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WSRC-TR-92-251

COMPLIANCE REVIEW FOR THE UNH STORAGE TANK (U)

by J. M. Low

Westinghouse Savannah River Company
Savannah River Site
Aiken, South Carolina 29808

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WESTINGHOUSE SAVANNAH RIVER COMPANY
INTER-OFFICE MEMORANDUM

WSRC-TR-92-251

May 19, 1992

TO: W.L. Williams, 707-H
Manager, Project 4257, UNH Storage Tank

**DOES NOT CONTAIN
UNCLASSIFIED CONTROLLED
NUCLEAR INFORMATION**

FROM: J.M. Low, 992W-1 *JML*
Separations Analysis, NPSR

Reviewing
Official:

Ray H. Von *Safety*
Engineer
(Name and Title)

Date:

5/19/92

Compliance Review For The UNH Storage Tank (u)

INTRODUCTION:

The purpose of Project S-4257, USF-UNH 150,000 Gallon Storage Tank, is to provide interim storage for the liquid uranyl nitrate (UNH) product from H-Canyon until the UNH can be processed in the new Uranium Solidification Facility (Project S-2052). NPSR was requested by Project Management and DOE-SR to perform a design compliance review for the UNH Storage Tank to support the Operational Readiness Review (ORR) and the Operational Readiness Evaluation (ORE), respectively. The project was reviewed against the design criteria contained in the DOE Order 6430.1A, General Design Criteria. This report documents the results of the compliance review.

SUMMARY:

Project information was reviewed against applicable design criteria contained in the DOE Order 6430.1A, General Design Criteria. The review, documented in this report, demonstrates that the design and construction of the UNH Storage Tank are in compliance with the General Design Criteria (i.e. no applicable design criteria were identified as non-compliances).

DISCUSSION:

Design information was collected and reviewed to provide the information necessary to select applicable design criteria from DOE Order 6430.1A, General Design Criