on streams and rivers rarely occurs. The Hartwell, Richard B. Russell, and Strom Thurmond dams moderate water temperature extremes, making ice formation on the Savannah River at SRS unlikely. Because the sites are so much higher than the nearest streams and rivers, it is not considered credible that they could be affected by ice flooding, even if the climatic conditions were conducive to ice formation.

1.5.1.8 Water Canals and Reservoirs

There are no operable large water canals or reservoirs at SRS that could affect flooding of F-Area or H-Area.

1.5.1.9 Channel Diversions

There is no historical record of diversions of streams or rivers in the site area.

1.5.1.10 Flooding Protection Requirements

Special flooding protection requirements are not necessary to assure the safety of F-Area and H-Area, because they are located at elevations well above the maximum flood.

1.5.1.11 Low Water Considerations

LOW FLOW IN RIVERS AND STREAMS

Low flow in the Savannah River adjacent to SRS is regulated by Strom Thurmond Dam and the New Savannah Bluff Lock and Dam. For additional discussion see the SCPD (Ref. 2).

LOW WATER RESULTING FROM SURGES OR SEICHES

This situation does not apply because SRS does not withdraw water from a large body of water, nor is it located in a region of active seismicity or volcanism that produce such surges.

HISTORICAL LOW WATER

See the SCPD (Ref. 2).

1.5.1.12 Future Control

Minimum flow conditions are controlled mainly by upstream dam releases, and no additional users of large amounts of water are anticipated.
1.5.2 EARTHQUAKES

Earthquakes are discussed in Section 1.4.4.

1.5.3 TORNADOES

Tornadoes are discussed in the SCPD (Ref. 2).
1.6 MAN-MADE EXTERNAL ACCIDENT INITIATORS

This section provides identification of specific man-made external events associated with the site considered to be potential accident initiators, exclusive of sabotage and terrorism.

1.6.1 TRANSPORTATION

Offsite and onsite roadways and the SRS rail network are discussed in the sections that follow.

Essentially no commercial waterborne transportation takes place on the Savannah River between Augusta and Savannah, Georgia. Private and commercial recreational purposes comprise the primary use. See Section 1.6.1.5 for additional information.

1.6.1.1 Roads and Highways

Roads and highways are the primary means of travel to areas outside of the study area, as well as between population centers and workplaces within the study area. Roads and highways with the highest traffic volumes in the vicinity of the site are in and around the city of Augusta, Georgia.

Various South Carolina state highways lead to the northern, eastern, and southern boundaries of SRS, although public access into SRS is limited. Two public roads are located on SRS: South Carolina Highway 125 and U.S. Route 278. In addition, public access is permitted on SRS Road 1. Commercial transportation of materials, including hazardous materials, takes place on these publicly accessed roads, but is not monitored or controlled by SRS. However, these roads do not pass near F-Area or H-Area and the events occurring on these roads are not considered credible accident initiators affecting the CSTF. Many different vehicles and transport packaging are used for transportation activities for hazardous materials on SRS. Materials transported by truck at SRS include radioactive materials in the form of powders, bulk liquids, samples, solid billets, fabricated components, gases, solid wastes, and contaminated equipment. Non-radioactive hazardous material forms that are transported include bulk liquids, granular solids, liquefied gases, laboratory reagents, and janitorial supplies. The transportation network within the general area of SRS is discussed in the SCPD (Ref. 2).

The Hazard and Accident Analysis (see Chapter 3) discusses potential accident scenarios from transportation activities within the CSTF.

1.6.1.2 Railroads

The existing rail system that serves SRS and the surrounding region is discussed in the SCPD (Ref. 2).

1.6.1.3 Airports and Air Traffic

Public airports located in South Carolina and Georgia within a radius of approximately 65 miles from the center of SRS are listed in the SCPD (Ref. 2).
1.6.1.4 **Airspace Restrictions**

The air space restriction over SRS was lifted in 1976. However, for reasons of national security, pilots are requested to avoid flight at low altitudes over SRS.

1.6.1.5 **Waterborne Transportation**

A discussion of this is located in the SCPD (Ref. 2).

1.6.2 **MISSILES AND BLAST EFFECTS**

Energy from man-made sources capable of generating missiles and blast effects that will impact the functioning of SSC items are discussed in the Hazard and Accident Analysis (see Chapter 3).
1.7 NEARBY FACILITIES

The SCPD identifies nuclear, industrial, and military facilities within a 50-mile radius of the SRS center that have potential safety importance to SRS (Ref. 2).

1.7.1 NUCLEAR FACILITIES

1.7.1.1 Non-Savannah River Site Nuclear Facilities

There are four non-SRS nuclear facilities within 50 miles of SRS; their locations are discussed in the SCPD (Ref. 2).

1.7.1.2 Savannah River Site Nuclear Facilities

F-AREA

This section discusses nuclear facilities on SRS that are in proximity to and have safety implications for F-Area.

The F-Canyon facility no longer processes plutonium and other materials for national defense purposes. The facility has been deactivated and is in a long-term surveillance and maintenance condition. It is considered a low hazard operation and poses no risk to F-Area.

E-Area is located within one mile of F-Area. It is used for disposal of solid SRS radioactive waste and poses no risk to F-Area.

The Tritium Facilities are located in H-Area approximately 1.5 miles (2.5 km) from F-Area. The Tritium Facilities process tritium for national defense purposes. Risk to the safety of F-Area because of H-Area operations is minimal except for tritium releases.

H-Canyon is located approximately 1.5 miles (2.5 km) from F-Area. The H-Canyon contains separation facilities, which dissolve irradiated fuel and target materials and produce solutions containing various products that have been separated from fission products by solvent extraction and ion exchange processes. Risk to the safety of F-Area because of H-Area operations is minimal.

S-Area is located approximately 2 miles (3.2 km) from F-Area. S-Area is the site of the Defense Waste Processing Facility (DWPF) Vitrification Plant. The DWPF immobilizes high level radioactive waste sludge and precipitate by "vitrifying" it into a solid glass waste form. Risk to the safety of F-Area because of S-Area operations is minimal.

Z-Area is located approximately 2.5 miles (4 km) from F-Area. Z-Area processes and disposes of decontaminated salt solution supernates fed from H-Area and ETP concentrate. It is considered a low hazard operation and poses no risk to F-Area.
The reactor materials facilities (M-Area) were located approximately 5 miles (8 km) from F-Area. The facility processed aluminum, lithium, uranium, and target materials for SRS reactors. The facility is demolished and poses no risk to F-Area.

The heavy water plant (D-Area), located approximately 6 miles (9.6 km) from F-Area, is demolished and poses no undue risk to facilities in F-Area.

Five production reactor facilities (C, K, L, P, and R) are located within an 8-mile (12.8-km) radius of F-Area and are all in cold shutdown. Although K Reactor is in cold shutdown, the current K-Area Complex function is interim storage of excess fissile/fissionable materials from the DOE complex. It is considered a low hazard operation and poses no risk to F-Area.

H-AREA

This section discusses nuclear facilities that are in proximity to H-Area and have safety implications for this area.

The Tritium Facilities risk to H-Area safety is minimal except for tritium releases.

The H-Canyon facility risk to H-Area safety is minimal.

E-Area is located within one mile of H-Area. It is used for disposal of solid SRS radioactive waste and poses no risk to H-Area.

S-Area is located within one mile of H-Area. Risk to the safety of H-Area because of S-Area operations is minimal.

The F-Canyon facility is located approximately 1.5 miles (2.5 km) from H-Area. It is considered a low hazard operation and poses no risk to H-Area.

Z-Area is located approximately 1.5 miles (2.4 km) from H-Area. It is considered a low hazard operation and poses no risk to H-Area.

The reactor materials facilities (M-Area) were located approximately 6 miles (10 km) from H-Area. The impact of the reactor materials facilities on H-Area is the same as for F-Area.

The heavy water plant (D-Area), located approximately 8 miles (13 km) from H-Area, is demolished and poses no undue risk to facilities in H-Area.

Five production reactor facilities (C, K, L, P, and R) are located within a 6-mile (9.6-km) radius of H-Area and are all in cold shutdown. Although K Reactor is in cold shutdown, the current K-Area Complex function is interim storage of excess fissile/fissionable materials from the DOE complex. It is considered a low hazard operation and poses no risk to F-Area.

For both F-Area and H-Area, inter-facility transfers of liquid and solid waste are the predominant operations whereby the CSTF interact with the adjacent facilities. These transfers are conducted in accordance with the sending and receiving facilities safety basis requirements,
and associated implementing procedures, to ensure that the safety basis assumptions (e.g., source terms, hydrogen generation rates, pH) of each facility’s hazard and accident analyses are maintained.

1.7.2 INDUSTRIAL CENTERS

The SCPD discusses industries within a 5-mile radius of SRS (Ref. 2).

F-AREA

The 5-mile area surrounding F-Area lies entirely within SRS boundaries; therefore, no industrial centers other than onsite SRS facilities are applicable.

H-AREA

The 5-mile area surrounding the H-Area lays entirely within SRS boundaries; therefore, no industrial centers other than onsite SRS facilities are applicable.

1.7.3 MILITARY FACILITIES

Information on military facilities is discussed in the SCPD (Ref. 2).
1.8 VALIDITY OF EXISTING ENVIRONMENTAL ANALYSES

A review of existing Environmental Impact Statements (EISs) and Environmental Assessments (EAs) that address SRS facilities and/or operations indicates that assumptions concerning site characteristics for these documents are the same as those used in DSAs/SARs. When there is a DSA/SAR for an operation/facility, the EIS or EA focuses on incremental effects of the proposed action compared to those effects identified in the DSA/SAR. Existing EISs addressing proposed activities/facilities and existing EAs prepared for SRS operations and facilities are discussed in the SCPD (Ref. 2).
1.9 REFERENCES


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1.10 TABLES

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Table 1.5-1  Probable Maximum Precipitation for F-Area

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Table 1.5-2  Cumulative Probable Maximum Precipitation for a 10-Square-Mile Area Surrounding the H-, S-, Z- and M-Areas

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</tr>
</tbody>
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Figure 1.3-1  Savannah River Site Map
Figure 1.3-2   SRS Map Showing Key Facilities
Figure 1.3-3    Deleted
Figure 1.3-4  F-, H-, S- and Z-Area Map
Contour Interval – 10 ft, 1-mile Radius, Scale 1:48 000
Source: FOREST SERVICE MAP: Constructed in 2004 by digital methods at the Geospatial Service and Technology Center, Salt Lake City, Utah, from FS Cartographic Feature Files and quadrangle maps. Field review provided by the Southern Region.
Figure 1.3-7  H-Area Map
Contour Interval – 10 ft, 1-mile Radius, Scale 1:48 000
Source: FOREST SERVICE MAP: Constructed in 2004 by digital methods at the Geospatial Service and Technology Center, Salt Lake City, Utah, from FS Cartographic Feature Files and quadrangle maps. Field review provided by the Southern Region.

Figure 1.3-8  Topographic Map of H-Area
Figure 1.3-9    SRS Emergency Planning Zone
Figure 1.5-1  River and Stream Cross Sections and Peak Water Level Stages at Probable Maximum Flood Conditions
CONCENTRATION, STORAGE, AND TRANSFER FACILITIES

DOCUMENTED SAFETY ANALYSIS

CHAPTER 2
FACILITY DESCRIPTION

Revision 20
August 2017
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## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>FACILITY DESCRIPTION</td>
<td>2.1-1</td>
</tr>
<tr>
<td>2.1</td>
<td>INTRODUCTION</td>
<td>2.1-1</td>
</tr>
<tr>
<td>2.2</td>
<td>REQUIREMENTS</td>
<td>2.2-1</td>
</tr>
<tr>
<td>2.3</td>
<td>FACILITY OVERVIEW</td>
<td>2.3-1</td>
</tr>
<tr>
<td>2.3.1</td>
<td>Current, Historical, and Projected Facility Use</td>
<td>2.3-1</td>
</tr>
<tr>
<td>2.3.2</td>
<td>Facility Configuration</td>
<td>2.3-1</td>
</tr>
<tr>
<td>2.3.3</td>
<td>Basic Facility Processes</td>
<td>2.3-3</td>
</tr>
<tr>
<td>2.4</td>
<td>FACILITY STRUCTURE</td>
<td>2.4-1</td>
</tr>
<tr>
<td>2.4.1</td>
<td>Waste Tanks/Control Rooms</td>
<td>2.4-1</td>
</tr>
<tr>
<td>2.4.1.1</td>
<td>Waste Tank Designs</td>
<td>2.4-1</td>
</tr>
<tr>
<td>2.4.1.2</td>
<td>Control Rooms</td>
<td>2.4-5</td>
</tr>
<tr>
<td>2.4.1.3</td>
<td>Level and Leak Detection</td>
<td>2.4-5</td>
</tr>
<tr>
<td>2.4.1.4</td>
<td>Ventilation</td>
<td>2.4-6</td>
</tr>
<tr>
<td>2.4.1.5</td>
<td>Temperature Monitors</td>
<td>2.4-8</td>
</tr>
<tr>
<td>2.4.1.6</td>
<td>Support Systems</td>
<td>2.4-8</td>
</tr>
<tr>
<td>2.4.2</td>
<td>242-16H Evaporator</td>
<td>2.4-8</td>
</tr>
<tr>
<td>2.4.2.1</td>
<td>242-16H Evaporator Building</td>
<td>2.4-8</td>
</tr>
<tr>
<td>2.4.2.2</td>
<td>242-16H Feed System</td>
<td>2.4-9</td>
</tr>
<tr>
<td>2.4.2.3</td>
<td>242-16H Evaporator Vessel/Pot</td>
<td>2.4-10</td>
</tr>
<tr>
<td>2.4.2.4</td>
<td>242-16H Overheads System</td>
<td>2.4-11</td>
</tr>
<tr>
<td>2.4.2.5</td>
<td>242-16H Concentrate System</td>
<td>2.4-13</td>
</tr>
<tr>
<td>2.4.2.6</td>
<td>242-16H Steam and Condensate System</td>
<td>2.4-14</td>
</tr>
<tr>
<td>2.4.2.7</td>
<td>242-16H Ventilation System</td>
<td>2.4-15</td>
</tr>
<tr>
<td>2.4.2.8</td>
<td>242-16H Gang Valves</td>
<td>2.4-16</td>
</tr>
<tr>
<td>2.4.2.9</td>
<td>242-16H Support Systems</td>
<td>2.4-17</td>
</tr>
</tbody>
</table>
CONTENTS

2.4.3 242-25H Evaporator .............................................................. 2.4-18
2.4.3.1 242-25H Evaporator Building ........................................ 2.4-18
2.4.3.2 242-25H Feed System ................................................... 2.4-19
2.4.3.3 242-25H Evaporator Vessel/Pot ..................................... 2.4-20
2.4.3.4 242-25H Overheads System ........................................ 2.4-21
2.4.3.5 242-25H Concentrate System ......................................... 2.4-22
2.4.3.6 242-25H Steam and Condensate System .......................... 2.4-23
2.4.3.7 242-25H Ventilation System ........................................ 2.4-25
2.4.3.8 242-25H Gang Valves ................................................ 2.4-25
2.4.3.9 242-25H Support Systems ........................................... 2.4-26

2.4.4 Transfer Facilities .............................................................. 2.4-27
2.4.4.1 Transfer Lines ................................................................. 2.4-27
2.4.4.2 Diversion Boxes .......................................................... 2.4-30
2.4.4.3 Pump Pits/Pump Tanks .................................................... 2.4-32
2.4.4.4 Valve Boxes ................................................................. 2.4-34
2.4.4.5 Pumps, Jets, and Waste Removal Equipment ................. 2.4-35
2.4.4.6 Contingency Transfer System ....................................... 2.4-38

2.4.5 Actinide Removal Process Facility ........................................... 2.4-39
2.4.5.1 Process Area ................................................................. 2.4-39
2.4.5.2 Strike Tanks ................................................................. 2.4-39
2.4.5.3 Support Facilities/Systems ............................................ 2.4-39
2.4.5.4 MST Feed Tank ............................................................ 2.4-40

2.4.6 Modular Caustic Side Solvent Extraction Unit ......................... 2.4-40
2.4.6.1 Main Process Area ........................................................ 2.4-40
2.4.6.2 Contactor Enclosure Area ............................................... 2.4-40
2.4.6.3 Support Facilities ........................................................ 2.4-41
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>PROCESS DESCRIPTION</td>
<td>2.5-1</td>
</tr>
<tr>
<td>2.5.1</td>
<td>Waste Storage</td>
<td>2.5-1</td>
</tr>
<tr>
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<td>2.5-1</td>
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<td>Waste Removal</td>
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</tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
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<tr>
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<td>Type I and Type II Waste Tank Chemical Cleaning Process</td>
<td>2.5-5</td>
</tr>
<tr>
<td>2.5.6.3</td>
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<td>2.5-5</td>
</tr>
<tr>
<td>2.5.7</td>
<td>Waste Tank/Equipment Grouting</td>
<td>2.5-6</td>
</tr>
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</tr>
<tr>
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<td>CONFINEMENT SYSTEMS</td>
<td>2.6-1</td>
</tr>
<tr>
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<td>2.6-1</td>
</tr>
<tr>
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<td>Dip Tubes</td>
<td>2.6-1</td>
</tr>
<tr>
<td>2.7</td>
<td>SAFETY SUPPORT SYSTEMS</td>
<td>2.7-1</td>
</tr>
<tr>
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<td>Fire Protection System</td>
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</tr>
<tr>
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<td>Monitoring Systems</td>
<td>2.7-2</td>
</tr>
<tr>
<td>2.7.2.1</td>
<td>Flammable Gas and Air Monitoring</td>
<td>2.7-2</td>
</tr>
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<td>Airborne Particulate Monitoring</td>
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## CONTENTS

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<tbody>
<tr>
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<td>UTILITY DISTRIBUTION SYSTEMS</td>
<td>2.8-1</td>
</tr>
<tr>
<td>2.8.1</td>
<td>Electrical</td>
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<td>2.8.1.1</td>
<td>Electrical System Arrangement</td>
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</tr>
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<td>Backup Power</td>
<td>2.8-1</td>
</tr>
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<td>Uninterruptible Power Supply</td>
<td>2.8-2</td>
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<td>Non-Electrical</td>
<td>2.8-2</td>
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<td>Steam System</td>
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<td>Well Water System</td>
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<td>Flush Water System</td>
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<td>Chromate Cooling Water/Cooling Tower Water Systems</td>
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<td>Inhibited Water/Bearing Water Systems</td>
<td>2.8-6</td>
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<td>CSTF Effluent System</td>
<td>2.8-6</td>
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<tr>
<td>2.9</td>
<td>AUXILIARY SYSTEMS AND SUPPORT FACILITIES</td>
<td>2.9-1</td>
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<td>2.9.1</td>
<td>299-H Maintenance Facility</td>
<td>2.9-1</td>
</tr>
<tr>
<td>2.9.2</td>
<td>Cold Feeds Area</td>
<td>2.9-2</td>
</tr>
<tr>
<td>2.9.3</td>
<td>Chemical Addition</td>
<td>2.9-3</td>
</tr>
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<td>REFERENCES</td>
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<td>TABLES</td>
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TABLES

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<tr>
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<td>Current, Historical, and Projected Facility Use</td>
<td>2.11-1</td>
</tr>
<tr>
<td>FIGURES</td>
<td>Page</td>
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</tr>
<tr>
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</tr>
<tr>
<td>Figure 2.3-1 Waste Facility General Locations</td>
<td>2.12-1</td>
<td></td>
</tr>
<tr>
<td>Figure 2.3-2 F-Tank Farm Layout</td>
<td>2.12-2</td>
<td></td>
</tr>
<tr>
<td>Figure 2.3-3 H-Tank Farm Layout</td>
<td>2.12-3</td>
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</tr>
<tr>
<td>Figure 2.3-4 Facility Boundaries</td>
<td>2.12-4</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-1 Type I Waste Tanks (Typical)</td>
<td>2.12-5</td>
<td></td>
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<tr>
<td>Figure 2.4-2 Type II Waste Tanks (Typical)</td>
<td>2.12-6</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-3 Type III and IIIA Waste Tanks (Typical)</td>
<td>2.12-7</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-4 Type IV Waste Tanks (Typical)</td>
<td>2.12-8</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-5 Evaporator Building (Typical)</td>
<td>2.12-9</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-6 242-16H Evaporator Feed System</td>
<td>2.12-10</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-7 Evaporator Vessel Cross Section</td>
<td>2.12-11</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-8 242-16H Evaporator Cell Ventilation</td>
<td>2.12-12</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-9 Gang Valve (Typical)</td>
<td>2.12-13</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-10 242-25H Evaporator Feed Pump</td>
<td>2.12-14</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-11 242-25H Primary Ventilation System</td>
<td>2.12-15</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-12 242-25H Secondary Ventilation System</td>
<td>2.12-16</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-13 Diversion Box and Pump Pit General</td>
<td>2.12-17</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-14 Valve Box Arrangement</td>
<td>2.12-18</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-15 Submersible Mixer Pump</td>
<td>2.12-19</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-16 242-16H Evaporator Chemical Cleaning</td>
<td>2.12-20</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-17 Actinide Removal Process</td>
<td>2.12-21</td>
<td></td>
</tr>
<tr>
<td>Figure 2.4-18 MCU Layout</td>
<td>2.12-22</td>
<td></td>
</tr>
<tr>
<td>Figure 2.5-1 MCU Process with BOBCalix-based Solvent</td>
<td>2.12-23</td>
<td></td>
</tr>
<tr>
<td>Figure 2.5-2 MCU Process with NGS</td>
<td>2.12-24</td>
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## ACRONYMS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>ADMP</td>
<td>Advance Design Mixer Pump</td>
</tr>
<tr>
<td>AIV</td>
<td>Automatic Isolation Valve</td>
</tr>
<tr>
<td>ARM</td>
<td>Area Radiation Monitor</td>
</tr>
<tr>
<td>ARP</td>
<td>Actinide Removal Process</td>
</tr>
<tr>
<td>ATS</td>
<td>Automatic Transfer Switch</td>
</tr>
<tr>
<td>BFV</td>
<td>Backflush Valve</td>
</tr>
<tr>
<td>CAM</td>
<td>Continuous Air Monitor</td>
</tr>
<tr>
<td>CDT</td>
<td>Contactor Drain Tank</td>
</tr>
<tr>
<td>CFA</td>
<td>Cold Feeds Area</td>
</tr>
<tr>
<td>COP</td>
<td>Clean Out Port</td>
</tr>
<tr>
<td>CRC</td>
<td>Cesium Removal Column</td>
</tr>
<tr>
<td>CSMP</td>
<td>Commercial Submersible Mixer Pump</td>
</tr>
<tr>
<td>CSS</td>
<td>Clarified Salt Solution</td>
</tr>
<tr>
<td>CSSX</td>
<td>Caustic Side Solvent Extraction</td>
</tr>
<tr>
<td>CSTF</td>
<td>Concentration, Storage, and Transfer Facilities</td>
</tr>
<tr>
<td>CTS</td>
<td>Concentrate Transfer System</td>
</tr>
<tr>
<td>DB</td>
<td>Diversion Box</td>
</tr>
<tr>
<td>DCS</td>
<td>Distributed Control System</td>
</tr>
<tr>
<td>DI</td>
<td>deionized</td>
</tr>
<tr>
<td>DIWF</td>
<td>Dilution and Inhibited Water Facility</td>
</tr>
<tr>
<td>DOE</td>
<td>Department of Energy</td>
</tr>
<tr>
<td>dP</td>
<td>differential pressure</td>
</tr>
<tr>
<td>DSS</td>
<td>Decontaminated Salt Solution</td>
</tr>
<tr>
<td>DSSHT</td>
<td>Decontaminated Salt Solution Hold Tank</td>
</tr>
<tr>
<td>DWPF</td>
<td>Defense Waste Processing Facility</td>
</tr>
<tr>
<td>EES</td>
<td>Electrical Equipment Skid</td>
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<tr>
<td>ETP</td>
<td>Effluent Treatment Project</td>
</tr>
<tr>
<td>FDB</td>
<td>F-Area Diversion Box</td>
</tr>
<tr>
<td>FPP</td>
<td>F-Area Pump Pit</td>
</tr>
<tr>
<td>FPT</td>
<td>F-Area Pump Tank</td>
</tr>
<tr>
<td>FTF</td>
<td>F-Area Tank Farm</td>
</tr>
<tr>
<td>GDL</td>
<td>Gravity Drain Line</td>
</tr>
<tr>
<td>GM</td>
<td>Geiger-Mueller</td>
</tr>
<tr>
<td>ACRONYMS AND ABBREVIATIONS (continued)</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------</td>
<td></td>
</tr>
<tr>
<td>HDB</td>
<td>H-Area Diversion Box</td>
</tr>
<tr>
<td>HEPA</td>
<td>High-Efficiency Particulate Air</td>
</tr>
<tr>
<td>HNO₃</td>
<td>nitric acid</td>
</tr>
<tr>
<td>HPP</td>
<td>H-Area Pump Pit</td>
</tr>
<tr>
<td>HPT</td>
<td>H-Area Pump Tank</td>
</tr>
<tr>
<td>HTF</td>
<td>H-Area Tank Farm</td>
</tr>
<tr>
<td>IAL</td>
<td>Inter-Area Line</td>
</tr>
<tr>
<td>ITP</td>
<td>In-Tank Precipitation</td>
</tr>
<tr>
<td>IW</td>
<td>Inhibited Water</td>
</tr>
<tr>
<td>kV</td>
<td>kilovolt</td>
</tr>
<tr>
<td>LDB</td>
<td>Leak Detection Box</td>
</tr>
<tr>
<td>LFL</td>
<td>Lower Flammability Limit</td>
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<tr>
<td>LPDT</td>
<td>Low Point Drain Tank</td>
</tr>
<tr>
<td>LPPP</td>
<td>Low Point Pump Pit</td>
</tr>
<tr>
<td>LPS</td>
<td>Leak Probe Sleeve</td>
</tr>
<tr>
<td>M</td>
<td>Molar</td>
</tr>
<tr>
<td>MCC</td>
<td>Motor Control Center</td>
</tr>
<tr>
<td>MCU</td>
<td>Modular Caustic Side Solvent Extraction Unit</td>
</tr>
<tr>
<td>MLDB</td>
<td>Modified Leak Detection Box</td>
</tr>
<tr>
<td>MRT</td>
<td>Mercury Removal Tank</td>
</tr>
<tr>
<td>MST</td>
<td>monosodium titanate</td>
</tr>
<tr>
<td>MWRCC</td>
<td>Mobile Waste Removal Control Center</td>
</tr>
<tr>
<td>N/A</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>NaOH</td>
<td>sodium hydroxide</td>
</tr>
<tr>
<td>NGS</td>
<td>Next Generation Solvent</td>
</tr>
<tr>
<td>OA</td>
<td>oxalic acid</td>
</tr>
<tr>
<td>OD</td>
<td>outside diameter</td>
</tr>
<tr>
<td>PCV</td>
<td>Pressure Control Valve</td>
</tr>
<tr>
<td>PP</td>
<td>Pump Pit</td>
</tr>
<tr>
<td>PRV</td>
<td>Pressure Relief Valve</td>
</tr>
<tr>
<td>psi</td>
<td>pounds per square inch</td>
</tr>
<tr>
<td>psig</td>
<td>pounds per square inch gauge</td>
</tr>
<tr>
<td>PVS</td>
<td>Primary Ventilation System</td>
</tr>
<tr>
<td>PVV</td>
<td>Process Vessel Ventilation</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>PW</td>
<td>Process Water</td>
</tr>
<tr>
<td>RBOF</td>
<td>Receiving Basin for Offsite Fuels</td>
</tr>
<tr>
<td>SDG</td>
<td>Standby Diesel Generator</td>
</tr>
<tr>
<td>SED</td>
<td>Strip Effluent Decanter</td>
</tr>
<tr>
<td>SEHT</td>
<td>Strip Effluent Hold Tank</td>
</tr>
<tr>
<td>SHT</td>
<td>Solvent Hold Tank</td>
</tr>
<tr>
<td>SMP</td>
<td>Submersible Mixer Pump</td>
</tr>
<tr>
<td>SRNL</td>
<td>Savannah River National Laboratory</td>
</tr>
<tr>
<td>SRR</td>
<td>Savannah River Remediation LLC</td>
</tr>
<tr>
<td>SSCs</td>
<td>Structures, Systems, and Components</td>
</tr>
<tr>
<td>SSFT</td>
<td>Salt Solution Feed Tank</td>
</tr>
<tr>
<td>SSRT</td>
<td>Salt Solution Receipt Tank</td>
</tr>
<tr>
<td>STD</td>
<td>Standard</td>
</tr>
<tr>
<td>STP</td>
<td>Submersible Transfer Pump</td>
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<td>SVS</td>
<td>Secondary Ventilation System</td>
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<td>TCV</td>
<td>Temperature Control Valve</td>
</tr>
<tr>
<td>UPS</td>
<td>Uninterruptible Power Supply</td>
</tr>
<tr>
<td>VAC</td>
<td>volt alternating current</td>
</tr>
<tr>
<td>VB</td>
<td>Valve Box</td>
</tr>
<tr>
<td>VFD</td>
<td>Variable Frequency Drive</td>
</tr>
<tr>
<td>WCT</td>
<td>Waste Collection Tank</td>
</tr>
<tr>
<td>wt. %</td>
<td>weight percent</td>
</tr>
<tr>
<td>WW</td>
<td>Well Water</td>
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2.0 FACILITY DESCRIPTION

2.1 INTRODUCTION

This chapter describes the Concentration, Storage, and Transfer Facilities (CSTF) Structures, Systems, and Components (SSCs), located in F-Area and H-Area, in sufficient detail to understand how the SSCs function and how they relate to individual safety-related SSCs. Additionally, the information provided in this chapter is typical of locations that are permitted to store, handle, or process waste streams. Conditions may exist (as defined in later chapters) such that SSCs described in this chapter are not necessary for operation of the facility.

The scope of this chapter includes F-Area Tank Farm (FTF), H-Area Tank Farm (HTF), Building 299-H Maintenance Facility, the Modular Caustic Side Solvent Extraction Unit (MCU) Facility, and the 241-96H Actinide Removal Process (ARP) Facility.

Facility layouts, dimensions, materials, sketches, and other information provided in this chapter are intended to support an overall understanding of the facility structure and the general arrangement of the facility as it pertains to hazard and accident analyses, as required by Section 2.4 of Department of Energy (DOE)-Standard (STD)-3009-94 (Ref. 1). This chapter is not intended to define safety-related SSCs; these SSCs are identified in Chapter 4 of this Documented Safety Analysis. Sketches were developed from Process and Instrumentation Diagrams, detail drawings, equipment arrangement drawings, and other drawings and are not to scale. It should be noted that all dimensions are “nominal” or “reference” values and are provided for information only.
2.2 REQUIREMENTS

Design codes, standards, regulations, and DOE Orders required for establishing the facility safety basis specific to this chapter and pertinent to the safety analysis include the following:

- DOE Order 420.1C (Ref. 2)
- 10 Code of Federal Regulations 830, Nuclear Safety Management (Ref. 3)
- DOE-STD-3009-94 (Ref. 1)
- DOE Order 6430.1A (Historical) (Ref. 4)
- Standards/Requirements Identification Document (Ref. 5)
2.3 FACILITY OVERVIEW

2.3.1 CURRENT, HISTORICAL, AND PROJECTED FACILITY USE

Table 2.3-1 includes current, historical, and projected use of evaporators, waste tanks, and other interacting facilities. Current and historical use of waste tanks includes the following:

- Evaporator feed and receipt tanks
- Storage of saltcake, supernate, and/or sludge
- Receipt of waste from 221-F or 221-H Separation Facilities
- Receipt of Defense Waste Processing Facility (DWPF) recycle
- Receipt of Receiving Basin for Offsite Fuels (RBOF) waste
- Processing tank in support of sludge washing activities
- Receipt of sludge washing spent wash water
- Receipt of Effluent Treatment Project (ETP) bottoms
- Preparation of DWPF feed (sludge washing)

Projected uses of waste tanks include continued evaporator feed and receipt, continued waste/saltcake storage, continued DWPF recycle receipt, and continued sludge washing.

Current and historical use of other interacting facilities includes the following:

- Receipt of salt solution batches from Tank 49, dilution/agitation with Process Water (PW) and monosodium titanate (MST) when the waste salt solution contains concentrations of strontium and actinides that exceed downstream acceptance criteria to achieve strontium and actinide adsorption and transfer of the MST/salt solution to 512-S for filtration
- Transfers of Tank 49 salt solution direct to 512-S for filtration when the waste salt solution does not contain concentrations of strontium and actinides that exceed downstream acceptance criteria
- Receipt of high cesium/low actinide Clarified Salt Solution (CSS) from the 512-S ARP to remove/reduce cesium using Caustic Side Solvent Extraction (CSSX) technology

2.3.2 FACILITY CONFIGURATION

The CSTF includes FTF, HTF, laydown yards (H1-1, HY-1, near N-Area, and Seven Springs), and the 299-H Waste Management Maintenance Facility. Figure 2.3-1 depicts the proximity of FTF and HTF with respect to each other and nearby/adjacent facilities. Figures 2.3-2 and 2.3-3 depict the general layout of the Tank Farms.
CSTF interfaces with DWPF, F-Canyon Facility, H-Canyon Facility, Saltstone Facility, and ETP. The following describe the facility boundaries:

- **DWPF Boundary** — DWPF, including the inter-area transfer lines [with Building 512-S and the Low Point Pump Pit (LPPP)] between DWPF and the Tank Farms, will not be included as part of the CSTF. The boundary for the sludge transfer lines from Tanks 40 and 51 to the LPPP is at the seal plates of Valve Boxes (VBs) Tank 40 VB and Tank 51 VB, respectively. The boundary for the ARP feed transfer line from Tank 49 to 512-S is at the seal plate of Valve Box Tank 49 VB. The boundary for the DWPF recycle transfer line from LPPP to the H-Area Diversion Box (HDB) HDB-8 is at the penetration to HDB-8.

  Building 512-S will not be included as part of the CSTF. Building 241-278H MCU will be included as part of the CSTF. The ARP filtrate transfer line (L-RCZ-37) from Building 512-S to Building 241-278H up to the seal plate at 241-278H will not be included as part of the CSTF. The seal plate where transfer line L-RCZ-37 transitions into Building 241-278H will be included as part of the CSTF.

  Line Segment 16054, which transitions into Line Segment SDP-1 (from the Tank 51 VB to Building 511-S (LPPP)) is cut and capped outside of Building 241-278H. Transfer line SDP-1 from the seal plate at 241-278H to the LPPP will not be included as part of the CSTF. The seal plate, where transfer line SDP-1 transitions into Building 241-278, will be included as part of the CSTF.

  Transfer line L-1657 from (but not including) the seal plate at Building 241-278H and transfer line L-RCZ-38 up to and including the seal plate, where transfer line L-RCZ-38 ties into transfer line HI-241-950-WTS-L-1663, will not be included as part of the CSTF. The remainder of the transfer line to Tank 50 (HI-241-950-WTS-L-1663), including leak detection, will be included as part of the CSTF. The seal plate, where transfer line L-1657 transitions into Building 241-278H, will be included as part of the CSTF.

Refer to Figure 2.3-4 for details on the interface of ARP and MCU facility boundaries.

- **H-Canyon Facility Boundary** — The transfer lines between H-Canyon (including the associated outside facilities) and the HTF, from the transition box wall to HTF, will be included as part of the CSTF. The leak detection location along this transfer line belongs to the H-Canyon Facility.

- **F-Canyon Facility Boundary** — The transfer lines between F-Canyon (including the associated outside facilities) and the FTF, from the canyon wall, will be included as part of the CSTF. The F-Canyon Facility has been shut down.

- **Saltstone Facility Boundary** — The inter-area transfer line between the Tank Farms and the Saltstone Facility, including the Low Point Drain Tank (LPD), will be included as part of the CSTF. The CSTF boundary extends up to, but not including, the first manual isolation valve in the Saltstone Facility.

- **Retention Basins** — The Retention Basins, including the storm sewers between the Tank Farms and the Retention Basins, will not be included as part of the CSTF.
• ETP Boundary — ETP, including the transfer lines between ETP and the Tank Farms, will not be included as part of the CSTF. In general terms, CSTF owns up to the Force Main Valve Pit. ETP has ownership from there.

2.3.3 BASIC FACILITY PROCESSES

The basic processes performed in the CSTF are described below. Section 2.5 of this chapter contains additional process information.

• Waste Storage
  - Maintaining tank chemistry
  - Performing inspections, surveillance and oversight
  - Monitoring process trends
  - Performing equipment maintenance

• Waste Transfer
  - Defining transfer routes
  - Confirming waste compatibility
  - Verifying transfer line/system integrity
  - Performing transfers

• Waste Concentration
  - Settling sludge
  - Decanting and transferring supernate
  - Evaporating supernate and transferring overheads to ETP

• Sludge Processing, including sludge washing to remove salts

• Decontamination of equipment/components at Building 299-H

• Waste Removal, including saltcake dissolution and sludge mobilization

• Tank/Equipment Closure, including tank spray washing and grouting

• Actinide Removal at Building 241-96H

• Cesium separation from CSS at MCU, Building 241-278H

• Residual Waste Removal
  - Chemical Cleaning Process
  - Waste Tank Annulus Cleaning Process
2.4 FACILITY STRUCTURE

2.4.1 WASTE TANKS/CONTROL ROOMS

There are 51 large subsurface waste tanks in the CSTF. Twenty-nine of the tanks are in H-Area, and 22 are in F-Area. Eight waste tanks (Tanks 5, 6, 12, 16, 17, 18, 19, and 20) have been closed and backfilled with grout. All of the waste tanks are built of carbon steel and reinforced concrete, but their designs differ. There are five types of waste tanks in the Tank Farms, designated as Type I, II, III, IIIA, and IV. Refer to Table 2.3-1, for the tank numbers associated with each type of tank and the location of each tank.

For tanks other than Type IV tanks, the carbon steel primary waste tank is attached to the concrete roof slab, which is supported by roof support columns, and supported on the bottom by a base slab and a working slab. The primary tanks, other than Type IV, have a carbon steel secondary containment, which provides a collection point for any primary tank leakage, a method for heating or cooling the primary tank wall in conjunction with the annulus ventilation system, and an area for expansion of the primary tank. For Type III and IIIA tanks, the secondary containment is a full-height annulus, while for Type I and II tanks, the secondary containment is a 5-foot high carbon steel pan. A reinforced concrete vault surrounding the secondary containment provides structural support and radiation shielding. Multiple risers provide access to the tank and annulus interiors and are used for inspections, steel taping, sampling, and the installation of equipment such as waste transfer equipment, annulus jets, dip tubes, thermocouples, conductivity probes, ventilation, reel tapes, and flammable gas monitors. Waste Tank sampling may be performed manually (e.g., manual dip samples, core samples) or via powered equipment (e.g., Ram-Set waste tank sampling system). The primary tanks, other than Type IV, are also equipped with the capability of cooling the waste with cooling coils submerged in the waste.

Reel tapes, radar devices, and conductivity probes, with associated alarms, are typically used to monitor the tank level. Steel taping can also be used as a backup to the reel tapes. Some waste tank sampling systems use hydraulic power to obtain samples through a waste tank riser. Tank annuli are equipped with conductivity probes and dip tubes, with associated alarms, to monitor for leakage from the primary tank. Thermocouples are used to monitor the waste and tank wall temperatures. Waste tanks and waste tank annuli are monitored and ventilated. Waste tank ventilation exhaust is filtered and monitored to prevent the dispersal of contamination. Following are specific features for each tank type.

2.4.1.1 Waste Tank Designs

Type I Waste Tanks (F-Area Tanks 1 through 8, H-Area Tanks 9 through 12)

The primary tank has ½-inch-thick walls, is 75 feet in diameter, and 24.5 feet in height with a maximum total volume of approximately 791,100 gallons. The cylindrical walls of the primary shell are welded to the flat top and bottom plates by curved knuckle plates. Twelve support columns, constructed of concrete-filled pipes, support the concrete roof slab. The carbon steel secondary containment pan, forming the lower annular space, is 5 feet high and 80 feet in diameter, with a capacity of approximately 22,800 gallons (to the top of the pan). The vault and
roof are 22 inches thick and the base slab is 30 inches thick. The vault is covered by approximately 9 feet of earth that also provides radiation shielding.

The upper annular space extends the full height of the primary tank and is formed by the continuation of the concrete vault that directly surrounds the 5-foot high liner at the bottom. The annulus has a maximum total volume of approximately 120,800 gallons (including capacity above the steel secondary containment pan).

Stainless steel waste transfer pipes are connected to the tanks. The pipes are enclosed in a carbon steel jacket pipe where they bridge across the tank annulus. These inlet pipes enter the primary tank through the top knuckle and either terminate in the vapor space within a few feet of the tank wall or terminate in a downcomer, which directs the liquid to a lower elevation in the tank.

The cooling for each tank is provided by vertical coils suspended from the roof and horizontal coils extending across the bottom of the tank. Supply and return valves, located in the valve house, are used to isolate each individual coil, as required.

See Figure 2.4-1 for general arrangement of tank equipment. The figure depicts equipment typical of Type I Waste Tanks and is not intended to represent a specific waste tank configuration.

**Type II Waste Tanks (H-Area Tanks 13 through 16)**

The primary tank is 85 feet in diameter and 27 feet in height with a maximum total volume of approximately 1,118,500 gallons. The top and bottom walls are ½ inch thick, while the inner and outer walls are \( \frac{5}{8} \) inch thick. The cylindrical walls of the primary shell are welded to the flat top and bottom plates by curved knuckle plates. A single concrete center column supports the roof. The carbon steel secondary containment pan, forming the lower annular space, is 5 feet high and 90 feet in diameter, with a capacity of approximately 26,400 gallons (to the top of the pan). The vault has a 45-inch-thick roof, 33-inch-thick walls, and a base slab that varies in thickness between 42 and 64 inches. The base slab sits on the working slab. The working slab is a concrete pad situated on prepared dirt. There is no earth overburden on Type II tanks.

The upper annular space is of the same basic design as the Type I annulus. The annulus has a maximum total volume of approximately 152,200 gallons (including capacity above the steel secondary containment pan).

Stainless steel waste transfer pipes are connected to the tanks. The pipes are enclosed in a carbon steel jacket pipe where they bridge across the tank annulus. These inlet pipes enter the primary tank through the top knuckle and either terminate in the vapor space within a few feet of the tank wall or terminate in a downcomer which directs the liquid to a lower elevation in the tank.

The cooling for each Type II tank is provided by vertical coils suspended from the roof and horizontal coils extending across the bottom of the tank. Supply and return valves, located in each tank valve house, are used to isolate each individual coil, as required. However, the cooling
water supply and return to the cooling coils for Tank 14 and 15 are not permanently connected and are blanked or physically disconnected when not in use, eliminating any siphon/pump-out potential. The chromate cooling water system is connected when operational plans require cooling for Tank 14 or 15.

See Figure 2.4-2 for a general arrangement of tank equipment. The figure depicts equipment typical of Type II Waste Tanks and is not intended to represent a specific waste tank configuration.

Type III Waste Tanks (F-Area Tanks 33 and 34, H-Area Tanks 29 through 32)

The annealed carbon steel primary tank is 85 feet in diameter and 33 feet in height with a maximum total volume of approximately 1,373,238 gallons. The top and bottom walls are ½ inch thick, the inner wall tapers from 5/8 inch thick at the bottom to ½ inch thick at the top, and the outer wall tapers from ¾ inch at the bottom to ½ inch at the top. A single concrete center column support is constructed as an integral part of the roof. The secondary containment, a full height carbon steel tank which forms in the annular space, is 90 feet in diameter and 33 feet in height. The vault has a 48 inch thick roof, 30 inch walls, and a base slab that varies between 42 and 64 inches thick. The primary tank rests on an insulating concrete slab that is grooved radially for airflow to cool the tank bottom. The vault rests on a concrete working slab. The roof support column and inner tank wall form a center annulus.

The outer annulus has a maximum total volume of approximately 176,100 gallons (including the cooling slots). The center annulus allows for ventilation airflow to the tank bottom and then out to the outer annulus.

Stainless steel waste transfer pipes are connected to the tanks. The pipes are enclosed in a carbon steel jacket pipe where they bridge across the tank annulus. These inlet pipes enter the primary tank through the top knuckle and either terminate in the vapor space within a few feet of the tank wall or terminate in a downcomer which directs the liquid to a lower elevation in the tank.

Type III tanks do not have installed cooling coils of the design used in Type I and Type II tanks; cooling is provided in Type III Tanks through coils suspended from the tank tops. These insertable or deployable coils are installed through the tank risers. The insertable coolers utilize consolidated cooling bundles, which rely upon convection through the liquid to provide distributed cooling. The deployable cooling coils are spread out into either a conical or cylindrical shape after being installed into the tank riser, thereby, providing greater cooling distribution than the consolidated cooling bundles. No cooling coils are provided across the tank bottom, with cooling instead being provided through the concrete slab grooves, as discussed above.

See Figure 2.4-3 for a general arrangement of tank equipment. The figure depicts equipment typical of Type III Waste Tanks and is not intended to represent a specific waste tank configuration.
Type IIIA Waste Tanks (F-Area Tanks 25 through 28 and 44 through 47, H-Area Tanks 35 through 43 and 48 through 51)

Type IIIA tanks have the same design as Type III except for the following:

- The outer annulus has a maximum total volume of approximately 177,800 gallons (including the cooling slots)
- The radial grooves in the insulating slab are larger
- The tank tops are sloped for drainage
- The cooling coils are permanently installed and bottom-supported, except for Tank 35, which has deployable bundles similar to Type III tanks
- The tanks are constructed of normalized steel that was stress relieved after fabrication
- A conductivity probe-equipped underliner sump is located between the secondary containment bottom and the base slab, except for Tanks 35, 36, and 37, which have no underliner sumps
- The outer wall of the tank tapers from ⅞ inch at the bottom to ½ inch at the top

See Figure 2.4-3 for general arrangement of tank equipment. The figure depicts equipment typical of Type IIIA Waste Tanks and is not intended to represent a specific waste tank configuration.

Type IV Waste Tanks (F-Area Tanks 17 through 20, H-Area Tanks 21 through 24)

The tank is 85 feet in diameter with a domed roof of 44 feet 10½ inches in height at the center with a maximum total volume of approximately 1,685,000 gallons. The domed roof rests on a concrete tank ring (Spring Line). The sidewalls and bottom are ⅜ inch thick, with knuckle plates at the junction between the tank bottom and sidewalls. The domed roof is covered by earth that provides radiation shielding. The vault was built around the tank by blowing a semi-thickened concrete liquid mixture onto the surface. The inner concrete wall is surrounded by a high-strength concrete wall that was pre-stressed by embedding girths of steel under tension. The outside concrete wall is 3 to 4 inches thick.

A 4-inch base slab supports the tank bottom and the entire tank system is supported by a 4-inch-thick working slab. The base slab has a network of channels to direct leakage to the leak detection sump, which is typically equipped with level instrumentation. For Type IV tanks in HTF, a sidewall sump with a pump out port is located adjacent to the base slab. The sidewall sump is open-topped and filled with crushed stone, similar to a french drain.

Stainless steel waste transfer pipes are connected to the tanks. The pipes are enclosed in transite pressure pipe where they pass through the wall of the tank concrete vault. These inlet pipes enter the primary tank just below the dome ring and terminate a few feet inside the tank wall.

Type IV tanks do not have installed cooling coils.
See Figure 2.4-4 for a general arrangement of tank equipment. The figure depicts equipment
typical of Type IV Waste Tanks and is not intended to represent a specific waste tank
configuration.

2.4.1.2 Control Rooms

There is one control room in FTF (supporting operations in FTF) and two control rooms in HTF
(supporting operations in FTF and HTF). A skid mounted Mobile Waste Removal Control
Center (MWRCC) or Electrical Equipment Skid (EES), which is designed to be movable from
one tank to another, supports waste removal operations in FTF and HTF. The control rooms
provide for monitoring process variables and operating major electrical equipment as follows:

- Control Room 241-18F — Supports Waste Tanks 25, 26, 27, 28, 44, 45, 46, and 47.
- Control Room 241-2H — Supports Waste Tanks 1, 2, 3, 4, 7, 8, 9, 10, 11, 13, 14, 15,
  21, 22, 23, 24, 29, 30, 31, 32, 33, 34, 35, 36, 37, 40, 41, 42, 48, 49, 50, and 51; the
  242-25H Evaporator; HDB-8; 241-96H ARP; MCU; and the inter-area transfer line.
- Control Room 241-28H — Supports Waste Tanks 38, 39, and 43; the 242-16H
  Evaporator; and HDB-7.
- MWRCC or EES (building number varies by skid) — Mobile control center that
  supports Submersible Mixer Pump (SMP) and Submersible Transfer Pump (STP)
  waste removal operations in FTF and HTF. This center houses the MCCs, controls,
  indications, and monitoring functions for the operation of the SMPs and STPs for
  waste tanks.

The control rooms utilize the Liquid Waste Control Network to support the operational activities
stated above. The Liquid Waste Control Network is a Distributed Control System (DCS) used to
monitor and control CSTF and ETP operations. The hardware architecture includes controllers,
operator work stations, a configuration work station, and a communication network. The
controllers, associated input/output subsystems, and work stations are distributed throughout the
facilities that are being monitored and/or controlled. The communication network includes a
serial link with the DWPF DCS.

As stated above, the operational activities for the F-Area CST Facilities have typically been
carried out utilizing the 241-18F Control Room. As part of the FTF control room consolidation
project, control room functions historically performed using the 241-18F Control Room will be
transitioned to the 241-2H Control Room. As FTF control room consolidation proceeds, the
functions listed above as being supported by the 241-18F Control Room will be taken over by
the 241-2H Control Room in stages, with the 241-2H Control Room ultimately overseeing all
operational activities for the F-Area CST Facilities. A radio repeater station is located between
FTF and HTF to provide radio communications between the 241-2H Control Room and the FTF
field operators.

2.4.1.3 Level and Leak Detection

- Reel Tapes — Reel tapes automatically measure the waste tank liquid level by reeling
  up or down a conductivity probe to detect the liquid/vapor interface. Normally, the
reel tape probe is in contact with the liquid surface in the tank. At periodic intervals, the probe is automatically raised to clear the tank liquid, then lowered to relocate the liquid level. When the probe comes in contact with the liquid, the drive stops and displays the probe position locally and in some cases the associated control room. A flushwater line is connected to the reel tape standpipe to spray down contamination when the reel tape is retracted. A purge line is also connected to the reel tape housing to maintain a continuous purge to prevent tank vapors from contaminating the housing. Reel tapes have high and low level alarms. The reel tapes can also be parked with the automatic movement feature disabled.

- **Steel Tapes** — Manual tapes (e.g., metal, fiberglass) may be used to measure the tank level.

- **Radar** — A radar level indicating device may be used to provide a tank level monitoring system to replace or augment the existing reel tape.

- **High Liquid Level Conductivity Probes** — In order to detect high waste levels in the primary tank, conductivity probes, with an associated control room alarm, are installed in each waste tank, and suspended at, or below, the desired maximum fill level.

- **Annulus Leak Detection** — Tank annuli are also equipped with conductivity probes and dip tubes. Type III and IIIA Waste Tanks, typically, have three conductivity probes positioned in the outer annulus and one in the center annulus (Type IIIA Waste Tanks only). Type I and Type II Waste Tanks, typically, have two annulus probes. Annulus conductivity probes provide an alarm upon the detection of a leak. Annulus dip tube instrumentation is also, typically, available to provide level indication.

- **Saltcake or Sludge Soundings** — Saltcake/sludge soundings, also known as steel tape saltcake/sludge soundings, consist of placing a manual tape with a metal wafer (or spike) at one end through the tank riser to measure the saltcake/sludge level. As the metal wafer (or spike) touches the saltcake/sludge, an average from multiple readings is taken, and the saltcake/sludge level is determined.

- **Turbidity Meters** — Turbidity meters are portable instruments that may be used to determine the suspended sludge level via clarified supernate in the waste tanks. A turbidity meter consists of a battery, an ohmmeter, a photoresistor, and a light source. The turbidity meter measures sludge level by using light resistance to determine the amount of suspended solids in the solution. Sludge has a larger amount of suspended solids than supernate, so as the meter passes sludge/supernate interface, the amount of light that passes through the solution will decrease. The photoresistor detects the amount of light passing through a solution and provides an output that is measured on the ohmmeter.

### 2.4.1.4 Ventilation

Waste tank ventilation is provided through either installed or portable ventilation systems. Most tanks utilize individual installed ventilation systems, though the use of portable ventilation or shared installed ventilation (e.g., on Type IV Tanks) commonly occurs. Waste tanks are
ventilated, as required, to remove flammable vapors from the tank while preventing the release of contaminants to the environment. Ventilation also provides tank cooling, with the effect being dependent on the ventilation flow rate. The tank primary and tank annulus ventilation system setups, described below, are generally true for all tanks except Type IV Tanks. However, the system design may vary for individual tanks (e.g., not all tanks have an installed High-Efficiency Particulate Air [HEPA] filter for annulus ventilation).

The following is a typical waste tank purge exhaust system setup. The purge exhaust fan draws air into the tank vapor space through HEPA filters and butterfly dampers in the purge inlet riser. Purge air flows through the vapor space, mixes with tank vapors, and exits the tank through a demister, a condenser, a re-heater, and a HEPA filter before being exhausted to the atmosphere. Condensate from the condenser drains back to the tank. Chromate cooling water typically provides cooling to the condenser. A Continuous Air Monitor (CAM) monitors the exhaust stream for contamination. Flush water is supplied to the demister to manually back-flush the demister element when Differential Pressure (dP) across the element exceeds a pre-set limit.

The most commonly used portable ventilation system in the Tank Farm consists of a portable blower with power module, HEPA filter, and flexible ducting. This system can be connected to the tank riser, and the blower draws the air through the HEPA filter. Portable ventilation systems may be used concurrently with the primary ventilation system when an increased flow rate through a process area (waste tank or pump tank) is desirable or as an alternate ventilation system when the primary ventilation system is not functioning. Portable ventilation systems may also be used on waste tank annuli.

Verification of proper operation of the portable ventilation system is accomplished by checking flow indication instrumentation on the permanent ventilation system (or manually measured if the portable ventilation system is installed in a riser), to ensure a required flow is maintained while using a portable ventilation unit. HEPA filters are provided with the portable ventilation unit, to ensure proper filtration of the ventilation exhaust. Differential pressure gauges are provided as part of the HEPA filter assembly in the portable ventilation unit, to verify filter operation.

Waste tank annulus ventilation systems are provided to maintain the primary tank wall above the nil ductility limit and to prevent the accumulation of condensation within the annulus space. Annulus ventilation also provides tank cooling with the effect being dependent on the ventilation flow rate. Waste tank annuli are also ventilated, as required, to remove flammable vapors from the tank annulus.

Type III and IIIA Tanks have a negative pressure annulus ventilation system. The system consists of a low efficiency filter and pre-heater on the annulus air inlet and an exhaust blower on the annulus outlet. A HEPA filter can be installed on the exhaust header, if needed.

Most Type I and II Tanks have a positive pressure annulus ventilation system, though some have a negative pressure ventilation system installed (e.g., Type I/II Waste Tanks undergoing Chemical Cleaning). The positive pressure annulus ventilation system consists of a low efficiency filter, a pre-heater and a blower on the annulus air inlet, and a HEPA filter on the annulus outlet. A circular ventilation duct is positioned around the bottom of the annulus. For
this system, air enters the annulus from the duct and circulates around the tank walls before exiting the annulus through a ventilation exhaust line. The negative pressure annulus ventilation system consists of an exhaust HEPA filter, exhaust blower, and exhaust stack; however, flow dampers, and air stream conditioning components may be installed. For this system, air enters the annulus through an inlet HEPA filter and circulates around the annulus vapor space before exiting the annulus through the exhaust header (via the exhaust HEPA filter, blower, and stack).

2.4.1.5 Temperature Monitors

At least one thermowell, with one or more thermocouples, is typically installed in waste tanks. Additional thermocouples may be positioned to monitor the temperatures at various tank locations, such as the tank bottoms, sidewalls, and interiors. Temperature ranges are established for various waste phases to avoid temperature related problems (e.g., temperature-induced embrittlement, increased tank wall corrosion, increased evaporation due to tank overheating, flammability controls). Depending on the tank, the thermocouples may be continuously monitored in the control rooms or may be monitored locally.

2.4.1.6 Support Systems

- Chromate Cooling Water System — Waste tank cooling coils are typically supplied from the Chromate Cooling Water System. Refer to Section 2.8.2.5 for additional information.
- Inhibited Water (IW) System — IW is supplied to waste tank slurry/transfer pump spray chambers, riser flush connections, and fill connections. IW is also used to flush transfer lines and to provide IW for various process operations (sludge washwater, heel removal, etc.). Refer to Section 2.8.2.6 for additional information.
- Instrument Air System — Instrument air is supplied for Lower Flammability Limit (LFL) analyzers, valve actuators, reel tape purge, dip tubes in the annuli, leak detection sumps (supports bubbler), and risers (supports evaporator backflush valve and evaporator drop tank dip tube operation). Refer to Section 2.8.2.2 for additional information.
- Nitrogen — Nitrogen supplies are available to Tanks 48 and 49. Nitrogen is used to inert the tank atmosphere. Refer to Chapter 18 for additional information.
- Steam System — Medium pressure steam is supplied to transfer jets. Low pressure steam is supplied to tank heating and ventilation systems.

2.4.2 242-16H EVAPORATOR

The evaporators concentrate waste to provide greater waste storage capacity by evaporating excess water from the waste. Two evaporators are in operation in the Tank Farms; 242-16H and 242-25H, commonly referred to as 2H and 3H, respectively. Three other evaporators, 242-F, 242-16F, and 242-H (commonly referred to as 1F, 2F, and 1H, respectively), have been removed from service, and are, therefore, not included in this chapter (including the associated Concentrate Transfer Systems [CTSs] for the 242-F and 242-H Evaporators). The 242-F Evaporator (including F-Area CTS), 242-16F Evaporator, and 242-H Evaporator (including
H-Area CTS) are considered inactive locations with respect to waste processing or waste transfers. Chemical cleaning operations are applicable to the 242-16H Evaporator only (see Figure 2.4-16).

The major evaporator systems/components are as follows:

- Evaporator building
- Feed system
- Evaporator vessel/pot
- Overheads system
- Evaporator concentrate (bottoms) system
- Steam and condensate systems
- Ventilation system
- Gang valves
- Support systems

The 242-16H Evaporator Cell may also be used as a secondary containment for tank-to-tank transfers directly through the cell (via a transfer jumper).

2.4.2.1 242-16H Evaporator Building

The 242-16H Evaporator facilities are arranged into three cells and a gang valve house. The evaporator cell contains the evaporator; the overheads condenser cell contains the overheads condenser; and a diked overheads receiver cell contains overheads system components other than the overheads condenser. The gang valve house, located at the upper level of the evaporator building, contains the gang valves for the evaporator cell sump, the steam lift and lance, and the chemical addition tank. An instrument cabinet contains the instrumentation associated with level measurement and control, alarms, and interlocks. See Figure 2.4-5.

The evaporator cell is 16 feet by 16 feet by 25 feet high with walls constructed of stainless steel lined, grooved concrete that is 3 feet 6 inches thick and a 1 foot thick roof, composed of concrete slab sections. The concrete slab sections have access ports for valves and viewing.

The evaporator cell is stainless steel-lined for collecting leakage from equipment inside the evaporator or overheads condenser cells, leakage from the lift/lance/evaporator cell sump gang valve vent header, and liquid from cell spray operations. There are two methods for detecting liquid level in the sump. An air-bubbler dip tube measures the sump level and provides level indication and an alarm to the control room. A conductivity probe monitors the liquid level and provides an alarm to the control room prior to an overflow of the sump. Liquid from the sump is jetted to the evaporator feed tank using a steam jet and gang valve, operated from the control room, with steam and process/plant air. An evaporator underliner sump collects any leakage through the concrete or stainless steel liner and provides an alarm to the control room.
The overheads condenser cell is 9 feet by 10 feet by 14 feet high with walls constructed of concrete and has a roof composed of concrete slab sections. The concrete slab sections have access ports for viewing. The overheads condenser cell contains a stainless steel liner pan on a sloped floor. The overheads condenser cell has an opening to the evaporator cell. The de-entrainment column piping enters the overheads condenser cell through this opening, which also permits airflow to the evaporator cell.

The overheads receiver cell (which is open to the environment) contains the Mercury Removal Tank (MRT), Cesium Removal Column (CRC) feed tank, two CRC pumps, two overheads receiver tanks, an overheads receiver tank sample system, filters for removing zeolite from condensate, CRC gamma monitors, CRC charging jet, and two overheads receiver pumps. The CRCs, filters, charging jets, and gamma monitors are no longer used and have been bypassed. The sump level is monitored by bubbler dip tubes and a conductivity probe, which alarms in the control room. Liquid is removed from the sump by a submersible pump or by jetting with a steam jet located in the sump. There is an area outside the overheads receiver cell (apron) that is diked. A pump is used to empty this area into the overheads receiver cell sump.

2.4.2.2 242-16H Feed System

The evaporator feed system includes a feed tank, feed pump can, feed pump and eductor, feed bypass valve, feed flow control valve, three-way priming valve, feed jumper, and evaporator cell wall nozzles.

The feed pump can, depicted in Figure 2.4-6, contains the feed pump, air-operated feed flow control valve, manual feed bypass valve, flush water valve, and three-way priming valve. The can is installed inside a riser on the feed tank. A conductivity probe is installed in the feed pump riser to detect leakage and alarm in the associated control room. However, the feed pump can is open at the bottom (i.e., drains to the associated waste tank) to minimize the chance that waste accumulates in the riser.

The evaporator feed pump continuously circulates waste liquid in an eductor loop inside the tank. Flow through the eductor draws waste from the feed tank into the pump suction. Simultaneously, waste is pulled out of the loop and fed to the evaporator pot through the feed control valve. The eductor pump suction height is positioned above the sludge level to minimize the potential for carryover of sludge. The feed pump is cooled by the fluid passing through the pump; venting to the atmosphere cools the motor windings. Flush water is used to prime the feed pump. Backflow prevention devices are installed to minimize waste from being pushed back into the Flush Water System. The backflow prevention device is a check valve and two devices are installed in series in a spool piece in the flush water line. Once the pump is primed and running, the flush water is isolated and the eductor loop is operated on waste only.

A feed pump discharge line (feed line) connects the discharge of the feed pump to a fill nozzle in the evaporator cell. If the evaporator levels reach a high level, an interlock closes the feed flow control valve. Control of the flow to the evaporator is accomplished by changing the air pressure to the feed flow control valve. During evaporator chemical cleaning operations, the feed tank is physically isolated to the evaporator pot.
2.4.2.3 242-16H Evaporator Vessel/Pot

The evaporator vessel has a capacity of approximately 4,400 gallons. The insulated vessel is 8 feet in diameter and 16.5 feet in height, with a cone-shaped bottom. The vessel is constructed of ½ inch 304L stainless steel.

Refer to Figure 2.4-7, which depicts the general arrangement of the 242-16H and 242-25H Evaporators with sketches of the major configuration differences captioned adjacent to the component. Evaporator vessel service/equipment lines installed in, or penetrating, the vessel include the following:

- **Feed Inlet Nozzle** — The feed nozzle conducts waste into the vessel from the evaporator wall nozzle via a jumper.

- **Steam Tube Bundle** — The steam tube bundle concentrates waste by heating the waste above its boiling point and driving off vapor, which exits the evaporator vessel through the de-entrainment column as vapor. The steam header provides steam to the tube bundle. The pressure is maintained with a Pressure Control Valve (PCV) and backpressure system. Flow from the header to the tube bundle can be varied using the Temperature Control Valve (TCV) and isolated using the Automatic Isolation Valve (AIV). Upon loss of steam pressure, the tube bundle is automatically supplied low pressure air to keep the tube bundle pressurized and to prevent the pot contents from contaminating the Steam System in the event of a tube bundle leak. The tube bundle is a bent tube design, intended to flex for descaling, and is constructed of 233 Hastelloy G-30 tubes with ¾ inch Outside Diameter (OD) and approximately 7.5 feet length. The tubes have an average wall thickness of 0.083 inch. The tube bundle design is rated for 171 pounds per square inch gauge (psig) and 380°F. The tubes terminate at both ends in heavy tube sheets, maintained at fixed spacing by tie-rods. Condensate exiting the tube bundle is routed to the condensate flash tank. The steam inlet for the highest tube is located just over 8 feet from the bottom of the vessel. Steam supply components to the tube bundle are discussed in Section 2.4.2.6.

- **Warming Coil** — The warming coil is isolated from use by a blank.

- **Lift Lines** — The evaporator has two installed lift lines that can be used to lift (transfer) the concentrated waste (bottoms) from the evaporator, through the concentrate outlet to a separator pot. The waste exits the bottom of the separator pot and gravity drains to the concentrate receipt (drop) tank. The separator pot has a vent at the top to allow the lift steam to exit to the vent tank. The vent also serves as an alternative path to empty the pot contents in case of line pluggage. During evaporator chemical cleaning operations, the separator pot is removed and a pump jumper is installed to transfer from the pot to the drop tank. The lift lines, constructed of 304L stainless steel, are 2 inches in diameter and have a ¾-inch steam line supplying the lifts. Motive force flow (steam or air) to the lifts is through a gang valve assembly. While steam is normally used as the motive force, plant air can also be used to lift waste out of the evaporator. A flow control valve is used to control steam flow to the lift, thereby, controlling the rate at which waste is lifted out of the evaporator. A hydrolance may be used to clean the lift lines.
• De-Entrainment Column — The de-entrainment column removes suspended liquid and solid particles from the vapor produced by the boiling action of the tube bundle. Because there are no straight flow paths through the de-entrainment column, moisture-vapor mixtures change directions frequently, causing the moisture to separate from the vapor.

The de-entrainment column contains a stainless steel mesh agglomerator pad. The pad is constructed of sheets of grid material. When the vapor-moisture mixture rises and impinges upon the agglomerator, moisture is separated and the heavier moisture drains back to the vessel while the lighter vapor continues to rise through the demister pad. The demister pad is constructed of stainless steel. Spray rings, supplied by the Flush Water System, are located above the demister and below the agglomerator pad for salt removal.

• Lance Lines — The evaporator vessel has penetrations through which steam sparging lines (lances) are installed. Steam is supplied through a limiting orifice and through the lower lance to sparge the vessel contents. Steam is normally supplied to the lance at all times during evaporator operation to help agitate the pot and minimize sedimentation. The lower lance follows the contour of the cone-shaped section and terminates near the bottom of the vessel. Steam is supplied to the lance through a gang valve assembly. Air may also be supplied by the gang valve assembly to provide sparging. The air flow is limited by orifices at the inlet of the gang valve and on the bypass line. During evaporator chemical cleaning operations, a larger air lance orifice is installed to facilitate mixing in the evaporator pot.

• Dip Tubes (2 sets of 4) — The dip tubes provide indication of evaporator pressure and the levels of waste and foam in the evaporator vessel. Evaporator dip tubes are air-bubbler type dip tubes. The pressure of air necessary to overcome the hydrostatic head of the liquid and allow air to escape from the submerged end of the tube is a measure of the weight of the waste column above the end of the tube. Instrument air is delivered to the dip tubes through variable pressure, constant flow, and flow indicating controllers. Instrument air is discussed further in Section 2.4.2.9. The automatic dip tube blowdown system provides instrument air or flush water to remove salt buildup from the dip tubes. Automatic dip tube blowdown is not performed when steam is supplied to the tube bundle.

Two sets of stainless steel dip tubes penetrate the evaporator vessel through two 3-inch instrument nozzles.

• Thermowells — Thermocouple(s) provide continuous indication of evaporator vessel temperature. Thermocouple(s) provide a signal to actuate the evaporator liquid high-temperature alarm and interlock to close the TCV. One thermowell is not in use.

• Seal Pot — The seal pot provides a water seal between the evaporator vessel and the environment when the chemical addition fill funnel isolation valve is opened. The inlet and outlet lines overlap, creating a water seal. Well water or chemicals are added to the evaporator through the seal pot. The chemical addition system is discussed in Section 2.4.2.9.
2.4.2.4 242-16H Overheads System

The overheads system consists of the overheads condenser, MRT, CRC feed tank, two CRC pumps, two overheads receiver tanks, two overheads receiver pumps, and associated alarms and interlocks. Following is a description of the overheads system.

- Overheads Condenser — The overheads condenser is a vertical, single-pass, counter-flow tube and shell type heat exchanger located in the overheads condenser cell. Vapor from the demister enters the top of the overheads condenser. Condensed overheads exit the bottom of the overheads condenser drain to the MRT. The overheads condenser rests on a stainless steel cell liner pan on a sloping floor. The tube side of the overheads condenser vents to the evaporator cell via the non-condensable vent line. Alarms and interlocks are associated with the overheads condenser vent temperature. Overheads condenser cooling water is supplied by the Cooling Tower Water System (see Section 2.8.2.5).

- Mercury Removal Tank — The MRT is a stainless steel tank that receives condensate from the overheads condenser. When full, the MRT overflows to the CRC feed tank, permitting the heavier mercury to settle out and remain in the MRT. The MRT vents to the overheads condenser cell, which vents and drains to the evaporator cell. Mercury is removed, periodically, by collecting mercury from the MRT at the Mercury Collection Station. The MRT drain line contains a 3-way valve used to align the MRT drain line to the Mercury Collection Station or to the overheads receiver tanks. The line also has a 1.5 liter sight glass (located at the end of the MRT drain line) to provide local indication of mercury quantity in the MRT and associated collection system.

- CRC Feed Tank — Though the CRC feed tank is no longer in use, the path from the evaporator vessel to the overheads receiver tanks still travels through the stainless steel CRC feed tank. Dip tubes are used to measure the tank level and a pneumatic controller is used to control the tank level. A conductivity probe actuates a high-high level alarm in the control room. One of the two CRC pumps is used to transfer overheads from the CRC feed tank to one of two overheads receiver tanks, located at ground level in the cell. The tank vents to the overheads condenser cell. The CRC feed tank can be bypassed to allow overheads to go straight to the overheads receiver tanks. During evaporator chemical cleaning operations, the CRC feed tank is isolated from the evaporator feed tank.

- Overheads Receiver Tanks — The overheads receiver tanks are constructed of stainless steel and are 6 feet in diameter by 6 feet in height, with a design temperature of 200°F and a pressure of 14.7 pounds per square inch, absolute. The tanks have a dip tube level measuring system, which provides a signal to actuate an overheads high level alarm. A 2-inch overheads receiver tank overflow line is routed to Tank 43 through a loop seal. During evaporator chemical cleaning operations, the overflow and drain lines to the evaporator feed tank are isolated.
The overheads receiver tanks are equipped with agitators, installed near the tank bottom, along with four equally spaced baffles installed around the tank circumference. The contents of the overheads receiver tanks are transferred to the ETP and are, periodically, sampled to ensure that they meet the ETP receipt limits. The overheads receiver tanks are vented into the overheads receiver cell Mercury Ventilation System.

2.4.2.5 242-16H Concentrate System

The concentrate, or bottoms, system includes two evaporator lifts (discussed in Section 2.4.2.3), a lift and vent jumper, Gravity Drain Lines (GDLs), and Backflush Valve (BFV). The vent jumper connects to one of the GDLs. The lift and vent jumper has inlet and outlet lines, a vent, and a separator pot.

The evaporator concentrate system includes the following:

- **Separator Pot/Lift Jumper** — Removes entrained steam from the concentrate and prevents siphoning of the evaporator. Vapors exit the separator pot through the top and enter the vent jumper. The concentrate exits the bottom of the separator pot and enters the GDL.

- **Clean Out Ports (COPs)** — COPs provide access for flushing or catheterization of the GDLs. COPs have conductivity probe leak detection. Any leakage within the COP is directed to a Leak Detection Box (LDB) or waste tank.

- **GDLs** — Jacketed pipe for transfer of bottoms (concentrate) to the concentrate (drop) tank. The jackets route any leakage to an LDB. The GDL jackets have stainless steel bellows type expansion joints where they drain to an LDB. A hydrolance may be used to clean the GDLs.

- **LDBs** — Provide for the collection and the detection of leakage from the GDLs. The LDBs have conductivity probe leak detection and drain and overflow plugs. The drain plug is normally installed to ensure that the leakage accumulates sufficiently to be detected. The overflow plug is normally removed. Drain piping for the LDBs is provided so leaks are diverted to locations (e.g., Diversion Box [DB] sump, LDB Drain Cell) and eventually to a waste tank. A conductivity probe located in the LDB has an alarm function.

- **BFV** — Enables flushing of the GDL. Includes a small port for the insertion of a catheter for cleaning out pluggage in the BFV. The BFV is pneumatically actuated, with the actuator mounted on the top of the riser outside of the drop or vent tank. The actuator rotates a plug, aligning the plug ports to provide a path from the evaporator to the tank, from the Flush Water System to the drop or vent tank, from the Flush Water System to the evaporator, and closed. The BFV can be operated manually if the actuator is out of service.

- **Area Radiation Monitors (ARMs)** — Monitor general area radiation levels. The monitors are typically gamma radiation detectors and provide audible and visual alarm indications (local and control room).
2.4-15

2.4.2.6 242-16H Steam and Condensate System

The steam and condensate system normally supplies steam to the lance and lifts; steam to the tube bundle, evaporator cell sump gang valve, cell sump jet, and flush tank water heater, and monitors and collects steam condensate.

- **Lance** — Steam enters via the lance gang valve. The lance gang valve low steam pressure alarm and lance gang valve low air pressure alarm sound in the control room. An orifice upstream of the gang valve limits the steam flow through the lance. The lance gang valve is discussed in Section 2.4.2.8.

- **Lift** — Steam enters through the lift control valve and the lift gang valve. The lift control valve is a pneumatic globe valve. Either a notch in the valve seat or a bypass orifice around the valve is installed to permit a small flow of steam downstream to keep the low pressure steam switch satisfied during no lift situations.

  The evaporator level controller controls the position of the lift control valve and lift rate of the waste out of the evaporator. In automatic mode, a decrease in the true level initiates a decrease in the instrument air signal to the lift control valve, causing the valve to move partially in the closed direction, admitting less steam to the lift, and thereby, decreasing the lift rate (the converse is also true). The level controller generates evaporator high liquid level and low liquid level alarms. The lift gang valve is addressed in Section 2.4.2.8.

- **Steam PCV/Pressure Relief Valve (PRV)** — A 150 psig PCV and PRV are located upstream of the tube bundle. These devices limit steam pressure and flow to the evaporator tube bundle and lance.

- **Tube Bundle** — Steam enters via an AIV and a TCV. From the tube bundle, steam/condensate passes through a back-pressure valve before entering the condensate system.

  A steam flow transmitter converts the dP across an installed orifice to steam flow and transmits the signal to the evaporator temperature controller and the chart recorder in the control room. In the automatic mode, the temperature controller compares the actual steam flow with the programmed setpoint and increases or decreases the output signal, as necessary, to maintain the desired steam flow through the TCV. In addition, the position of the TCV can be manually set to the desired position. The TCV closes on initiation of several interlocks.

  The AIV is operated from a panel at the evaporator building. The AIV closes under several interlock conditions and will not re-open until the interlock conditions are cleared. Additionally, the AIV and associated interlocks may be configured to allow manual operation of the valve without remote or automatic actuation.

- **Evaporator Cell Sump Jet** — Steam enters via a gang valve and transfers the contents of the sump to the evaporator feed tank. The sump jet gang valve is addressed in Section 2.4.2.8.

- **Cell Sump Jet** — Steam enters the jet and transfers the contents of the sump to overheads receiver tanks.
• **Flushwater Tank Heater** — Consists of a vertical pipe inserted into the flush water tank. Steam delivered to the pipe allows the tank contents to be heated.

• **Condensate System** — Consists of a condensate flash tank, condensate level chamber, steam traps, and a condensate radiation monitor. The vented condensate level chamber maintains a water seal between the tube bundle and the flash tank. The flash tank has dip-tube level monitoring with an associated control room alarm and an interlock for flash tank high and low levels. The condensate radiation monitor provides a signal to a chart recorder in the control room and actuates a high level alarm/interlock and a monitor trouble alarm. If radiation is not detected, condensate from the evaporator is directed to the H-Canyon Segregated Water System or ETP for monitoring and release. Otherwise, condensate is directed back to the evaporator feed tank via the condensate diversion valve.

### 2.4.2.7 242-16H Ventilation System

The evaporator building ventilation system maintains a negative pressure on the overheads condenser and evaporator cells to provide cooling, remove flammable gases, and prevent the spread of contamination through joints in the cell covers to the outside environment (see Figure 2.4-8). The evaporator exhaust blower draws outside air through the overheads condenser cell HEPA filter assembly and through the opening between the cells into the evaporator cell.

Each of the two exhaust filter assembly contains a pre-filter and HEPA filter contained within a single housing with isolation dampers and a test connection. Air is drawn through the filter assemblies by a single exhaust fan. Differential pressure gages and a pressure switch on the exhaust filter assemblies provide local indication and a control room alarm for evaporator cell exhaust filter high dP. A CAM provides indication to the control room and actuates an alarm when the radioactivity level of the discharged air is high.

The overheads receiver cell Mercury Ventilation System removes mercury vapor from the Mercury Collection Station, overheads sample location, and overheads receiver tank vents. The mercury vapor is removed at the sources by the fume collection hoods and exhaust ducts through the exhaust stack via a blower venting to atmosphere.

### 2.4.2.8 242-16H Gang Valves

Electro-pneumatic gang valves are used to remotely operate the evaporator lift, steam lance, and cell sump jet. Gang valves are used to admit steam and air in the proper sequence to prevent contaminated process fluid from entering the steam piping and are used on all steam lines that have an opening that may come in contact with waste. The gang valve includes four pneumatically controlled valves arranged on a manifold so that the steam, air, and vent valves are in parallel and are also in series with the jet valve, as shown in Figure 2.4-9. For each of the gang valves, a three-way solenoid valve admits air to open or close the valves. The steam and air valves are instrument air-opened, spring closed; the jet and vent valves are spring-opened, air-closed.

2.4-16
2.4.2.9 242-16H Support Systems

- **Plant and Instrument Air Systems** — Plant and instrument air is provided by compressors in the Tank Farms. Section 2.8.2.2 provides a general discussion of the CSTF air distribution system.

  Plant air is provided for the following:
  - The evaporator cell sump, lift, and lance gang valves
  - Maintain pressure in the tube bundle
  - The overheads receiver tanks sample system

  Instrument air is provided to operate the following:
  - Evaporator vessel instrumentation
  - Evaporator steam isolation valves
  - Feed control operator and feed pump flush water valve
  - dP instrumentation for the de-entrainment column
  - CRC feed tank instrumentation
  - Overheads receiver tank instrumentation, tank, and pump selector valves
  - Overheads diversion valve
  - Evaporator and overheads receiver cell sump instrumentation
  - Back-flush valve
  - Flash tank instrumentation
  - Condensate radiation monitor diversion valve
  - Lift gang valve steam control valve
  - Lift, lance, sump, and gang valve control instruments

- **Chemical Addition System** — Components include an antifoam mixing tank, an antifoam tank agitator, an antifoam circulating pump for transferring the solution from the mixing tank to the well water fill line to the evaporator vessel, and a flowmeter. The well water fill line consists of a well water line, a funnel, an isolation valve, and a seal pot. The seal pot penetrates the evaporator vessel. Refer to Section 2.4.2.3 for a description of the seal pot. The seal pot is also depicted in Figure 2.4-7.

- **Flush Water and Well Water Systems** — Flush water is provided to the evaporator systems from a nominal 1,000-gallon tank. The tank has instruments that provide level indication in the control room. Automatic makeup capability for the flush water tank has been removed, limiting the amount of flush water that can be transferred without operator intervention. Domestic water can be used as an alternate makeup source for the Flush Water System on a temporary basis as permitted in Reference 6. Well water provides fill for the flush water tank as well as makeup water to the
evaporator vessel and water to the antifoam tank. Flush water is provided for the following:
- Feed pump priming and flushing
- Evaporator vessel dip tubes
- GDLs and vent line
- De-entrainment column spray rings
- Lance, lift, and sump gang valves
- Evaporator cell spray
- Condensate flash tank

- Chemical Cleaning Equipment — In addition to equipment already described, periodic performance of evaporator chemical cleaning may utilize the following equipment (see Figure 2.4-16):
  - Transport vehicles (tanker trucks and tote vehicles) to transport nitric acid and caustic solution
  - Nitric acid/caustic addition line consisting of flexible piping, hard piping, and acid/caustic addition pump (piped to the well water addition line)
  - Air lance orifice sized specifically for chemical cleaning, to facilitate agitation of the evaporator contents
  - Pump jumper from evaporator to evaporator drop tank, with double valve isolation
  - Air driven pump
  - Downcomer below surface of waste in evaporator drop tank, to minimize splashing of waste in the riser

2.4.3 242-25H EVAPORATOR

The 242-25H Evaporator has the same function and many of the same features as the 242-16H Evaporator. The major difference is the capacity, or size, of the vessel. The following paragraphs address the 242-25H Evaporator in terms of similarities and differences.

2.4.3.1 242-25H Evaporator Building

The 242-25H Evaporator building arrangement consists of an Enclosure Building (commonly referred to as the Service Building) that encompasses the evaporator cell, the overheads condenser cell, the overheads receiver cell, the GDL cell, truck bay, and four service floors. The evaporator cell, overheads condenser cell, and overheads receiver cell are arranged similarly to the 242-16H cells in that the overheads condenser cell is above the overheads receiver cell. The 242-25H GDL cell occupies the space north of and on the same level as the overheads condenser cell. The Primary Ventilation System (PVS) fans and HEPA filters are housed in the HEPA Filter Building.
The Service Building is of structural steel construction, supports the overhead crane, provides platforms and stairs for access to the four floors of the Service Building, and contains support systems.

The stainless steel lined evaporator cell is 20 feet by 27.5 feet by 32 feet high with 3.5 feet thick walls, and a segmented cell cover. The floor of the evaporator cell slopes to a 2 feet 2 inches by 3 feet by 2 feet deep sump, which has a conductivity probe, a bubble dip tube, and sump jet. Liquid from the sump is jetted to the evaporator feed tank. The cell floor under the liner is slotted and slopes towards an underliner sump.

The stainless steel lined overheads condenser cell is 10 feet 9 inches by 18 feet 10 inches with 18 feet high walls with a single cell cover. The liner covers the floor and the walls up to the height of the curb. The floor is sloped towards a gutter and a sump. The sump drain is connected to an embedded pipe, which drains to the evaporator cell sump.

The stainless steel lined overheads receiver cell is 25 feet by 24 feet with 23 feet high walls on three sides. The fourth side is open to the first level of the Service Building, with a concrete curb separating the overheads receiver cell from the first level. The liner covers the floor of the cell up to the height of 2 feet on three walls and up to the height of the 14-inch curb on the fourth side. The floor slopes towards a gutter and sump. The sump has a conductivity probe, a bubbler dip tube, and electric sump pump. The floor drains from the second and third floors of the Service Building drain to this sump.

The GDL cell is 9 feet 6.25 inches by 24 feet with 17 feet 1 inch high walls with a cell cover. The cell houses the GDLs, which exit the west side of the building. The jacketed GDLs pass through a sleeved penetration, with the space between the jacket and penetration packed with mineral fiber as an expansion-absorbing cushion.

The first floor of the Service Building houses the chemical addition pump and tanks, the plant air reducing station, the 150 psig steam reducing station, the AIVs, tube bundle flow control valve, and building sump. The second floor houses the flush water heater, flash tank and flash tank drain pumps, the flush water pumps, the condensate control pot, and the gamma monitor pot. The third floor houses the evaporator vessel instrumentation, the anti-foam mix tank and pump, the lift, lance, and evaporator sump gang valve stations, and the 25 psig steam control station. The secondary ventilation HEPA filters and flush water tank are located on the fourth floor.

2.4.3.2 242-25H Feed System

The feed system functions much the same as the 242-16H feed system but differs in the type feed pump and means of feed flow control. The feed pump is a long-shaft, closed impeller centrifugal pump (illustrated in Figure 2.4-10). The feed pump motor is controlled by one of two Variable Frequency Drives (VFDs). The lower seal is cooled with pressurized water from the Bearing Water System. A thermocouple element, installed on the bearing inside the spray can above the upper pump column seal, monitors feed pump thrust bearing temperature. A vibration transmitter, located on the motor stand, provides feed pump vibration indication. A high vibration alarm is associated with the instrument. Conductivity probes inside the feed pump shielding containment have DCS alarms that activate when liquid is detected in the riser.
containment is fabricated from a stainless steel plate filled with lead. A lead filled stainless steel split collar provides shielding at the top of the containment.

Waste is transported via a jacketed feed line through a feed mass flowmeter to the evaporator vessel. The core pipe is Alloy G-30, and connects to an existing 304L core pipe at the tank. The jacketed pipe contains an LDB and a Leak Probe Sleeve (LPS). A conductivity probe inside the feed line LDB and LPS generate an alarm in the control room. The LDB drains to the evaporator cell sump in the event of a leak in the core pipe.

The feed pump is remotely operated but also has a local stop button. In addition, an electrical disconnect at the tank provides an independent backup means of stopping the flow of waste. There are several interlocks associated with the feed pump that will cause it to shutdown.

2.4.3.3 242-25H Evaporator Vessel/Pot

The 242-25H Evaporator vessel is configured much like the 242-16H vessel, but is larger. The vessel has a capacity of 18,607 gallons. The insulated vessel is 14 feet in diameter and approximately 26.5 feet tall. The vessel is constructed of Alloy G-3 and varies in thickness from 5/16 inch to 9/16 inch. Four pedestals mounted on the floor of the evaporator cell and two trunion guides provide lateral seismic support for the vessel.

Refer to Figure 2.4-7, which depicts the general arrangement of the 242-16H and 242-25H Evaporators with sketches of the major configuration differences captioned adjacent to the component. Evaporator vessel service/equipment lines installed in, or penetrating, the vessel are constructed of Alloy G-3 and are similar to the 242-16H Evaporator service/equipment lines. Following is a description of the evaporator vessel:

- Steam Tube Bundle — The steam tube bundle functions in the same manner as the 242-16H Evaporator tube bundle. The tube bundle has 648 curved tubes, approximately 12.5 feet long with a ¾ inch OD and average wall thickness of 0.1455 inch, welded to 2-inch thick tube sheets. The tube bundle has a design temperature and pressure of 325 psig and 425°F. A mid-span tube sheet is provided for support and is designed to move radially with respect to the tubes for descaling. Flow from the condensate chest through the vent line, depicted in Figure 2.4-7, is controlled by DCS. Condensate exiting the bottom of the condensate chest flows through the Tube Bundle Exit Valve before entering the Condensate Controller Pot. Steam supply components to the tube bundle are discussed in Section 2.4.3.6.

- Warming Coil — The warming coil pressure boundary integrity has been visually confirmed as failed. The steam supply piping to, and condensate return piping from, the warming coil have been cut and capped just outside of their respective evaporator cell wall piping penetrations.

- Lift Lines — The 242-25H lifts function in the same manner as the 242-16H Evaporator lifts. The evaporator has two installed lift lines that can be used to lift (transfer) the concentrated waste (bottoms) from the evaporator through the concentrate outlet to separator pot. The waste exits the bottom of the separator pot and gravity drains to the concentrate receipt (drop) tank. The separator pot has a vent
at the top to allow the lift steam to exit to the vent tank. The vent also serves as an alternative path for the lift separator to empty the pot contents in case of line pluggage. The lift lines are 3 inches in diameter and have a 2-inch steam line supplying the lifts. Only one lift at a time is in active use. Motive force flow (steam or air) to the lifts is through a gang valve assembly. While steam is normally used as the motive force, plant air can also be used to lift waste out of the evaporator. Air can be supplied to the gang valve through flow limiting orifices. Steam flow is varied to the gang valve via a flow control valve.

- **De-Entrainment Column** — The 242-25H de-entrainment column functions in the same manner as the 242-16H Evaporator de-entrainment column. It includes a convex splash plate, to divert large drops of water thrown into the vapor space by waste boiling, and a demister pad. The demister pad is constructed of three stainless steel mesh pads. The demister has upper and lower spray rings for salt removal. The DCS provides alarms and interlocks for high demister dP. The demister is designed to provide a decontamination factor for overheads in order to meet ETP receipt requirements.

- **Lance Line** — The 242-25H lance functions and operates in the same manner as the 242-16H Evaporator lower lances. The lance bends to follow the contour of the cone-shaped section and terminates near the bottom of the vessel. Steam is supplied to the lance through a gang valve assembly. Air may also be supplied by the gang valve assembly to provide sparging. The air flow is limited by orifices at the inlet of the gang valve and on the bypass line.

- **Dip Tubes (2 sets of 4)** — The 242-25H Evaporator has a fully redundant dip tube system (i.e., dual indication and alarms, as applicable for pressure, liquid level, foam level, and specific gravity). The 242-25H dip tubes function and operate in the same manner as the 242-16H Evaporator dip tubes. See Section 2.4.2.3 for a full description of evaporator vessel dip tubes.

- **Thermowells (2)** — Each thermowell has three Resistance Temperature Detectors. One is located in the vapor space. Three temperature indicating transmitters provide input to the DCS, which generates a high temperature alarm and interlocks steam to the tube bundle if the temperature reaches the appropriate setpoint.

- **Seal Pot** — The 242-25H seal pot functions and operates in the same manner as the 242-16H Evaporator seal pot. The inlet and outlet lines overlap, creating a water seal. Flush water or chemicals are added to the evaporator through the seal pot.

### 2.4.3.4 242-25H Overheads System

The 242-25H overheads system consists of the overheads condenser, MRT/collection station, overheads receiver tanks and pumps, and overheads sample station. Following is a description of the overheads system:

- **Overheads Condenser** — The 242-25H overheads condenser functions and operates in the same manner as the 242-16H Evaporator overheads condenser. It is a vertical, single-pass, counter-flow tube and shell type heat exchanger located in the overheads
condenser cell. Vapor from the demister enters the overheads condenser. The tube side of the overheads condenser vents to the evaporator cell. Condensed overheads exit the bottom of the overheads condenser and drain to the MRT. Overheads condenser cooling water is supplied by one of two dedicated cooling tower package units. Alarms and interlocks are associated with the overheads condenser vent temperature.

- **Mercury Removal Tank** — The 242-25H MRT is a stainless steel tank that receives condensate from the overheads condenser. The MRT is vented, and when full, overflows to one of two overheads receiver tanks. Mercury is removed, periodically, by collecting mercury from the removal tank at the Mercury Collection Station. The MRT includes a radiation monitor to detect activity in the overheads. Diversion capability to the feed tank exists if high activity of the overheads is detected.

- **Overheads Receiver Tanks** — The sloped-bottom overheads receiver tanks are constructed of stainless steel and are 8 feet in diameter by 9 feet in height. Overheads receiver tank vents are directed into the Secondary Ventilation System (SVS) air stream. The tanks have a dip tube level measuring system and an overflow line to the cell sump through a loop seal normally filled with flush water to prevent the tanks from ventilating via the sump and bypassing the normal tank vent route. Overheads can be sampled at the overheads sampling station using a sample jet (supplied by plant air), or at an alternate location near the pump discharge. The contents of the overheads receiver tanks are transferred to the ETP. The contents are periodically sampled to ensure that they meet ETP receipt limits. Overheads receiver tanks contents can also be transferred back to the evaporator feed tank.

The overheads receiver tanks have alarms and interlocks associated with the level system.

### 2.4.3.5 242-25H Concentrate System

The concentrate system includes a steam lift nozzle, separator pot/lift and vent jumper, GDLs, a BFV, dip tubes, COPs, LDBs, and radiation monitoring equipment. Following is a description of these components:

- **Steam Lift Nozzle** — A 3-inch nozzle connected to the separator pot with a jumper.
- **Vent Jumpers** — A 3-inch jumper connects the separator pot to the vent line. The vent line routes the entrained steam to the vent tank from the separator pot.
- **Separator Pot/Lift Jumper** — Removes entrained steam from the concentrate and prevents siphoning of the evaporator. Vapors exit the separator pot through the top and enter the vent jumper. The concentrate exits the bottom of the separator pot and enters the GDL.
- **GDLs** — Jacketed pipe for transfer of concentrate to the drop tank. The jackets route any leakage to an LDB. The GDL jackets have stainless steel bellows type expansion joints where they pass through the LDBs.
• COPs — COPs provide access for flushing or catheterization of the GDLs. COPs have conductivity probe leak detection. Any leakage within the COP is drained to an LDB or waste tank.

• LDBs — Provide for collection and detection of leakage from the GDLs. The LDBs have conductivity probe leak detection and drain and overflow plugs. The drain plug is normally installed to ensure that leakage accumulates sufficiently to be detected. The overflow plug is normally removed. Drain piping for the LDBs is provided so that leaks are diverted to the evaporator cell sump. A conductivity probe and associated instrumentation have control room alarm and interlock functions.

• LPSs — Provide for the collection and detection of leakage from some of the GDLs. LPSs are equipment remaining from the retirement of the old CTS. LPSs do not have drain and overflow plugs and the signal from the conductivity probe within the LPS actuates a control room alarm.

• BFV — Enables flushing of the GDLs. Includes a small port for the insertion of a catheter for cleaning out pluggage in the BFV. The BFV is pneumatically actuated, with the actuator mounted on the top of the riser outside of the drop or vent tank. The actuator rotates a plug, aligning the plug ports to provide a path from the evaporator to the drop or vent tank, from the Flush Water System to the tank, from the Flush Water System to the evaporator, and closed. The BFV can be operated manually if the actuator is out of service. There is no BFV on the Tank 32 vent line.

• Dip Tubes — Installed in, and monitors, salt buildup in the concentrate receipt tank riser. The dip tubes and associated instrumentation have control room alarm functions.

• ARMs — Monitors general area radiation levels. The monitors are gamma radiation detectors and provide audible and visual control room alarm indication; some have interlock functions.

2.4.3.6 242-25H Steam and Condensate System

The 242-25H Evaporator steam and condensate system supplies steam and collects steam condensate. Steam is supplied to the lance and lift, to the evaporator cell sump gang valve, flush water heater, unit heaters, and to the tube bundle. Steam pressure is reduced from a nominal 385 psig supply to 325 psig, from 325 psig to 150 psig, and from 150 psig to 25 psig, through a series of dedicated steam reducing stations. Isolation valves, PCVs, PRVs, bypass/warm-up valves, steam traps, strainers, and drains are installed at each steam reducing station.

Two valves in series are provided to automatically shutoff all steam flow to the 242-25H Evaporator facility during abnormal operating conditions. The valves utilize three-way solenoid valves for air opening and spring closure. The valves are hard-wire interlocked to close on high vessel pressure, or on high overheads condenser vent temperature.

• Lance — Steam enters via the lance gang valve. The lance gang valve low steam pressure alarm and lance gang valve low air pressure alarm sound in the control room. Steam pressure and flow is limited to the lance gang valve via the 25 psig
steam PCV and PRV. The steam flow is further limited by an orifice on the discharge of the gang valve supplying the lance. The lance gang valve is discussed in Sections 2.4.2.8 and 2.4.3.8.

- Lift — Steam enters through the lift control valve and the lift gang valve. The lift control valve is a pneumatic globe valve. Either a notch in the valve seat or a bypass orifice around the valve is installed to permit a small flow of steam downstream to keep the low pressure steam switch satisfied during no lift situations.

The evaporator level control system controls the position of the lift control valve and lift rate of the waste out of the evaporator. In automatic mode, a decrease in the true level initiates a decrease in the instrument air signal to the lift control valve, causing the valve to move partially in the closed direction, admitting less steam to the lift, and thereby, decreasing the lift rate (the converse is also true). The lift gang valve is discussed in Sections 2.4.2.8 and 2.4.3.8.

- Tube Bundle — Steam enters through a flow control valve. The valve utilizes a three-way solenoid valve for air opening and spring closing. Condensate exiting the bottom of the condensate chest flows through the tube bundle exit valve before entering the condensate controller pot. The tube bundle exit valve is opened by instrument air and is spring closed. Air is supplied to the tube bundle in the event pressure cannot be maintained.

A positioner modulates the steam flow based on a signal from the DCS via the flow element/controller. The steam supply valves and the tube bundle discharge valve close in response to several interlocks.

- Evaporator Cell Sump Jet — Steam enters via gang valve and transfers the contents of the sump to the evaporator feed tank. The sump jet gang valve is discussed in Sections 2.4.2.8 and 2.4.3.8.

- Flushwater Heater — Steam is directly injected into a chamber in the heater. Steam flow is automatically controlled to maintain flushwater at the required temperature. Condensate is directed to storm drains.

- Unit Heaters — Steam supplied to the unit heaters is controlled with a thermostat located near the heater. The unit heaters provide heating to the evaporator building.

- Condensate System — Consists of a condensate controller pot, flash tank, flash tank drain pumps, gamma monitor pot (monitor no longer in service), and steam traps and drains. An air-operated level control valve regulates the flow out of the condensate controller pot. A process vent sub-system is provided between the tube bundle endbell and condensate controller pot to vent non-condensable gases from the endbell during startup, and as necessary. A second vent line with a flow limiting orifice is provided from the top of the condensate controller pot to the flash tank.

The flash tank drain pumps are automatically controlled to maintain a liquid level in the flash tank. The condensate is normally directed to the segregated water system or ETP through an air-operated control valve but may be directed to the overheads receiver tanks or evaporator feed tank.

2.4-24
2.4.3.7 242-25H Ventilation System

The ventilation system includes a PVS and a SVS. These ventilation systems are illustrated in Figures 2.4-11 and 2.4-12. The PVS and SVS are once-through pull type air systems, drawing in outside air, distributing the air throughout the ventilated areas, collecting exhaust air through a ductwork system, directing exhaust air through HEPA filter banks, and then discharging the filtered exhaust air to the atmosphere through separate CAM discharge stacks. Humidity is controlled in the PVS with steam heating coils to prevent moisture loading of the HEPA filters. Multiple alarms are actuated for the following:

- High humidity
- High and low temperatures
- High and low dP across the HEPA filters and pre-filters
- Low exhaust and CAM fan flow rates

Only the most significant are discussed individually.

The PVS system serves the evaporator cell and overheads condenser cell. The PVS has an inlet HEPA filter unit, an air exhaust duct connected to two redundant banks of outlet HEPA filter units, two redundant centrifugal exhaust fans, and an air discharge stack. The inlet HEPA filter unit is located in the overheads condenser cell and the outlet HEPA filter unit and exhaust fans are located in the HEPA Filter Building. The exhaust fans are controlled with VFDs through a DCS. The HEPA filter units contain balancing dampers to maintain the pressure differential between the evaporator and overheads condenser cells, and between the evaporator cell and atmosphere. An alarm is actuated when the dP between the evaporator cell and the atmosphere drops below the setpoint; an interlock switches from the on-line filter and fan train to the standby train when the evaporator cell exhaust vacuum drops below the setpoint. This interlock is also actuated when HEPA filter dP increases above the setpoint, when the pre-filter dP increases above the setpoint, when the exhaust stack CAM detects activity above the setpoint, or when the exhaust duct discharge dampers are closed.

The SVS includes a majority of the same components as the PVS, however, it has a third bank of HEPA filter housings, which is in standby. Two individual air conditioning units are provided for the electrical equipment rooms and are considered part of the SVS. The SVS serves the Enclosure (Service) Building and the overheads receiver and evaporator cells when the cell covers have been removed. An interlock switches from the on-line fan to the standby fan when exhaust stack flow rate drops below the setpoint, when the discharge dampers are closed, or when the VFD run signal is lost. Both fans are interlocked off if the exhaust stack CAM detects activity above the setpoint or if the PVS system is interlocked off. Switching of the SVS HEPA filter trains requires operator action depending on the alarm/indication received.

2.4.3.8 242-25H Gang Valves

Electro-pneumatic gang valves are used to remotely operate the evaporator lift, steam lance, and evaporator cell sump jet. Refer to Section 2.4.2.8, for a description of gang valves.
2.4.3.9 242-25H Support Systems

- Plant and Instrument Air Systems — Plant and instrument air is provided by compressors in the Tank Farms. Section 2.8.2.2 provides a general discussion of the CSTF air distribution system.

  Plant air is provided for the following:
  - Evaporator cell sump, lift, and lance gang valves
  - Maintain pressure in the tube bundle
  - Overheads receiver tanks sample system

  Instrument air is provided to operate the following:
  - Evaporator vessel instrumentation
  - Evaporator steam isolation valves
  - Lift gang valve flow control valve
  - dP instrumentation for the de-entrainment column
  - Overheads receiver tank instrumentation, tank, and pump selector valves
  - Overheads diversion valve
  - Evaporator and overheads receiver cell sump instrumentation
  - Back-flush valve
  - Flash tank instrumentation
  - Gamma monitor pot diversion valve
  - Lift, lance, sump, and gang valve control instruments

- Chemical Addition System — This system is comprised of two subsystems. One subsystem includes an antifoam mixing tank, with an agitator and a metering pump for transferring the antifoam solution from the mixing tank to the seal pot and into the evaporator. The seal pot penetrates the evaporator vessel, as shown in Figure 2.4-7. The other subsystem includes a chemical addition tank, with an agitator and an addition pump for transferring chemicals to the demister spray, evaporator pot, evaporator nozzles and cell, overheads receiver tank, and evaporator feed line. Flush water is used to mix and deliver chemicals.

- Cooling Tower Water System — Two closed-loop, forced draft cooling towers provide cooling water for the overheads condenser. The system includes three pumps and chemical addition capabilities. One tower is sufficient to provide cooling capacity to the overheads condenser. Makeup water for the cooling tower is provided by domestic water, with backup from well water.

- Flush Water and Well Water Systems — Flush water is provided to the evaporator systems. The flush water tank level is monitored by DCS and is filled in the control room, when required. Automatic makeup capability for the flush water tank has been removed, limiting the amount of flush water that can be transferred without operator
intervention. Domestic water can be used as an alternate makeup source for the Flush Water System on a temporary basis as permitted in Reference 6. Well water provides fill for the flush water tank. Refer to Section 2.8.2.3 and 2.8.2.4 for a description of the Well and Flush Water Systems. Flush water is provided for the following:

- Feed line flushing
- Evaporator vessel dip tubes
- Demister sprays
- Lance, lift, and sump gang valves
- Seal pot/evaporator pot
- Evaporator cell sprays
- GDLs and vent line
- Overheads receiver tanks
- MRT
- Overheads receiver cell sump pump
- Condensate flash tank
- Hose stations
- Antifoam tank

2.4.4 TRANSFER FACILITIES

Waste from other facilities (e.g., the Canyons, Savannah River National Laboratory [SRNL], DWPF, and ETP) is received into the Tank Farms and transferred between facilities via the components described below.

2.4.4.1 Transfer Lines

Waste transfer lines are typically constructed of a stainless or carbon steel primary core pipe and are normally located below ground. Those lines that are above, or near, the surface are shielded to minimize radiation exposure to personnel. Most primary transfer lines have secondary containments of some type. The majority of primary transfer lines are surrounded by another pipe (jacket) constructed of carbon steel, stainless steel, or cement-asbestos. These jackets typically drain to LDBs, Modified Leak Detection Boxes (MLDBs), LPSs, or to another primary/secondary containment (e.g., a waste tank), which are described in other sections. A few primary transfer lines are located inside a covered, concrete encasement.

Waste transfer lines are typically sloped to be self-draining and, where a pipe transitions from one size to another, the bottom of the pipe is generally aligned to prevent a weir effect which would prevent waste from draining to the intended tank. The line segments are from a few feet in length to nearly 9,000 feet and are supported using rod or disk type core pipe spacers, core pipe supports, jacket supports, jacket guides, or other approved methods. Typically, core pipe
The following types of transfer lines exist in the Tank Farms [Core pipe not fitting one of these types (e.g., flexible hose) may be used as a transfer line for approved evolutions]:

- **Type I** — The core pipe is constructed of stainless steel, which is enclosed in a covered reinforced concrete encasement below ground (e.g., transfer lines from HDB-1 to Tanks 9, 10, 11, 13, 14, 15, and HDB-2). Leakage from the core pipe into the encasement and in-leakage of ground water into the encasement gravity drain to the catch tank. The catch tank is described below.

- **Type II** — The core pipe is stainless steel inside a carbon steel jacket. Pipe joints are typically welded and leak tested. Most jackets are encased in insulation. The portion of the carbon steel pipe in contact with the soil is protected against corrosion with polyethylene film wrap or bituminous coating. Type II transfer lines are the most common type of transfer lines in use. The longest line segment, nearly 9,000 feet, is from Tank 50 to the Saltstone Facility. The Inter-Area Line (IAL) is nearly 4,300 feet long from F-Area Diversion Box (FDB) FDB-2 to the High Point Flush Pit, and over 6,300 feet from H-Area Pump Pit (HPP) HPP-7 to the High Point Flush Pit.

- **Type IIA** — Type IIA lines are similar to Type II except that typically both core pipe and jacket are of carbon steel. This type of line is only used in HTF at Tanks 10 and 11 transfer jets.

- **Type III** — The core pipe is stainless steel within a cement-asbestos secondary containment, with rubber seals in the joints between the sections of cement-asbestos. In FTF, Type III lines are still in use between FDB-3 and Tank 34. In HTF, Type III lines are either out-of-service or abandoned in place.

- **Type IIIA** — Type IIIA lines are the same as Type III lines, except the line is made of carbon steel and includes some special end seals and transition pieces. These lines are either out-of-service or abandoned in place.

- **Type IV** — Type IV lines are similar to Type II except that both the core pipe and jacket are of stainless steel. This type of line is used for the GDLs for the 242-16H Evaporator as well as the 242-25H Evaporator inside the cell. Beyond the cell wall, the GDLs transition into Type II transfer lines.

- **Type V** — A Type V transfer line consists of an exposed stainless steel transfer line. Some Type V lines are encased in polyethylene radiation containment. These transfer lines are used within the processing facilities to interconnect pieces of process equipment. These lines are either out-of-service or abandoned in place.

- **Type VI** — Type VI transfer lines are designed to transfer evaporator overheads to and from the CRC. These lines do not have secondary containment because the evaporator overheads do not contain sufficient amounts of contaminants. These lines are either out-of-service or abandoned in place.

- A flexible hose-in-hose transfer line is a double hose system used to convey radioactive waste. Typically, this transfer line is designed as a temporary transfer
path, routed above ground, covered by temporary shielding, and used in lieu of permanently installed transfer lines. The flexible hose-in-hose transfer line main components typically include a primary hose for the material to be transferred, an encasement hose to contain potential leakage, and end connections to interconnect process equipment. Depending on the particular application, the flexible hose-in-hose transfer line may also include such features as heat trace for freeze protection, leak detection capabilities, shielding for dose rate reduction, and additional insulation. The above-ground flexible hose-in-hose transfer line is restrained, barricaded and shielded as appropriate for the material being transferred.

As discussed above, transfer line secondary containments (jackets or encasements) typically drain to LDBs, MLDBs, LPSs, or to another primary/secondary containment, such as a catch tank, drain cell, or waste tank:

- **Catch Tank** — There is a single catch tank in each Tank Farm designed to collect drainage from FDB-1, HDB-1 (FDB-1 and HDB-1 are no longer in active service [considered inactive locations with respect to waste processing or waste transfers] and the drain line from HDB-1 to the H-Area Catch Tank has been plugged), and certain transfer line encasements. The stainless steel tank is approximately 11,700 gallons and is located in an underground reinforced concrete cell and includes level instrumentation. The cell has level indication for the detection of leakage. Leakage into the H-Area Catch Tank cell sump is jetted to the catch tank via the tank jet suction line. Leakage into the F-Area Catch Tank cell sump is jetted to FDB-1 where it gravity drains back into the catch tank via the FDB-1 sump drain. However, the F-Area Catch Tank is considered an inactive location with respect to waste processing or waste transfers.

- **LDB Drain Cell** — The 4,700-gallon LDB Drain Cell collects leakage from LDBs, VBs, and gang valve vents associated with Tanks 48, 49, 50, and 51. Leakage into the drain cell can be emptied by pumping the contents to a drum or jetted to Tank 48 (waste transfers into Tank 48 currently prohibited as discussed in Chapter 18).

- **LDBs** — LDBs provide for the collection and detection of leakage from the transfer line. The LDBs have conductivity probe leak detection and drain and overflow plugs. The drain plug is normally installed to ensure that leakage accumulates sufficiently to be detected. The overflow plug is normally removed. Drain piping for the LDBs is provided so that leaks are diverted to the evaporator cell sump, or to a DB, Pump Pit (PP), or drain cell. Some LDBs have the drain and overflow piping permanently plugged. Liquid from the plugged LDBs is pumped to an adjacent tank, PP, VB or a drum after sampling the contents. A conductivity probe and associated instrumentation located in the LDB have control room alarm and some setups include interlock functions.

- **MLDBs** — MLDBs serve the same purpose as the LDBs but are larger and are installed at low points that cannot be gravity drained to a collection point. In addition to a conductivity probe and the associated control room alarm, MLDBs also include a vent line to a DB or PP, an above ground pressure gage to monitor for potential
over-pressurization, and a smear/cleanout pipe for measuring level and manual pump-out of leakage into the box.

- LPSs — LPSs provide for the collection and detection of leakage from the transfer line. LPSs are equipment remaining from the retirement of the old evaporator CTS. LPSs do not have drain and overflow plugs; LPS conductivity probes actuate a control room alarm.

- LPDT — The LPDT is located in the transfer path approximately half way between Tank 50 and the Saltstone Facility. The 7,500-gallon capacity of this tank is large enough to accept the contents of the entire H/Z inter-area transfer line. The jackets surrounding the inter-area core transfer pipe can be drained to the LPDT. The tank also contains an agitator to mix the contents of the tank and a transfer pump to transfer the contents of the LPDT into the transfer line. The concrete pit containing the LPDT is sloped at the bottom to provide a sump area where liquid from a tank overflow or leakage is collected.

2.4.4.2 Diversion Boxes

DBs, depicted with PPs and pump tanks in Figure 2.4-13, are shielded reinforced concrete structures containing transfer line nozzles to which jumpers are connected in order to direct waste transfers to the desired location. See Figures 2.3-2 and 2.3-3 for locations of the DBs relative to other tank farm components. The majority of the DBs are located below ground and are either stainless steel lined or sealed with water proofing compounds to prevent ground contamination. Walls are approximately 2 to 3 feet thick and sloped floors are approximately 3 feet thick. DBs have concrete slab-type cell covers, approximately 2 to 3 feet thick that must be removed for changing jumper alignment. Where specific transfers are conducted, valves and associated jumpers may be installed to minimize the need for frequent jumper changes. Jumpers are specially fabricated stainless steel pipe segments, with Hanford connectors for connecting to DB nozzles and are designed to complete a specific transfer route.

The High Point Flush Pit, located between FTF and HTF provides a point to introduce flush water into the IAL between the Tank Farms. The High Point Flush Pit is equipped with a sump, a submersible pump, and a valved jumper.

The DB design provides for flush water to be available to active DBs for flushing transfer lines. The flush water is available through permanently installed header connections (within flush boxes) or through external flush water hose connections. FDB-4 and HDB-5 through HDB-8 are equipped with flush boxes that drain back to the respective DB. The remaining DBs require installation of an external hose connection.

The following is a description of the features associated with the DBs:

- FDB-1 — This DB is no longer in active service (considered inactive location with respect to waste processing or waste transfers). A blank has been installed in the FDB-1 wall nozzle for the line to F-Area Pump Tank (FPT) FPT-1 to reduce the potential for waste leakage into FDB-1 via this line. FDB-1 drains to the F-Area Catch Tank and vents to Tank 7.
- FDB-2 — This DB is approximately 8,300 gallons with a sump conductivity probe/alarm, dip tubes for level indication, high level alarm, and interlock of the IAL transfer pump. FDB-2 has an inlet HEPA filter and is ventilated through a vent duct to the adjacent PP (F-Area Pump Pit [FPP] FPP-1), which has a forced ventilation exhaust system. Leakage into the FDB-2 sump drains into FPP-1 through an opening in the sump. FDB-2 is the connection point from FTF to the IAL.

- FDB-3 — This DB is approximately 1,900 gallons with a sump conductivity probe/alarm, dip tubes for level indication, and high level alarm. FDB-3 drains to FDB-2. FDB-3 has no installed ventilation system (forced or passive).

- FDB-4 — This DB is approximately 21,700 gallons with an underliner and has conductivity probes/alarms associated with both the sump and the underliner, dip tubes for level indication, and high level alarm. FDB-4 has an inlet HEPA filter and is ventilated through openings (vent and drain slots, and through the pipe chase) to the adjacent FPP-2 and FPP-3, which have a forced ventilation exhaust system. Leakage into the FDB-4 sump drains into FPP-2.

- FDB-5 and FDB-6 — These DBs are no longer in active service (considered inactive locations with respect to waste processing or waste transfers).

- HDB-1 — This DB is no longer in active service (considered inactive location with respect to waste processing or waste transfers). The drain from HDB-1 to the H-Area Catch Tank has been plugged.

- HDB-2 — This DB is approximately 28,100 gallons with a sump conductivity probe/alarm, dip tubes for level indication, and high level alarm. HDB-2 has an inlet HEPA filter and is ventilated through a sump drain line to HPP-3, which has a forced ventilation exhaust system. HDB-2 drains into HPP-3.

- HDB-3 — This DB is no longer in active service (considered inactive location with respect to waste processing or waste transfers).

- HDB-4 — This DB is approximately 1,100 gallons with a sump conductivity probe/alarm, dip tubes for level indication, high level alarm, and a transfer jet for jetting leakage back to a waste tank. HDB-4 has passive ventilation through a HEPA filter.

- HDB-5 — This DB is approximately 1,200 gallons with a sump conductivity probe/alarm, dip tubes for level indication, high level alarm, and a transfer jet for jetting leakage back to a waste tank. HDB-5 has no installed ventilation system (forced or passive).

- HDB-6 — This DB is approximately 11,200 gallons with a sump conductivity probe/alarm, dip tubes for level indication, high level alarm, a transfer jet for jetting leakage back to a waste tank, and a forced ventilation exhaust system. The ventilation exhaust system includes a HEPA filter and a fan. HDB-6 has no inlet HEPA filter.

- HDB-7 — This DB is approximately 37,700 gallons with a sump conductivity probe/alarm, dip tubes for level indication, high level alarms, a transfer jet for jetting leakage back to a waste tank, and a forced ventilation exhaust system. The
ventilation exhaust system includes a HEPA filter and a fan. HDB-7 has no inlet HEPA filter.

- **HDB-8 Complex** — The HDB-8 Complex includes HDB-8, with a volume of approximately 33,000 gallons, and HPP-7, HPP-8, HPP-9, and HPP-10, with volumes of approximately 74,180 gallons each. The DB is equipped with sump conductivity probes/alarms, dip tubes for level detection, and high level alarm. The HDB-8 Complex facilities are interconnected via a pipe chase. The HDB-8 sump is equipped with conductivity probes, dip tubes for level detection and high level alarm, and a transfer jet for jetting sump contents to H-Area Pump Tank (HPT) HPT-10. A conductivity probe is located in the underliner sump and also provides a high level alarm to the control room through the DCS. The HDB-8 Complex contains the HTF interface with the F/H inter-area transfer line. The HDB-8 Complex also receives DWPF recycle transfers from S-Area.

HDB-8 is ventilated in conjunction with HPP-7, HPP-8, HPP-9, and HPP-10 via the installed Process Vessel Ventilation (PVV) system. The PVV system takes suction directly on each of the four pump tanks. Each pump tank vapor space is connected to its PP via the tank overflow line. The vapor space of the four PPs and the DB are interconnected by means of a pipe chase. Air is drawn through an inlet HEPA filter into the DB and from the DB and PPs through the overflow lines into the pump tanks. From the pump tanks, the air passes through a condenser, demister, reheater, and HEPA filter before being exhausted to the environment. The PVV has two exhaust fans in parallel. The normal system alignment is to have one fan running and the second fan in standby condition. System flow rate is measured by a flow element on the suction side of the fans. On an indication of low system flow, the flow element generates a low flow alarm and actuates an interlock to start the standby exhaust fan. The inlet damper to each fan is interlocked to open when the associated exhaust fan is started and to close when the fan is stopped. The inlet dampers are closed by instrument air and fail open on loss of power to the damper, or loss of instrument air. Backup power is supplied to the PVV system by a diesel generator.

The HDB-8 Complex is also equipped with a Building Ventilation System. The Building Ventilation System provides general ventilation for the HDB-8 Complex, and can also provide ventilation flow to specific areas during maintenance activities. Each ventilation system airflow passes through HEPA filters before discharging to a common exhaust stack.

2.4.4.3 **Pump Pits/Pump Tanks**

PPs are shielded reinforced concrete structures located below grade at the low points of transfer lines and are usually lined with stainless steel. PP walls are approximately 2 to 3 feet thick, sloped floors are approximately 3 feet thick, and cell covers are concrete slabs approximately 2 to 3 feet thick. All PPs, except HPP-1, house a pump tank. PP sumps are equipped with conductivity probes, dip tubes, and transfer pumps/jets. Most of the PPs have flush water connections installed. PPs provide secondary containment for pump tanks. See Figures 2.3-2 and 2.3-3 for locations of the PPs relative to other tank farm components.
Each stainless steel pump tank is equipped with dip tube level detection (redundant in most tanks) for monitoring the status of waste transfers (e.g., pump tank level) and an overflow line to the PP sump. Most pump tanks have redundant means of emptying the tank through a pump or jet transfer. The pump tanks are typically vented to a ventilation system having a demister, condenser, reheater, HEPA filters, and fan. The ventilation systems are typically housed in separate adjacent enclosures. The ventilation systems directly exhaust the pump tanks. Since the pump tanks are open to the PPs through passive vent devices and overflow lines, air is drawn from the pit into the tank and out the exhaust. Air is typically allowed into the PPs through a filtered inlet attached either to a PP (e.g., HPP-5 and HPP-6) or a co-located DB (e.g., FDB-2 Complex and FDB-4 Complex). From the entry point into the Complex, airflow occurs between cells via ducts, slots, or other openings.

Pump tanks, FPT-1, FPT-2, FPT-3, HPT-2, HPT-3, HPT-4, HPT-5, and HPT-6, have passive vents, seal pots for maintaining a water seal during flush and IW additions, and cooling coils. The pump tank cooling coils are no longer used and the cooling water supply and return to the cooling coils are blanked to eliminate any siphon potential. Several pump tanks have agitators (pulse tube or mechanical) or recirculation pumps to prevent waste from settling. Mechanical agitation is typically provided by motor-driven blades that are attached to a stainless steel shaft. Pulse tube agitation is more complex than mechanical agitation and typically consists of three primary components: 1) charge vessel, 2) primary controller (suction and drive jets), and 3) secondary controller (computer control unit). The primary controller creates a partial vacuum in the charge vessel, drawing liquid from the pump tank into the charge vessel. Once the charge vessel is filled, the primary controller pressurizes the charge vessel, driving the liquid back into the tank.

The following is a description of the features of the PPs and pump tanks:

- **FPP-1/FPT-1** — FPP-1 has a volume of approximately 33,000 gallons and a sump pump for transferring sump contents into FPT-1. FPT-1 has a volume of approximately 7,025 gallons. FPT-1 is equipped with a variable speed drive transfer pump, a pulse tube agitator, a recirculation pump, transfer flow and pressure instrumentation, and an IW connection. FPP-1 is connected through a vent duct to FDB-2. Condensate from the ventilation system demister and condenser drain back to the tank. FPT-1 serves as the inter-area pump tank.

- **FPP-2/FPT-2 and FPP-3/FPT-3** — FPP-2 and FPP-3 each have a volume of approximately 37,400 gallons. The FPP-2 and FPP-3 sumps are equipped with conductivity probes. FPT-2 and FPT-3 each have a volume of approximately 7,025 gallons. FPT-2 is equipped with a mechanical agitator. FDB-4 is connected through vent and drain slots to the adjacent FPP-2. FPP-3 is connected through vent slots and a pipe chase to FDB-4. The FPP-2 and FPP-3 underliners drain to the FPP-2 underliner sump, which is equipped with a conductivity probe. The PP sumps have transfer jets for transferring leakage back to the pump tanks. The pump tanks have a transfer pump and a transfer jet. Both pump tanks have flush water connections through seal pots.
2.4-34

- HPP-1 — This PP is no longer in active service (considered inactive location with respect to waste processing or waste transfers).

- HPP-2/HPT-2, HPP-3/HPT-3, and HPP-4/HPT-4 — HPP-2, HPP-3, and HPP-4 each have a volume of approximately 36,900 gallons. HPT-2, HPT-3, and HPT-4 each have a volume of approximately 7,025 gallons. The pump tanks are equipped much the same as FPP-2/FPT-2 and FPP-3/FPT-3, except that HPT-4 has a mechanical agitator. HPT-3 and HPT-4 have a recirculation jet, which is no longer in service. These PPs/pump tanks share a common ventilation system (with HDB-2), which includes a pre-filter, HEPA filter, and a fan. Inlet flow for the PPs is provided by a common inlet header which contains a HEPA filter.

- HPP-5/HPT-5 and HPP-6/HPT-6 — HPP-5 and HPP-6 each have a volume of approximately 45,100 gallons. The HPP-5 and HPP-6 sumps are equipped with conductivity probes. The HPP-5 and HPP-6 underliners drain to the HPP-6 underliner sump, which is equipped with a conductivity probe. HPT-5 and HPT-6 each have a volume of approximately 7,025 gallons. The pump tanks are equipped much the same as FPP-2/FPT-2 and FPP-3/FPT-3. These PPs/pump tanks share a common ventilation system, which includes a pre-filter, HEPA filter, and a fan. HPP-5 contains an inlet HEPA filter. HPP-5 is connected to HPP-6 through a vent duct. These pump tanks receive waste transfers from the H-Area Canyon Facility.

- HPP-7/HPT-7, HPP-8/HPT-8, HPP-9/HPT-9, and HPP-10/HPT-10 — HPP-7, HPP-8, HPP-9, and HPP-10 each have a volume of approximately 74,000 gallons and have an underliner with conductivity probes and a pump-out connection. HPT-7, HPT-8, HPT-9, and HPT-10 each have a volume of approximately 6,950 gallons. The pump tanks are equipped with temperature elements, agitators, DCS-controlled VFD transfer pumps, a common ventilation system (shared with HDB-8 as discussed previously), and overflow lines to the PP sumps.

### 2.4.4.4 Valve Boxes

Transfer VBs, depicted in Figure 2.4-14, in FTF and HTF facilitate specific waste transfers that are conducted frequently. The valves are generally manual ball valves in removable jumpers with flush water connections on the transfer piping. VBs are equipped with one or more conductivity probes with control room alarms. In some cases, actuation of an alarm will automatically shut down the associated transfer equipment. Leakage collects in the VB and drains back to the associated waste tank, DB, LDB, or LDB Drain Cell. VBs do not have installed forced ventilation and are passively ventilated primarily via atmospheric breathing. VBs are generally located adjacent to the tanks they serve and are designated accordingly, except as described:

- VB-1, VB-2, VB-3, VB-4, and VB-5 — These VBs facilitate transfers between FDB-2, FPP-1 and Tanks 4 and 8. VB-1, VB-2, VB-3, and VB-4 have approximate volumes of 330 gallons, while VB-5 is slightly larger at approximately 380 gallons.

- VB-15/16 — This VB is no longer in active service (considered inactive location with respect to waste processing or waste transfers).
• VB LDB-17 — This VB has an approximate volume of 140 gallons and facilitates Tank 8 transfers. Leakage drains back to a riser on Tank 8.

• Tank 21 VB and Tank 22 VB — These VBs have an approximate volume of 400 gallons each. Leakage into the Tank 21 VB drains to the Tank 22 VB drain line and into Tank 22 along with leakage directly into Tank 22 VB.

• VB-28A and VB-28B — VB-28A is located on the top of Tank 28, and has an approximate volume of 450 gallons. VB-28B is adjacent to Tank 28, and has an approximate volume of 365 gallons. Leakage to VB-28B drains to LDBs and the LDB drain header. VB-28A drains back to Tank 28. VB-28A and VB-28B, together, are commonly referred to as VB-28.

• Tank 40 VB and Tank 40 Drain VB — The transfer VB and drain VB have approximate volumes of 1,030 gallons and 350 gallons. Leakage into the VB drains to a riser on Tank 40. Leakage into the drain VB drains to an LDB.

• Tank 42 VB — This VB has an approximate volume of 1,460 gallons. Leakage drains to an LDB and then to the HDB-7 sump.

• Tank 49 VB — This VB has an approximate volume of 1,300 gallons and drains to the LDB Drain Cell.

• Tank 50 VB — This VB has an approximate volume of 1,530 gallons. Leakage into the VB drains to Tank 50.

• Tank 51 VB and Tank 51 Drain VB — The transfer VB and drain VB have approximate volumes of 1,030 gallons and 630 gallons. Leakage into the VB drains to Tank 51. Leakage from the drain VB goes to an LDB.

• 241-96H VB — This VB has an approximate volume of 1,916 gallons. Leakage into the VB drains to the LDB Drain Cell.

2.4.4.5 Pumps, Jets, and Waste Removal Equipment

For the purpose of this DSA, the term “waste tank mixing device(s)” is used to describe any of the following: slurry pumps (any type), SMPs, or Commercial Submersible Mixer Pumps (CSMPs).

• Transfer pumps (typical) are vertical, long-shafted centrifugal pumps installed in tank risers and pump tanks. The pump motor is located above the waste/pump tank while the volute and impeller are submerged in waste. A strainer at the bottom of the pump column filters out any large debris to prevent clogging the pump. The pump shaft runs down the center of the pump column and is supported by bushings at each flange. The column is filled with Bearing Water to cool and lubricate the bushings.

Waste is typically transferred via a pump discharge pipe connected to a transfer line within a spray chamber. The discharge line of the transfer pump may be telescoping or connected to a fixed length transfer line. The telescoping feature allows the transfer pump to be raised or lowered, while maintaining a fixed discharge connection point to the Waste Transfer System. The spray chamber includes spray nozzles (for
flushing during maintenance or removal), a discharge connector that connects the pump discharge to the fixed transfer piping, and a conductivity probe. Leakage from the connector flows back into the tank. Transfer pumps may be single speed or variable speed. Transfer pumps may contain a valve(s) on the pump discharge line to allow for recirculation of waste within the waste tank.

- The STP is a submersible, product (i.e., waste) cooled centrifugal pump with the ability to be installed (in tank risers) and removed remotely. The STP is designed to be supported by either the tank bottom or the tank top (riser).

Similar to the standard transfer pump, waste is transferred via a pump discharge pipe connected to a transfer line. The discharge line of the STP may be telescoping or connected to a fixed length transfer line. The telescoping feature allows the STP transfer pump to be raised or lowered, while maintaining a fixed discharge connection point to the Waste Transfer System. Leakage from the STP discharge line flows back into the tank. The STPs may be single speed or variable speed. STPs may contain a siphon break on the pump discharge line. STPs may also contain a valve(s) on the pump discharge line to allow for recirculation of waste within the waste tank.

- Transfer jets are used to transfer liquids that are relatively free of suspended particles from one tank to another and to empty secondary containment sumps. Transfer jets operate by expanding pressurized steam through a venturi-type eductor assembly creating a low-pressure zone that entrains liquid. Transfer jets may be telescoping, raised and lowered by a gear/handwheel assembly, or fixed length jets. Transfer jets are used to transfer materials from sumps, pump tanks, annuli, and tanks. Transfer jets may contain a valve(s) on the jet discharge line to allow for recirculation of waste within the waste tank.

- Leak collection chambers are installed on some transfer pump/jet connection locations. Some of these transfer pump/jet riser connection locations are equipped with a conductivity probe with control room alarm, in particular in those locations where the potential for pluggage exists. If the potential does not exist (e.g., open directly to the tank, or large openings in the bottom of the riser, or the type of material transferred is not prone to pluggage), a probe may not be in place.

- Slurry pumps discharge back to the tank, rather than a transfer line, to agitate and mix tank contents. Slurry pumps are similar to transfer pumps in configuration and installation. Slurry pumps are mounted on a turntable driven by a reversible motor. Slurry pumps may be of standard volute, low shear volute, or quad-volute design. The low shear volute is configured similar to the standard volute design (used only on Tank 48) but has a larger clearance in the pump volute between the impeller and surrounding surfaces. The quad-volute design has four nozzles, two of which are used, and two of which are blanked off. Slurry pumps may be single speed or variable speed.

- The SMP (see Figure 2.4-15) may be used in all Type I, II, III, and IIIA (excluding Tank 48 and Tank 50) tanks to agitate and mix waste. SMPs are mounted on a turntable driven by a reversible motor. The SMP is designed to fit through typical waste tank riser openings and can either be suspended vertically from the tank top or
rest on its mounting foot on the waste tank bottom during sludge mixing operations. The column assembly is sealed at the top and welded to the SMP motor/pump assembly via a transition piece to prevent waste from entering the interior of the column. The SMP motor is product (i.e., waste) cooled and lubricated. To start the SMP with the tank level below the top motor bearing, water is supplied to the motor from an external source to lubricate the bearings prior to start-up and until internal circulation of waste is established. The SMP design has two 3,800 gpm flow discharge nozzles and two motor cooling discharge ports. SMPs are variable speed.

- A CSMP may be used in Type I, II, III, IIIA, and IV tanks (excluding Tank 40, Tank 48, Tank 49, Tank 50, Type I/II Acidic Chemical Cleaning Waste Tanks, Type I/II Non-Acidic Chemical Cleaning Waste Tanks, and evaporator feed tanks) to agitate and mix waste. CSMPs are mounted on a turntable and driven by a reversible motor. The CSMP is designed to fit through typical waste tank riser openings and is suspended vertically from the tank top. The CSMP mast provides a solid support to suspend the CSMP to the desired operation level while providing riser confinement and interface with the turntable assembly. To maintain the solid support and provide shielding, the mast (excluding conduits) is filled with grout. The total volume of the mast (concrete and void space) is less than the void space volume of the quad-volute slurry pump. The pump is direct coupled to a sealed, canned AC motor. The motor/pump assembly is submerged in and cooled by the liquid/waste surrounding the pump. The pump includes approximately 5 gallons of oil barrier fluid as part of the thrust bearing seal. The CSMP has two discharge nozzles with a nominal pumping capacity of 1,950 gpm. CSMPs are variable speed.

- The Advance Design Mixer Pump (ADMP) was used in Type IV Tanks to agitate and mix waste. The ADMP was a long shafted centrifugal pump rated at over 10,000 gallons per minute with an air filled column. The ADMP is no longer used and is grouted in place.

- Flygt Mixers were pumping devices, powered by submersible motors, which developed long-range currents within the tank for suspending solids. These mixers were sized to fit through typical waste tank riser openings and were rated at approximately 11,080 gallons per minute. The Flygt Mixers are no longer used and have been permanently disabled / de-energized.

- VFD – Most waste tank mixing devices are equipped with a VFD, which is used to control the pump speed. VFD settings for specific mixing operations/pump runs are determined and adjusted based on motor loading data and pump curves obtained from the manufacturer or from field testing.

- Closed-circuit television cameras – Closed-circuit television cameras may be used to inspect the waste tank interior to determine extent of mixing, support cleaning operations, verify that rooster tailing does not occur, and monitor the process of closure grouting.

- Additional equipment, such as, water-mouse, crawler, sprayer, hydrolance, and/or hydrolaser may be used for removing residual solids after bulk sludge removal.
• Spray nozzles will be utilized in available risers in order to wash residual sludge and salt from the interior surfaces of the waste tanks. The spray nozzles will use WW, IW or OA to remove residual deposits and are supplied by either existing water systems or connected to tanker trucks and utilize a booster pump to provide required operating pressure.

• Steam spargers in Tank 42 were used to heat waste for the purpose of performing high temperature aluminum dissolution; however, these spargers are no longer in service.

• Saltcake Dissolution – Equipment which may be utilized during saltcake dissolution activities consists of the following:
  - Transfer Pumps – Transfer pumps may be used to mix liquid within a waste tank (via recirculation) to perform saltcake dissolution.
  - Flushwater tank – The flushwater tank supplies water to the waste tank for dissolving saltcake. The tank is equipped with a level gauge which is used to determine the volume of water that has been added to the waste tank.
  - Dissolution Water Skid System – The in-tank components (e.g., eductors, piping) of the system are inserted through the tank risers. These components extend near the saltcake layer and provide uniform mixing of the free liquid during water addition. System components (e.g., water skid, supply tanks) are arranged to the side of the tank top depending on the available space near the location of the risers used for eductor insertion. The system uses WW to feed the supply tanks.

• Saltcake Interstitial Liquid Removal – Equipment which may be utilized during saltcake interstitial liquid removal activities consists of the following:
  - Transfer Pumps – Transfer pumps are inserted into wells mined into the saltcake to perform saltcake interstitial liquid removal.
  - In-line flowmeters – In-line flowmeters may be installed on the saltcake interstitial liquid removal transfer pump discharge to monitor the pumpout rate and provide a low-flow cutoff to protect the pump.
  - Caissons – Caissons are provided to keep a mined saltcake well from caving in during saltcake interstitial liquid removal.

2.4.4.6 Contingency Transfer System

The Contingency Transfer System provides an alternate method to remove accumulated waste from the annulus of a leaking waste tank and transfer the waste back to the primary side of the same waste tank. Each Contingency Transfer System is comprised of a portable submersible pump/motor assembly, portable generator, and associated support equipment. A flexible hose-in-hose transfer line is utilized to transfer the waste from the annulus to the vapor space of the leaking waste tank (through a tank top riser). The Contingency Transfer System flexible hose-in-hose transfer line high point continuously slopes back to the annulus and to the waste tank riser.

2.4-38
2.4.5 ACTINIDE REMOVAL PROCESS FACILITY

The 241-96H ARP Facility supports liquid waste salt processing by providing actinide removal capabilities. The 241-96H ARP Facility is the first phase of the ARP when the waste salt solution contains concentrations of strontium and actinides that exceed downstream acceptance criteria and its purpose is to:

- Receive batches of salt solution
- Dilute the salt solution with PW and add MST
- Agitate the MST/salt solution to achieve strontium and actinide adsorption
- Transfer the MST/salt solution to 512-S for filtration and sludge concentration

The facility layout for the ARP is shown in Figure 2.4-17.

2.4.5.1 Process Area

The 241-96H ARP Facility consists of two Strike Tanks within two separate cells, with ventilation and PW support systems. Ventilation for the Strike Tanks is separate from the cells and the 241-96H Building. The facility is supported by the 241-96H VB and the MST Feed Tank.

2.4.5.2 Strike Tanks

241-96H includes two Strike Tanks, one in the East Cell (No. 1 Cell) and one in the West Cell (No. 2 Cell). Each tank has a transfer pump, an agitator, and a chilled water cooling coil. The two identical Strike Tanks receive ARP feed and MST solution. The MST facilitates adsorption of the soluble actinides/strontium and removal from solution through filtration in 512-S. The Strike Tanks each have an overflow line that empties near the bottom of the cell, but above the sump liquid level. The sump is emptied back into the Strike Tank using an eductor. Each tank has level indication for minimum liquid level for pump operation and for agitator operation and a passive siphon break. The tanks themselves are designed to allow in-leakage and draw air from the cell, preventing a vacuum.

2.4.5.3 Support Facilities/Systems

The 241-96H VB is a support facility adjacent to 241-96H that provides the capability to isolate the transfer path from Tank 49 to either Strike Tank. This VB allows double valve isolation of the transfer path from either Strike Tank to the transfer lines. The VB also has leak detection capabilities.

The 241-96H ARP Facility is provided with two support systems: ventilation and PW. The ARP process vessel ventilation system ventilates the Strike Tanks to remove hazardous gases during normal operation, as well as maintaining each tank at negative pressure relative to the cell atmosphere. This system passes the exhaust ventilation through a HEPA filter system before routing to the Filter Building Stack. The process cells have a separate ventilation system from the Strike Tanks. The process cell ventilation system passes through a HEPA filter system.
before it exhausts out the same Filter Building Stack as the ARP process vessel ventilation system. The PW System provides dilution water to the Strike Tanks. The PW System also provides the motive force to eductors to jet cell sumps back into the Strike Tanks or transfer MST from the MST Feed Tank to the Strike Tanks. The Process Water System is supplied by the site Domestic Water System.

2.4.5.4 **MST Feed Tank**

The MST Feed Tank will be used to supply MST to the Strike Tanks. PW flows through the eductor, pulling the MST from the supply tank through the pipe and into the Strike Tank. The MST addition line terminates in the Strike Tank above the tank overflow and therefore, cannot siphon material out of the tank into the MST addition system or the PW System.

2.4.6 **MODULAR CAUSTIC SIDE SOLVENT EXTRACTION UNIT**

The MCU process is designed to receive waste streams from the 512-S ARP, and reduce cesium content using CSSX technology. Cesium is separated from the CSS and the low Cs-137, low actinide Decontaminated Salt Solution (DSS) will be transferred to Tank 50 for feed to the Saltstone Facility, and the cesium-laden Strip Effluent Solution from the CSSX process will be transferred to the DWPF. The MCU consists of a Main Process Area (or tank vault), Contactor Enclosure Area, and associated support facilities. See Figure 2.4-18 for the MCU layout.

2.4.6.1 **Main Process Area**

The Main Process Area, with a footprint of approximately 68 feet by 61 feet, has exterior walls up to approximately 3 feet thick and interior concrete walls ranging from 2 feet to 3 feet thick. The concrete cell walls extend approximately 4 feet above grade. This area houses 9 below-grade tanks. The DSS Hold Tank (DSSHT), two Salt Solution Receipt Tanks (SSRTs), the Salt Solution Feed Tank (SSFT), the Solvent Hold Tank (SHT), and the DSS Decanter are in one cell located within the Main Process Area. These tanks share a single sump. Within this area are three other cells containing the below-grade Strip Effluent Hold Tank (SEHT), Strip Effluent Decanter (SED), and Contactor Drain Tank (CDT). The SEHT and SED share a sump while the CDT has its own sump. The Main Process Area has removable concrete cell covers for maintenance access. The sumps have bubbler-type level detection to provide indication of leakage from a tank or in-leakage of rain. A transfer pump is connected to a suction leg in each of the sumps for transfer of liquid to the CDT. A transfer jet is also available as a backup to the sump pump (for Main Process Area).

2.4.6.2 **Contactor Enclosure Area**

The Contactor Enclosure Area footprint is approximately 17 feet by 42 feet. The adjacent Air Lock footprint is approximately 19 feet by 9 feet. Exterior Air Lock concrete walls are approximately 1 foot thick. Concrete walls shared by the Contactor Area and the Air Lock are between 2 feet and 3 feet thick. A steel shield door, approximately 11 inches thick, provides shielding for workers outside the facility.
Four banks of annular centrifugal contactors are provided. The four banks include Extraction Contactors (7), Scrub Contactors (2), Strip Contactors (7), and Caustic Wash Contactors (2), which use identical operating principals and are housed in a secondary confinement. The Extraction Contactors are 10 inches in diameter while the other contactors are 5 inches diameter.

2.4.6.3 Support Facilities

MCU support facilities include the Sample Enclosure and Cold Feeds Area (CFA). The Sample Enclosure footprint is approximately 9 feet by 16 feet. The Sample Enclosure Air Lock footprint is approximately 9 feet by 10 feet. These enclosures are located south of the Main Process Area enclosure.

The CFA is located south of the Sample Enclosures and east of the Contactor Enclosure. The Scrub Feed Tank, containing low molarity nitric acid or sodium hydroxide, and the Strip Feed Tank, containing low molarity nitric acid or boric acid, are located in the CFA along with their associated feed pumps. Also located in this area are the MCU Process Vessel Ventilation System and Enclosure HEPA Filtration Unit, the Tepid Water System and Chiller used for maintaining the process temperature, and the Strip Aqueous Pre-heater. Tanks currently in use for other Tank Farm processes include: 1) Well Water Break tank for makeup of IW, 2) IW storage/feed tank for supplying the East Hill IW needs, 3) IW NaOH storage tank for makeup of IW and Bearing Water, 4) Caustic Storage Tank for supplying MCU, and 5) one out-of-service tank that previously was intended to serve the In-Tank Precipitation (ITP) process (Wash Water storage tank).

Located east of the Contactor Area, the second part of the CFA contains the Contactor Cleaning delivery equipment, the Cleaning Agent Totes, the Caustic Unloading Pump and Makeup Totes, and the Solvent Drums (which will be staged in this area only during solvent staging). Associated feed pumps are also located in this area.

Equipment necessary to process the salt solution includes:

- 7,400-gallon Scrub Feed Tank and Scrub Feed Pump. The nitric acid or sodium hydroxide Scrub Feed is delivered via a high point line with a vacuum breaker through a seal pot to the Scrub Contactors. The Scrub Feed line vents via a common header to the CDT.

- 6,400-gallon Strip Feed Tank and Strip Feed Pump. The nitric acid or boric acid Strip Feed is delivered via a high point line with a vacuum breaker through a seal pot to the Strip Aqueous Heater upstream of the Strip Contactors. Strip Feed, also delivered through a seal pot, is also used to backflush the Strip Coalescer. The Strip Feed line vents via a common header to the CDT.

- Chemical Cleaning Agent Totes and Feed Pump. The chemical cleaning agents, nitric acid (HNO₃), sodium hydroxide (NaOH), or deionized (DI) water, will be used to clean the Contactors and DSS Coalescer. The chemical cleaning agent is delivered to the contactors via a high point line with a vacuum breaker through a seal pot to each Contactor. Likewise for DSS Coalescer cleaning, the chemical cleaning agent is delivered via a high point line with a vacuum breaker through a seal pot to the
Decontaminated Salt Solution Hydraulic Accumulator upstream of the DSS Coalescer. The Contactor and DSS Coalescer Cleaning Agent lines vent via a common header to the CDT.

- 9,250-gallon Caustic Storage Tank and Caustic Makeup Feed Pump.
- Caustic Wash Totes and Caustic Makeup Feed Pump.
- Solvent Drum(s) to be connected temporarily to add solvent to the system.

MCU instrument air is connected to the H-Area Tank Farm Instrument Air System at the CFA, and is supplied to support the sampling system, tank purging, various instruments, and air-operated dampers and valves.
2.5 PROCESS DESCRIPTION

Processing in the CSTF includes those functions necessary to receive wastes from various generators while maintaining adequate storage space in the tanks for additional incoming wastes and to transfer those wastes to the disposal facilities. Waste storage includes conversion of liquid wastes to a more stable form for lower-risk storage by evaporation or settling.

Waste generators/interfaces include the following:

- Separations Facilities — Waste is generated during fuel reprocessing
- SRNL and Reactors Areas — Small amounts of waste may be transported to CSTF by tank trailers
- DWPF — Waste (recycle) from the DWPF vitrification process is sent to CSTF
- ETP — Radioactive concentrate stream is directed to a waste tank while evaporator overheads are sent to ETP

The waste streams handled at the CSTF are varied in composition and characteristics and can differ from tank to tank and by source of waste generation.

2.5.1 WASTE STORAGE

Waste is received through transfer facilities and into a waste tank from Separations, SRNL, ETP, and DWPF Facilities as salt solution with some sludge slurry. Alkaline wastes are transferred to the appropriate storage tanks and high heat wastes are aged to allow decay of short-lived radionuclides. Lower heat waste has lower concentrations of radionuclides and does not require aging before evaporation. In storage, metal hydroxides and hydrated metal oxides settle as sludge to the bottom of the tank.

During waste storage, the major operational considerations are waste containment and control of hydrogen generation/accumulation in the transfer facilities and tanks. Sections 2.4.1, 2.4.4, and 2.7.2 describe level detection, leak detection, ventilation, radiological monitoring, temperature control/monitoring, and support systems necessary to maintain operational control of the waste tanks. Waste transfers may be suspended upon the loss of operational capability of these systems. In addition, administrative programs are implemented to monitor waste transfers in progress, maintain the integrity of the waste tanks and associated equipment, and provide radiological protection to workers and offsite individuals.

2.5.2 EVAPORATION

Once the sludge in the waste has settled to the bottom of the tank, a region of supernate, composed principally of water and dissolved salts, remains above the sludge layer. To improve the safety of storage and maintain space for additional wastes, the supernate is evaporated. The supernate becomes concentrated and may crystallize to form a saltcake.
Waste is transferred by a feed pump and an associated feed control system to the evaporator vessel and heated by the steam tubes to drive off the excess moisture. The vapors from evaporation are passed through the water cooled overheads condenser, leaving a mildly contaminated wastewater stream. After condensation, the overheads are passed through a MRT to settle out any mercury that may have been carried over in the condensate before being sent to the overheads receiver tanks. The overheads are sent to ETP for further decontamination and eventual release.

During evaporation, the major operational considerations are containment and maintaining the evaporator vessel integrity by monitoring and controlling the level, temperature, and pressure. Sections 2.4.2 and 2.4.3, describe the systems necessary to maintain operational control of the evaporators.

2.5.2.1 242-16H Evaporator Chemical Cleaning Process

Chemical cleaning of the 242-16H Evaporator for sodium aluminosilicate scale requires the removal of jumpers used in routine waste processing and installation of a specially designed jumper containing a diaphragm pump. The drop tank BFV is replaced with a downcomer and a portable skid is installed containing a nitric acid pump and a caustic pump. All lines that would allow nitric acid (HNO₃) to be transferred from the evaporator to the feed tank are isolated. Nitric acid (1.5 molar) is pumped into the evaporator pot to a level that covers the bulk of the scale. The pot is heated using steam through the tube bundle and agitated with air, supplied through the lance. Steam to the lance may be used for supplemental heating and to maintain the pot level. After temperature is maintained for a predetermined time, the solution is then cooled using well water flowing through the tube bundle. Once cooled, sodium hydroxide (50 weight percent [wt. %] or 19 molar) is added while being agitated with air at a high flow rate through the lance. A sufficient amount of sodium hydroxide is added to raise the pH of the solution to greater than or equal to 7.0. After the required mixing time has elapsed, the contents are pumped to the drop tank. Water is typically added to the evaporator and pumped to the drop tank after each batch to remove residual solids. The process is repeated as required to remove the scale from the pot. Section 2.4.2 describes the systems necessary to maintain operational control of the evaporator during chemical cleaning.

2.5.3 WASTE REMOVAL

Waste removal includes saltcake dissolution, saltcake interstitial liquid removal, sludge agitation (using waste tank mixing devices), and/or residual chemical cleaning. Following bulk waste removal, mounds or heels of sludge may remain, requiring spraying, chemical sludge removal, mechanical waste removal or other methods to meet Federal Facilities Agreement requirements for quantities of remaining waste. After sufficient waste is removed, reducing grout is used to chemically stabilize and/or physically encapsulate incidental waste so that the potential for transport of contamination into the environment is reduced.

Sludge agitation is the process of mixing sludge using waste tank mixing devices. Saltcake dissolution is the process of dissolving saltcake by adding liquid to a waste tank and/or mixing of liquid within a waste tank (via waste tank mixing devices, mixing eductors, or transfer pumps associated with waste tank recirculation). Saltcake well mining is also considered a saltcake
dissolution activity. Saltcake well mining is the process of dissolving saltcake, usually to allow insertion of equipment such as a pump for saltcake interstitial liquid removal. Saltcake interstitial liquid removal is the process of removing interstitial liquid from bulk saltcake, with the liquid level in the waste tank at or below the saltcake layer, by pumping liquid from a well in the saltcake.

During saltcake dissolution, saltcake interstitial liquid removal, and sludge agitation, hydrogen concentration is of particular concern because of the potential for release of trapped gas. Sections 2.4.1, 2.4.4, and 2.7.2 describe systems for hydrogen monitoring, ventilation, radiological monitoring, waste removal equipment, and support systems necessary to maintain operational control of waste removal operations.

2.5.4 241-96H ARP

The 241-96H ARP Facility is the first phase of the ARP when the waste salt solution contains concentrations of strontium and actinides that exceed downstream acceptance criteria, which utilizes MST for adsorption of the strontium and actinides from the waste salt solution once inside the Strike Tanks. This solution is later transferred to the 512-S Facility for filtration.

The strontium and actinide removal process in 241-96H consists of the addition of MST slurry to the Strike Tanks containing salt solution feed to remove soluble actinides.

In order to facilitate the processing of salt solution, 241-96H ARP is configured with two Strike Tanks for the adsorption of strontium and actinides from salt solution feed. Salt solution is transferred in batches to one of the Strike Tanks in 241-96H for treatment where the soluble strontium and actinides in the solution are converted to an insoluble form. MST slurry is added from the MST Feed Tank via an eductor.

Agitation in the Strike Tank promotes adsorption of the strontium and actinides onto the MST slurry particles. Strike Tank temperature is maintained at approximately 25°C by a cooling coil/chilled water system for removing heat added by the agitator and maintaining the process kinetics at an optimum temperature for the adsorption process. While one tank is performing adsorption, the other Strike Tank is available to receive salt solution, process solution with MST, or transfer solution to 512-S.

2.5.5 MCU PROCESS

The MCU provides a facility for receiving high cesium/low actinide CSS from the 512-S ARP. MCU will receive and process the salt solution output from 512-S ARP (using an organic solvent [CSSX technology] to remove cesium) such that the majority of the radioactivity can be removed. The CSSX technology utilizes multi-component organic solvent and annular centrifugal contactors to extract cesium from salt waste. The MCU process may operate with different organic solvents. The original MCU solvent, known as BOBCalix-based solvent, is composed of Isopar L (diluent), Cs-7SB (modifier), BOBCalixC6 (extractant), and Trioctylamine (suppressor). An additional MCU solvent is the Next Generation Solvent (NGS), composed of Isopar L (diluent), Cs-7SB (modifier), MaxCalix (extractant), and TiDG (suppressor). A blended solvent may be used when NGS is introduced into the MCU process.
The MCU process, depicted in Figures 2.5-1 (BOBCalix-based solvent) and 2.5-2 (NGS), includes:

- Batches of filtered salt solution are introduced into one of the SSRTs via a single transfer line from the 512-S ARP Facility and transferred to the SSFT.
- Salt solution is transferred through the Extraction Aqueous Heat Exchanger to the Extraction Contactors. Organic solvent is transferred from the SHT into the Extraction Contactors and flows counter-current to the salt solution across the extraction bank to extract the Cs\textsuperscript{137} into the solvent.
- The aqueous DSS, decontaminated of the Cs\textsuperscript{137}, is transferred to the DSS Coalescer and Decanter to allow entrained solvent separation and removal prior to staging in the DSSHT for transfer to Tank 50. The organic solvent from the DSS Decanter is fed back into the SHT. From Tank 50, the DSS will be sent to the Saltstone Facility for incorporation into grout.
- The Cs\textsuperscript{137} loaded organic solvent is circulated through Scrub Contactors, where dilute nitric acid (Figure 2.5-1) or dilute sodium hydroxide (Figure 2.5-2) flows counter-current to the solvent to remove other soluble salts (sodium and potassium) from the solvent and neutralize entrained alkaline wastes. The aqueous solution is fed back into the system upstream of the Extraction Contactor.
- The Cs\textsuperscript{137} loaded organic solvent is then passed through the Strip Solvent Heater and the Strip Contactors where dilute nitric acid (Figure 2.5-1) or dilute boric acid (Figure 2.5-2) flows counter-current to the solvent to strip the Cs\textsuperscript{137} from the organic solvent. The acid temperature is adjusted in the Strip Aqueous Heater prior to entering the Strip Contactors.
- The aqueous Strip Effluent is transferred to the Strip Effluent Coalescer and Decanter to allow entrained solvent separation and removal prior to staging in the SEHT for later transfer to DWPF.
- The organic solvent from the SED is fed back into the system upstream of the Extraction Contactors and upstream of the point where aqueous solution re-enters the stream from the Scrub Contactors.
- The organic solvent exiting from the Strip Contactors is transferred to the Caustic Wash Contactors where it flows counter-current to the caustic wash solution to remove any impurities that may develop in the organic solvent over time. The purified organic solvent is fed back into the SHT.

2.5.6 RESIDUAL WASTE REMOVAL

Prior to final closure of a waste tank it may be necessary to conduct residual waste removal from the waste tank and/or its annulus. The residual waste contained in a waste tank may be removed using a chemical cleaning process. The residual waste contained in an F-Area Type I Waste Tank annulus may be removed using a mechanical cleaning process. The cleaning processes involve removing the residual waste from the waste tank and/or its annulus and transferring it to
a designated receipt tank. In support of waste tank closure, waste samples can be taken from the waste tank undergoing cleaning using a temporary sampling device.

2.5.6.1 Deleted

2.5.6.2 Type I and Type II Waste Tank Chemical Cleaning Process

The chemical cleaning process in Type I and Type II waste tanks treats the residual sludge or sludge heel remaining following bulk waste removal with commercially available (nominal) 8 wt. % oxalic acid (OA) to dissolve the metal hydroxides (e.g., iron, aluminum, manganese, uranium, plutonium) for the purpose of final waste tank closure. A combination of hydraulic slurring and acid treatment is employed to remove the insoluble solids in the sludge heel. The chemical cleaning process is used when the sludge heel in a waste tank has been reduced to 10,000 gallons or less.

Oxalic acid is added to the tank being treated from an external source (tanker truck, rail car, etc.). A first strike of nominal 8 wt. % OA is added to the sludge heel in the treatment tank to reach up to 20:1 ratio by volume of OA to sludge. After the required amount of acid is added, additional water (IW/WW) is added to reduce the acid concentration to $\leq 4$ wt. % and to bring the tank up to a level necessary to start mixing pumps. Mixing is performed in order to keep a supply of fresh acid in contact with the sludge surfaces. At the end of the treatment time the acidic waste solution is transferred to a pre-conditioned receipt tank. The acidic waste solution is transferred using a standard centrifugal transfer pump. The receipt tank is pre-conditioned with supernate, sodium hydroxide, or other inhibitor to neutralize the acidic waste being added to it. A waste tank mixing device is in operation during receipt of acidic wastes.

The acidic waste solution is transferred from the tank being treated to the receipt tank utilizing standard Tank Farm Transfer Systems (e.g., transfer piping w/ secondary containment, DB, VB, flushing capability). After the transfer has been completed, the transfer line is vented and drained. Pump tanks used for vent and drain operations will be pre-charged with sufficient inhibitors to neutralize the acidic waste that drains into the pump tank.

After the acidic waste solution is transferred out of the treated tank, the treated tank may be spray washed using OA, IW, or WW. Spray washing is included as part of the chemical cleaning process to remove waste material from the tank walls and internal equipment. The waste solution is then transferred from the treatment tank to the receipt tank. Spray washing between acid sludge dissolution treatments is conducted as needed. After completion of the chemical cleaning process, sodium hydroxide or another inhibitor may be added to the treatment tank to neutralize remaining acidic waste material.

2.5.6.3 F-Area Type I Waste Tank Annulus / Waste Tank Wall Cleaning Process

F-Area Type I Waste Tanks are known to have leaks that have resulted in waste material entering the annulus space and forming salt deposits at the leak site of the tank wall. An annulus inspection/cleaning crawler is used for inspection and/or removal of salt deposits from leak sites on the exterior (i.e., annulus side) of the waste tank wall and the interior and exterior of the annulus ventilation system ductwork located on the annulus floor.
The annulus inspection/cleaning crawler is a mechanical robotic device typically with the following features:

- General-viewing video camera with auxiliary lighting.
- Magnetic wheels for attaching to the tank wall. Pneumatically operated pistons facilitate separation from the tank wall.
- Electric motor actuated boom arm assembly with an inspection camera, inspection lighting, and low-volume liquid nozzle.
- Brush and nozzle assembly containing an electric motor powered rotating brush and two solenoid actuated low-pressure (nominally 90 psig) liquid spray nozzles.

The crawler is remotely driven on the waste tank wall. Operation of the crawler is monitored by personnel using lighting, cameras, and video surveillance equipment. The motive force for the movement of the crawler is electric power. Electric power and fluids for the crawler are supplied to the crawler using an umbilical harness.

Salt deposits and/or salt nodules (from the wall cleaning operation) on the annulus floor are dissolved by adding water to the annulus. The accumulated waste solution is then transferred out of the annulus using a transfer (e.g., diaphragm) pump.

2.5.7 WASTE TANK/EQUIPMENT GROUTING

As part of waste tank closure, high level waste tanks (primary and annulus) will be filled with grout for the purpose of chemically stabilizing residual material, filling the tank/annulus void space, and discouraging future intrusion. Typically, the bulk fill grout is introduced through risers using multiple pour points. Closure grout is flowable, pumpable, and self-leveling with cohesive properties to minimize segregation.

2.5.7.1 Waste Tank/Equipment Grouting Process

Grout is added to a waste tank (primary and annulus) by various methods including using hoppers and portable grout pumps filled from concrete trucks. The pumps typically push the grout through slick lines to the risers of the selected tanks. If additional pour locations are required to cover tank residual material, additional access points are identified and installed to address the exact area requiring additional grout. As necessary, modifications are made to provide delivery points into the tank, to manage air displacement, to manage ventilation condensate, and to handle any overflow while filling equipment void spaces or tank risers. The riser is prepared to allow the addition of grout utilizing a slick line routed to a tank/annulus riser. The slick line may be connected to a flexible tremie. A tremie is a flexible pipe used to distribute grout over a site. The tremie, if utilized, is inserted through a riser access port(s) to allow introduction of the bulk fill grout down into the tank/annulus. The slick line and tremie may be cleared by pigging (a ball pushed through the line with compressed air). The slick line configuration is temporarily modified for pigging operations such that grouting and pigging cannot physically be performed simultaneously. The tank/annulus grout filling progress is periodically monitored (e.g., in-tank video camera) and grout height is typically determined using the volume of grout added and/or visual reference markings inside the tank. During riser
grouting operations, containment provisions are typically made to restrict or contain grout overflows.

Various types of equipment from waste tank operations, bulk waste removal, and heel removal campaigns that remain in the waste tanks may be grouted in place. Open vertical pathways (e.g., transfer jet piping, thermowells, cooling coils, pump columns) in the tank/annulus are filled with grout to the extent practical. A cooling coil flushing/grouting system may be used to collect the displaced flush water and any excess grout during grouting of cooling coils. Any displaced flush water will be decanted to either another vessel or directly to an active waste tank.

An additional pour system (e.g., mixer, accumulator drum, grout pump, fill line, component fill equipment, and associated vent/collection paths) may be used to grout the in-tank equipment. A highly flowable grout is injected into the equipment to ensure that all voids are filled to the extent practical.

Grouting of in-tank equipment may take place separately from or concurrently with bulk tank/annulus grouting. During the grouting activities of the tank/annulus, the tank/annulus is periodically monitored for hydrogen and is ventilated utilizing a ventilation system. During the grouting activities of the tank/annulus risers, the risers are periodically monitored for hydrogen and ventilated as necessary for removal of flammable gases. Sections 2.4.1, 2.4.4, and 2.7.2 describe systems for hydrogen monitoring, ventilation, radiological monitoring, and support systems necessary to maintain operational control of waste tank/equipment grouting process.
2.6 CONFINEMENT SYSTEMS

Confinement systems include process vessels, structures, ventilation systems, and level and leak detection systems. Evaporator, waste tank, and transfer facility process vessels and structures are described in Sections 2.4.1 through 2.4.4. Ventilation system design, level, and leak detection systems are also discussed in those sections. Conductivity probes are used throughout the CSTF and are discussed below.

2.6.1 Conductivity Probes

Conductivity probes are installed inside various process areas (e.g., waste tanks, waste tank annuli, evaporator and overheads condenser cell sumps, VBs, DB and PP sumps, and LDBs) such that the tip of the probe is set at, or below, the maximum permissible liquid height for that location. The probes are grounded from the junction box to the component for the level being monitored. A low voltage is continuously applied to the line so that when the probe comes in contact with liquid, it is grounded out, tripping a relay and resulting in one or more of the following: actuation of a visual and audible alarm in the associated control room, actuation of a local alarm in the field, and/or actuation of an associated interlock. The probes have two wires attached by separate set screws to ensure that the probe does not become disconnected from the wires. The wires from the junction box to the control room are routed (encased) in conduit or cable trays. For some components, actuation of the alarm will activate an interlock (e.g., shutdown an operating SMP). Typically, conductivity probe circuits are equipped with test switches to activate and test the alarm function.

2.6.2 Dip Tubes

Dip tubes (also known as air-bubblers or bubbler dip tubes), which are installed in various locations (e.g., leak detection sumps and tank annuli), are used as alternatives to conductivity probes for level indication. As discussed in Section 2.4.2.3, dip tubes operate by sensing the hydrostatic pressure (height) of a liquid column to cause a backpressure in the dip tube.
2.7 SAFETY SUPPORT SYSTEMS

2.7.1 FIRE PROTECTION SYSTEM

The F-Area and H-Area Fire Protection Systems include automatic sprinkler and/or halon systems and hydrants fed from a closed-loop fire main, local and central fire alarms, fire and/or smoke detection devices, and portable fire extinguishers. The closed-loop fire main includes water storage tanks, electric and diesel fire pumps, underground fire main piping, post indicator valves, and fire hydrants (e.g., dry barrels).

The underground fire mains run around the perimeters of F-Area and H-Area, with hydrants distributed around the loop such that at least two hydrants are in close proximity of each tank. In each area, two fire water storage tanks (each greater than 500,000 gallons) supply the water for the fire main, with two jockey pumps in each area to maintain header pressure during low or no demand conditions. Tank water is automatically supplied by domestic water or by well water in the event domestic water is out-of-service. The tanks are located near the pump houses (902-3F, 902-3H, and 241-125H).

Sprinkler systems are equipped with flow or pressure switches that indicate if water flow is present downstream of the control valves. Indication of the water flow is sent to the fire alarm control panel and to the Savannah River Site Operations Center. Fire and/or smoke dampers are installed in some ventilation systems to stop airflow to, or from, the area of the fire. The following Tank Farm buildings have automatic sprinklers (designated with an “(S)” below) or halon (designated with an “(H)” below) fire suppression systems.

- 241-18F control room (S)
- 241-74F building (H)
- 242-25H evaporator support buildings (242-11H, 242-9H) (S)
- 241-100H/241-101H/241-195H/241-223H DB/PP facility (S)
- 241-2H control room (S)
- 241-28H control room (H)
- 241-74H building (H)
- 241-82H radcon support facility (S)
- 241-77H cold feeds remote control room (S)
- 241-78H radcon support facility (S)
- 241-33H cold feeds MCC building (S)
- 241-96H ARP facility (S)
- 241-146H fire protection foam building (S)

Dry chemical ABC-type extinguishers are typically provided at the tank tops and at other facilities throughout the Tank Farms.
2.7.2 MONITORING SYSTEMS

2.7.2.1 Flammable Gas and Air Monitoring

Gas concentration is monitored to ensure that flammable gases do not reach flammable to explosive concentration (Chapter 18 discusses monitoring associated with Tank 48). LFL monitors utilize an aspirator and instrument air to produce a vacuum to draw a waste tank vapor sample through a filter, flowmeter, and detector/transmitter. The air sample, along with the instrument air is returned to the tank vapor space or ventilation exhaust duct.

In the CSTF, hydrogen is the primary flammable gas of concern and is measured in units of percent LFL, the smallest quantity of a combustible gas that supports a self-propagating flame when mixed with air and ignited. LFL monitors, calibrated for hydrogen (except Tank 48), are used to monitor the waste tank vapor space. The monitoring is performed using a combination of installed and portable monitors. Some tanks have installed monitors that display the percent LFL in the control room or locally. Portable monitors, which read out in percent of lower explosive limit, are used to monitor the vapor space of most waste tanks.

2.7.2.2 Airborne Particulate Monitoring

CAMs or isokinetic samplers are used to monitor ventilation exhaust downstream of HEPA filters from various process areas (e.g., waste tank vapor spaces, waste tank annuli, DBs, PPs, and evaporator cells). CAMs draw an air sample from the ventilation exhaust ductwork or from the ventilation exhaust stack at a constant rate and pass the air sample across filter paper and a Geiger-Mueller (GM) detector and through a flowmeter before exhausting the sample to the atmosphere. The GM tube measures the gamma radiation from the particulate collected on the sample paper, and sends a signal to the associated control room. Alarms may be generated for high radiation levels, CAM blower, or detector failure.

Isokinetic samplers may be used in some limited instances for the same purpose. The isokinetic samplers automatically vary the sample flow rate according to the exhaust stack flow rate, but otherwise function the same as CAMs described above. Portable air samplers are used for ventilation systems that do not have installed CAMs.

2.7.2.3 Area Radiation Monitoring

ARMs, stationed throughout the Tank Farms, monitor area gamma radiation levels and provide indication (audible and visual alarms both locally and remotely in the control rooms) to notify personnel/operators of a high radiation level or failed instrument. The detectors are mounted throughout the Tank Farms at various locations (e.g., chromate cooling water pump houses, waste tanks and waste tank gang valves, DBs and PPs, evaporators, MCU sampling enclosure, MCU ventilation skid HEPA filter, and control rooms). Portable ARMs can also be utilized to perform this monitoring.
2.8 UTILITY DISTRIBUTION SYSTEMS

2.8.1 ELECTRICAL

2.8.1.1 Electrical System Arrangement

Transmission lines running between switching Substations 52 and 53 supply power from the site-wide power grid to the F-Area 251-F substation and the H-Area 251-H substation. The 115-kilovolt (kV) power supplied to the substation is stepped down to 13.8-kV by two 115-kV/13.8-kV transformers through main breakers to two 13.8-kV buses. From the 13.8-kV buses, which include a bus tie breaker to allow one bus to supply the other in the event a power supply line is unavailable, power is sent through feeder cables to the Tank Farms. In F-Area, power is supplied to six 13.8-kV/480-volt alternating current (VAC) transformers through fused disconnect switches at substations 252-21F, 252-21FA, 241-74F, 252-17F, 252-24F, and 252-26F. From the substation, power is supplied to various MCCs. In H-Area, power is supplied to permanent substations, including 241-17H, 241-74H, 252-1H, 252-7H, 252-12H, 252-16H, 252-21H, 252-21HA, 252-51H-A, 252-51H-B, 252-51H-C, 252-53H, 252-25H, 252-77H, and 252-HDB-8. In addition to permanently installed substations, the 13.8/480V Mobile Unit Substation or Electrical Substation Skid is designed to be relocated from tank to tank in either Tank Farm to power the MWRCC or EES for waste removal operations.

The 480-VAC power is supplied through feeder breakers to essential and non-essential loads. MCCs provide power to low voltage power transformers to supply loads requiring lower voltage. Fused feeder switches, which provide over-current protection, are used for feeding 480-VAC to small components such as self-contained sampling systems, hoists, air conditioners, and heaters.

2.8.1.2 Backup Power

H-Area has Standby Diesel Generators (SDGs) to provide a source of power to selected loads in the event normal power is lost. Each diesel generator is rated at 480-VAC, 60 hertz, three-phase, and has its own fuel and lubrication oil, combustion air, cooling water, battery start, and electrical generating systems. The starting batteries also provide power to the diesel generator control panel. The SDGs are interlocked to trip on low lube oil pressure, high-high cooling water temperature, over-speed, and over-crank.

Selected loads are supplied through an Automatic Transfer Switch (ATS) to ensure that backup power from a SDG is provided in the event that normal power is lost. Normal-seeking ATSs are used in the Tank Farms and are switched back to normal power once it is restored.

Examples of the type of loads switched to SDG power include the following:

- Plant air compressors and air dryers
- Waste tank annulus and/or purge fans
- Pump motors
- Agitator motors

2.8-1
• Breathing air compressors
• DB purge fans
• Pump tank purge fans
• Bearing Water pump motors
• Pumphouse control load centers
• Cooling tower fan motors
• Control room heating, ventilation, and air conditioning
• Radiological controls — Monitoring power panels
• Lighting panels

2.8.1.3 Uninterruptible Power Supply

The Uninterruptible Power Supply (UPS) components include battery cells, a battery charger (rectifier), an inverter, a static transfer switch, and control and distribution panels. The UPS is normally fed from a 480-VAC/208-VAC transformer supplied by a MCC. UPSs are provided in the CSTF, supporting equipment as described below.

Examples of equipment powered by UPSs include the following:

• DCSs
• Programmable Logic Controllers
• Public address systems
• Fire alarm systems

2.8.2 NON-ELECTRICAL

2.8.2.1 Steam System

Site utilities supply 325 psig steam for use in the FTF and HTF. Steam is routed through one of multiple main steam reducing stations. A typical steam reducing station includes the steam pressure reducing valve, inlet and outlet isolation valves, safety relief valves, a bypass/warm-up valve, strainers, and steam traps. Most of the reducing stations include two stages of steam pressure reduction (325/150 psig and 150/25 psig).

Steam is provided to various users in the CSTF, including the following:

• Waste tank ventilation (primary and annulus)
• Waste transfer gang valves to provide motive force for transfer jets
• Evaporators (tube bundles, lance, and lift gang valves)
• Building ventilation systems
2.8.2.2 Instrument Air/Plant Air Systems

FTF and HTF utilize compressors (e.g., rotary screw, piston) and associated inter-coolers, air receivers, air dryers, and reducers to provide 165 psig plant air to the tank and evaporator gang valves, evaporator steam tube bundles, pressure regulators, and several other miscellaneous loads. The compressors have various alarms and/or interlocks for pressures, temperatures, levels, and vibration.

The instrument air reducing stations reduce the 165 psig plant air to provide 90 psig instrument air to various users, such as LFL monitors, dip tubes, pneumatic control valves, level transmitters, temperature controllers, and reel tapes.

2.8.2.3 Well Water System

The Well Water System is the normal source of makeup water to the Flush Water Systems and provides cooling water and makeup water for various systems and facilities from any one well or any combination of wells in the Tank Farms. The systems use an electric pump. The FTF receives well water from the F–Area Service Water System (which is pH adjusted well water). HTF has two wells (905-87H and 905-108H). In some cases, an alternate water source (e.g., domestic water) may be substituted for the Well Water System.

In FTF, well water users normally include the following:

- Makeup water for the 242-16F Evaporator Flush Water System supply tank
- Makeup water for the Chromate Cooling Water System surge tanks
- Makeup water for the IW facility well water dilution tank
- Secondary source of makeup water for the IW tank
- Water for saltcake dissolution process (e.g., feed supply to the Dissolution Water Skid System supply tanks)

In HTF, well water users normally include the following:

- Makeup water for the Chromate Cooling Water System surge tank
- Makeup water for the HDB-8 Flush Water System supply tank
- Water for the 242-16H Evaporator seal pot and anti-foam tank
- Makeup water for the 242-16H/242-25H Evaporator Flush Water System supply tank
- Well water break tank to supply makeup water to the IW System
- Water for saltcake dissolution process (e.g., feed supply to the Dissolution Water Skid System supply tanks)
- Provide cooling medium for acid/caustic solution during 242-16H Evaporator chemical cleaning operations
2.8.2.4 Flush Water System

There are seven Flush Water Systems in the Tank Farms: two FTF systems (located at 242-16F and the High Point Flush Pit), an HDB-8 dedicated system, two HTF systems (located at 242-16H and 242-25H) that supply the entire Tank Farm, a batch system that can supply Tanks 9, 10, 11, 13, 14, and 15 and HDB-2 via hose connections and manual valves, and a dedicated inhibited Flush Water System used to flush the transfer piping between Tanks 40 and 51 and DWPF. Flush water is used to support many of the systems previously discussed in this chapter (e.g., waste tanks, evaporator, and transfer systems). Backflow prevention devices are installed in the flush water line used to prime the 242-16H Evaporator to minimize waste from being pushed back into the Flush Water System. Domestic water can be used as an alternate makeup source for the Flush Water System on a temporary basis as permitted in Reference 6.

2.8.2.5 Chromate Cooling Water/Cooling Tower Water Systems

The Chromate Cooling Water Systems typically provide cooling to Type I, II, III, and IIIA waste tank cooling coils and waste tank purge ventilation condensers. The Chromate Cooling Water Systems include centrifugal pumps, two tube and shell type cooling water heat exchangers arranged in series, surge tanks, chemical additions pots, sample valves, and drain tank and associated pumps. The surge tanks provide a surge volume to compensate for temperature changes, leakage, and operational transients, as well as, positive head for the systems’ circulation pumps. The surge tanks are elevated to maintain the Chromate Cooling Water System pressure higher than waste tank pressure in order to minimize the possibility that contamination will be transferred from the waste tank to the cooling water system in the event a cooling coil breach occurs. Should a breach in a waste tank cooling coil occur, individual coil isolation valves can be used to isolate the leaking coil from the rest of the tank’s Chromate Cooling Water System. If desired or required, the waste tank can be isolated from the cooling water system by closing the tank’s supply and return header isolation valves, except in Type I tanks, which have supply header isolation valves, but do not have return header isolation valves. Make-up water for the chromate cooling water surge tanks is provided by well water with domestic water as an acceptable back-up where cross-contamination can be prevented. Additionally, the Flush Water System may be used to refill drained portions of the Chromate Cooling Water System.

In FTF, the west pumphouse is equipped with four chromate cooling water pumps while the east pumphouse is equipped with two pumps. Secondary cooling to the east and west pumphouse is provided by a Cooling Tower Water System. The FTF chromate drain tank is located between the east and west pumphouses and collects pumphouse drains and surge tank overflows from both pumphouses. The west pumphouse supplies cooling water to the FPP-1/FDB-2 ventilation condenser and Tanks 1, 2, 3, 4, 7, and 8. The east pumphouse typically supplies cooling water to Tanks 25, 26, 27, 28, 33, 34, 44, 45, 46, and 47.

In HTF, the west and far east pumphouses are equipped with two chromate cooling water pumps. Cooling towers provide secondary cooling for both operational pumphouses. In the west pumphouse, chromate cooling water overflow and drainage are directed to a building sump. The far east pumphouse utilizes a chromate drain tank for overflow and drainage. The west pumphouse Chromate Cooling Water System typically supplies cooling water to Tanks 9, 10, 11,
13, 14, 15, 29, 30, 31, 32, 35, 36, and 37. The far east pumphouse typically supplies cooling water to Tanks 38, 39, 40, 41, 42, 43, 48, 49, 50, and 51.

The FTF Cooling Tower Water System, located at Building 241-20F, consists of three towers, three pumps, chemical addition capability, and associated valves and instruments. The FTF Cooling Tower Water System, located at 241-13F, consists of one forced draft tower, one pump, chemical addition capability and associated valves and instruments. Makeup water is provided by the Domestic Water System. The HTF west Cooling Tower Water System, located at Building 241-13H, consists of two cooling towers, two cooling water pumps, chemical addition capability, and associated valves and instruments. The HTF far east Cooling Tower Water System, located at 241-29H, consists of three cooling towers, three cooling water pumps, chemical addition capability, and associated valves and instruments. All cooling towers are standard cross-flow type towers with induced draft fans except the FTF west pumphouse tower which are counter-flow with forced draft fans. The cooling towers devoted to the 242-25H Evaporator are discussed in Section 2.4.3.9.

For both FTF and HTF chromate water systems, the chromate cooling water pumps are interlocked to shut down on surge tank low-low level. The Cooling Tower Water Systems are maintained at a higher pressure than the chromate water system. Typically, alarms are actuated in the control rooms when these system pressures fall below the set points and when the dP of the heat exchanger cooling water outlet and chromate water inlet indicates the chromate water pressure is higher than the cooling water. An ARM at each pump house alerts operators if radiation levels in the Chromate Cooling Water System increase beyond the set point. If necessary, the chromate drain tanks can be pumped to the evaporator feed tanks.

Siphon breakers are installed on the supply and return headers of Tanks 13, 14, 15, 29, 30, 31, 32, 33, 34, and 35. These devices are designed to prevent siphoning waste from tanks via the Chromate Cooling Water System. Two sets of siphon breakers (two on the supply header and two on the return header) serve Tanks 13, 14, and 15. Three separate sets of siphon breakers serve Tanks 29, 30, 31, 32, 33, 34, and 35. One set serves Tanks 29, 30, 31, and 32, one set serves Tanks 33 and 34, and one set serves Tank 35. The Chromate Cooling Water System is not permanently connected to Tanks 14 and 15. The system is connected when operational plans require cooling for Tanks 14 or 15.

A Sealant Deployment System may be used for cooling coils that have developed leaks on Tanks 1, 2, 3, 4, 7, 8, 9, 10, 11, 13, 14, 15, and 30. This system is a portable, self-contained unit that enables the application of liquid sealant material to be circulated within the cooling coils, sealing leaks. The components of this system are a centrifugal pump, a storage tank with heater, and supply and return lines to be connected to the affected cooling coils.

A Chromate Water Deionizer, which is installed/operated from a pumphouse, may be used to remove radioactive contaminants from a Chromate Cooling Water System. The Chromate Water Deionizer consists of an ion exchange vessel, associated flexible hoses, isolation valves, and hose connections. The Chromate Water Deionizer receives a small side stream of Chromate Cooling Water System flow (taken from upstream of the heat exchangers), filters the water, and returns the flow downstream of the heat exchangers.
2.8.2.6 Inhibited Water/Bearing Water Systems

IW may be used to perform various activities. These activities include, but are not limited to the following:

- Rewet sludge in waste tanks
- Saltcake dissolution in waste tanks
- Provide mixing medium for mixing operations during waste removal
- Decontaminate slurry and transfer pump shaft columns
- Flush transfer lines and mixing pumps
- Provide bearing lubrication during SMP start-up when the waste level is below the top motor bearings
- Supply makeup water to the Bearing Water Systems

IW is produced by mixing a solution of sodium hydroxide (to minimize general and pitting corrosion in tanks) and sodium nitrite (to protect tank walls from stress corrosion cracking) with water (e.g., well water, domestic water). The IW Systems include caustic tanks, caustic re-circulating pumps, caustic metering pumps, well water dilution tanks, IW dilution pumps, IW tanks, static mixers, flow elements and control valves, chemical addition tanks and siphon jets, heaters, and associated valves. The well water fill valves are interlocked to close when the IW tank high-high level alarm actuates. In FTF, the Dilution and Inhibited Water Facility (DIWF) supplies IW to the inter-area pump tank to dilute sludge from FTF before being transferred to HTF and provides makeup water for the IW tank. The major components of the DIWF system are the same as described above (i.e., dilution tank/pumps, caustic tank/pumps, static mixer, control valves, and re-circulating pump).

The Bearing Water Systems include Bearing Water tanks with rupture disks, strainers, Bearing Water pumps, filters for removal of suspended solid material, back-pressure regulators, and associated valves. Bearing Water is used to provide a seal in the transfer pumps, slurry pumps, and the 242-25H Evaporator feed pump to prevent contaminated salt and sludge in the waste tank from flowing into the pump columns and to cool and lubricate the pump shaft and associated bearings. Slurry and transfer pumps are typically interlocked to stop if the associated Bearing Water Supply low pressure alarm is actuated.

2.8.2.7 CSTF Effluent System

The effluent systems include storm sewer zones and storm sewer ditches. Typically, the storm sewers collect wastewater from cleanout port encasements, drainage ditches, steam drains, cooling water effluent, and leaks from various fluid systems. Wastewater runoff is collected and diverted to the ETP retention basins.
2.9 AUXILIARY SYSTEMS AND SUPPORT FACILITIES

2.9.1 299-H MAINTENANCE FACILITY

The Waste Management Maintenance Facility, Building 299-H, is a Hazard Category 3 facility used for the repair and modification of equipment used in the radioactive waste management program.

Building 299-H contains support areas, located in the low-bay area, and operational areas. Support areas include offices, a tool crib, change rooms, and a regulated shop.

Operational areas include the High Bay Area (including a receiving area or truckwell, a decontamination cell, a storage/test cell, and a repair cell), a Waste Collection Tank (WCT), a CFA, and Auxiliary Support/Utility Systems. The WCT, CFA, ventilation, and steam supply interface with the Separations Facilities.

- **High Bay Area**

  The truckwell contains a traveling crane used to remove concrete cell covers from the decontamination, repair, and storage cells and to transfer equipment between cells. The truckwell is considered a contaminated area and is ventilated by an exhaust fan that draws air from the truckwell, through HEPA filters and through a stack to the atmosphere. CAMs sample the discharge from the stack.

  The decontamination cell contains a 304L stainless steel, 3,600-gallon decontamination tank in which nitric acid solution is used for decontamination of equipment placed into the tank using an in-cell hoist and trolley. When decontamination is complete, contaminated nitric acid solution is drained from the decontamination tank through the cell floor drain and into the WCT. The decontamination cell is ventilated by air circulated through the repair cell and drawn through the sand filter by the Building 292-H fans.

  The storage/test cell is ventilated by air supplied by the cell air-handling unit that circulates to the repair cell. The storage and repair cells have floor drains that drain to the WCT.

- **Waste Collection Tank**

  The WCT receives spent acid solution from the decontamination tank, fluids from the maintenance facility floor drains, segregated water return, and spray nozzle flush water. The WCT capacity is 1,680 gallons. The contents of the WCT are pH adjusted to greater than 9.5 by the addition of caustic from the sodium hydroxide storage tank via a sump drain that communicates with the WCT. Waste is then jetted through a Separations low level waste header in the 211-H Area, then to HPT-5, and finally to a waste tank. The WCT is contained within a covered, lined, concrete pit with a lined sump and leak detection.
- **299-H CFA**
  Nitric acid and caustic are supplied, via overhead lines from the 211-H CFA, at 50 wt. % and 30 wt. %, respectively, to two 420-gallon storage tanks in the 299-H CFA. Both tanks have agitators (to keep chemicals in the solution), level indication/alarm, and temperature indication/alarm. The tanks vent through the Vessel Vent System to a blower upstream of the decontamination cell.

- **Auxiliary Support/Utility Systems**
  Ventilation for 299-H is aided by the Building 292-H sand-filter exhaust fans. Air is circulated from the storage cell to the repair cell and then through exhaust fans to the decontamination cell. Back-flow of canyon air to the storage and repair cells is prevented by interlocks that shut down the exhaust fans to the decontamination cell in the event of low flow, low vacuum to the sand filter, or when sand filter exhaust fans are off. Back-flow of canyon air to the decontamination cell is prevented by the unidirectional sand-filter exhaust fan rotation.

  Medium pressure steam is supplied to Building 299-H at 150 psig and is used to supply steam to the waste transfer jets, the chemical cleaning jet, and to steam clean contaminated equipment. Part of the steam is reduced to 25 psig at the 299-H reducing station for supply to ventilation unit heaters.

  A dedicated SDG and UPS is provided at Building 299-H.

2.9.2 **COLD FEEDS AREA**

The CFA, located outdoors and east of the HTF, includes a diked concrete pad containing various chemical storage tanks. The dike is sized to contain at least 10,000 gallons, which is the volume of the largest tank within the dike. The chemicals are delivered in tank trucks (to unloading stations near the tanks) and are pumped into the tanks.

The CFA spill containment tank is the collection point for spills at the CFA unloading station but outside of the CFA curbed area. The capacity of the tank is 13,000 gallons (20 feet by 10 feet by 8.67 feet), and the sides and bottom are constructed of 10-inch-thick reinforced concrete. The tank lid is ¼-inch steel with penetrations for an open 2-inch tank vent, sump pumpout lines, and liquid-level instrumentation. The tank floor is sloped to a 2-foot sump with a sump pump. Spills drain through a 6-inch line through a side wall penetration. The top of the tank is 8 inches above ground.

The CFA is located in part south of the MCU Sample Enclosures and partly east of the MCU Contactor Enclosure. The CFA has been modified to include components necessary for the MCU process and makes use of existing equipment/vessels in the area. The CFA provides various support services for the MCU process as discussed in Section 2.4.6.3.

The Scrub Feed Tank is located outside the 10,000-gallon capacity dike, but is contained in a partial diked area with a capacity of approximately 2,400 gallons. The tank itself has liquid level indication. In addition a nearby sump with level indication and control room alarm, also provide notification in case of a containment breach.
2.9.3 CHEMICAL ADDITION

Chemical additions to waste tanks are sometimes required from external sources (e.g., tanker trucks, drums). These additions are typically required in order to inhibit corrosion of the waste tank. During the chemical cleaning process, an external source will also be used for OA additions to the tank to support residual sludge heel removal. Typically, chemical additions are made through dedicated addition routes using temporary hoses from the external source to a downcomer connection at the tank top. A small portable chemical unloading manifold is used to allow venting, draining and flushing the hoses after the transfer is complete.
2.10 REFERENCES


## 2.11 TABLES

**Table 2.3-1**  
Current, Historical, and Projected Facility Use

<table>
<thead>
<tr>
<th>FACILITY</th>
<th>CURRENT USE</th>
<th>HISTORICAL USE (a)</th>
<th>PROJECTED USE</th>
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</thead>
<tbody>
<tr>
<td>Tank 1F</td>
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Table 2.3-1  Current, Historical, and Projected Facility Use (Continued)

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<td>Tank 18F (Type IV)</td>
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<td>Tank 24H (Type IV)</td>
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<tr>
<td>Tank 25F (Type IIIA)</td>
<td>Waste Storage</td>
<td>242-16F Evaporator concentrate receipt</td>
<td>Sludge, saltcake, and supernate storage.</td>
</tr>
<tr>
<td>Tank 26F (Type IIIA)</td>
<td>Waste Storage</td>
<td>221-F Canyon fresh waste receipt, 242-16F Evaporator feed tank</td>
<td>Sludge, saltcake, and supernate storage.</td>
</tr>
<tr>
<td>Tank 27F (Type IIIA)</td>
<td>Waste Storage</td>
<td>242-16F Evaporator concentrate receipt</td>
<td>Sludge, saltcake, and supernate storage.</td>
</tr>
<tr>
<td>FACILITY</td>
<td>CURRENT USE</td>
<td>HISTORICAL USE (a)</td>
<td>PROJECTED USE</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------</td>
<td>-----------------------------------------------------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>Tank 28F (Type IIIA)</td>
<td>Waste Storage</td>
<td>242-16F Evaporator concentrate receipt</td>
<td>Shudge, saltcake, and supernate storage.</td>
</tr>
<tr>
<td>Tank 29H (Type III)</td>
<td>Waste Storage</td>
<td>242-H Evaporator concentrate receipt</td>
<td>Saltcake and supernate storage.</td>
</tr>
<tr>
<td>Tank 31H (Type III)</td>
<td>Waste Storage</td>
<td>242-H Evaporator concentrate receipt</td>
<td>Shudge, saltcake, and supernate storage.</td>
</tr>
<tr>
<td>Tank 33F (Type III)</td>
<td>Waste Storage</td>
<td>221-F Canyon fresh waste receipt</td>
<td>Shudge, saltcake, and supernate storage.</td>
</tr>
<tr>
<td>Tank 34F (Type III)</td>
<td>Waste Storage</td>
<td>221-F Canyon fresh waste receipt</td>
<td>Shudge, saltcake, and supernate storage.</td>
</tr>
<tr>
<td>Tank 35H (Type IIIA)</td>
<td>Waste Storage</td>
<td>221-H Canyon fresh waste receipt</td>
<td>Shudge, saltcake, and supernate storage.</td>
</tr>
<tr>
<td>Tank 36H (Type IIIA)</td>
<td>Waste Storage</td>
<td>221-H Canyon fresh waste receipt, 242-H Evaporator concentrate receipt</td>
<td>Saltcake and supernate storage.</td>
</tr>
<tr>
<td>Tank 38H (Type IIIA)</td>
<td>Waste Storage</td>
<td>242-16H Evaporator concentrate receipt, DWPF recycle receipt</td>
<td>Saltcake and supernate storage. 242-16H Evaporator concentrate receipt tank. DWPF recycle receipt.</td>
</tr>
<tr>
<td>Tank 39H (Type IIIA)</td>
<td>Waste Storage</td>
<td>221-H Canyon fresh waste receipt</td>
<td>Shudge, saltcake, and supernate storage.</td>
</tr>
<tr>
<td>Tank 40H (Type IIIA)</td>
<td>Sludge washing and storage, feed to DWPF</td>
<td>Receipt tank for sludge removed from other tanks</td>
<td>Sludge washing and storage. Feed to DWPF.</td>
</tr>
<tr>
<td>Tank 41H (Type IIIA)</td>
<td>Waste Storage</td>
<td>221-H Canyon fresh waste receipt, 242-16H Evaporator concentrate receipt, DWPF recycle receipt</td>
<td>Sludge, saltcake, and supernate storage. DWPF recycle receipt.</td>
</tr>
<tr>
<td>Tank 42H (Type IIIA)</td>
<td>Waste Storage</td>
<td>Receipt tank for sludge removed from other tanks, demo tank for Extended Sludge Processing</td>
<td>Sludge, saltcake, and supernate storage.</td>
</tr>
<tr>
<td>FACILITY</td>
<td>CURRENT USE</td>
<td>HISTORICAL USE (a)</td>
<td>PROJECTED USE</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Tank 43H (Type IIIA)</td>
<td>Waste Storage</td>
<td>221-H Canyon fresh waste receipt, 242-16H Evaporator feed tank, DWPF recycle receipt</td>
<td>Shudge, saltcake, and supernate storage. 242-16H Evaporator feed tank, DWPF recycle receipt</td>
</tr>
<tr>
<td>Tank 44F (Type IIIA)</td>
<td>Waste Storage</td>
<td>242-16F Evaporator concentrate receipt</td>
<td>Shudge, saltcake, and supernate storage.</td>
</tr>
<tr>
<td>Tank 45F (Type IIIA)</td>
<td>Waste Storage</td>
<td>242-16F Evaporator concentrate receipt</td>
<td>Shudge, saltcake, and supernate storage.</td>
</tr>
<tr>
<td>Tank 46F (Type IIIA)</td>
<td>Waste Storage</td>
<td>242-16F Evaporator concentrate receipt</td>
<td>Shudge, saltcake, and supernate storage.</td>
</tr>
<tr>
<td>Tank 47F (Type IIIA)</td>
<td>Waste Storage</td>
<td>221-F Canyon fresh waste receipt, 242-16F Evaporator concentrate receipt, reactor basin sludge receipt, SRNL waste receipt</td>
<td>Shudge, saltcake, and supernate storage.</td>
</tr>
<tr>
<td>Tank 48H (Type IIIA)</td>
<td>Salt precipitate and supernate storage (high benzene-producing waste)</td>
<td>Main reaction tank for the ITP process</td>
<td>Salt precipitate and supernate storage. Disposition existing inventory to allow future use in processing salt.</td>
</tr>
<tr>
<td>Tank 49H (Type IIIA)</td>
<td>Salt Processing/ARP Feed Tank</td>
<td>ITP demonstration spent wash water storage</td>
<td>Salt processing and supernate storage.</td>
</tr>
<tr>
<td>Tank 50H (Type IIIA)</td>
<td>Waste Storage, feed to Saltstone Facility</td>
<td>ITP filtrate receipt tank, ETP evaporator bottoms receipt</td>
<td>Salt processing and supernate storage. Feed to Saltstone Facility.</td>
</tr>
<tr>
<td>Tank 51H (Type IIIA)</td>
<td>Sludge washing and storage, DWPF feed preparation</td>
<td>Receipt tank for sludge removed from other tanks, 221-H Canyon fresh waste receipt, SRNL waste receipt</td>
<td>Sludge washing and storage, DWPF feed preparation.</td>
</tr>
<tr>
<td>242-F Evaporator and CTS</td>
<td>Shutdown</td>
<td>Volume reduction, Shutdown in 1988</td>
<td>To be decommissioned.</td>
</tr>
<tr>
<td>242-16F Evaporator</td>
<td>Shutdown</td>
<td>Volume reduction, Shutdown in 2012</td>
<td>To be decommissioned.</td>
</tr>
<tr>
<td>242-H Evaporator and CTS</td>
<td>Shutdown</td>
<td>Volume reduction, Shutdown in 1994</td>
<td>To be decommissioned.</td>
</tr>
<tr>
<td>241-96H ARP</td>
<td>Salt processing / ARP</td>
<td>Formerly the 241-96H Filter/Stripper Building of the ITP Facility</td>
<td>Salt processing / ARP until Salt Waste Processing Facility becomes operational.</td>
</tr>
</tbody>
</table>
### Table 2.3-1  Current, Historical, and Projected Facility Use (Continued)

<table>
<thead>
<tr>
<th>FACILITY</th>
<th>CURRENT USE</th>
<th>HISTORICAL USE (a)</th>
<th>PROJECTED USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>241-278H MCU</td>
<td>Remove / reduce cesium content from ARP feed</td>
<td>N/A</td>
<td>Remove / reduce cesium content until Salt Waste Processing Facility becomes operational.</td>
</tr>
</tbody>
</table>

**Notes:**

(a) Use of the term “concentrated supernate” in the Historical Use column is not intended to reflect Concentrated Supernate as defined in Section 3.4.1.5.3.
Figure 2.3-1    Waste Facility General Locations
Figure 2.3-2  F-Tank Farm Layout
Figure 2.3-3 H-Tank Farm Layout
Figure 2.4-1  Type I Waste Tanks (Typical)
Figure 2.4-2  Type II Waste Tanks (Typical)
Figure 2.4-3  Type III and IIIA Waste Tanks (Typical)
Figure 2.4-5  Evaporator Building (Typical)
Note: Two types of Eductors

See Note: Eductor

Figure 2.4-6 242-16H Evaporator Feed System
Figure 2.4-7  Evaporator Vessel Cross Section
Figure 2.4-8 242-16H Evaporator Cell Ventilation
Figure 2.4-9    Gang Valve (Typical)
Figure 2.4-10 242-25H Evaporator Feed Pump

2.12-14
Figure 2.4-11  242-25H Primary Ventilation System
Figure 2.4-12  242-25H Secondary Ventilation System
Figure 2.4-13  Diversion Box and Pump Pit General

2.12-17
Note: This figure depicts general features of a Valve Box and is not specific to a particular facility configuration.

Figure 2.4-14   Valve Box Arrangement

2.12-18
Figure 2.4-15  Submersible Mixer Pump

2.12-19
Figure 2.4-16  242-16H Evaporator Chemical Cleaning
Figure 2.4-17  Actinide Removal Process
Figure 2.4-18  MCU Layout

2.12-22
Figure 2.5-1   MCU Process with BOBCalix-based Solvent
Figure 2.5-2  MCU Process with NGS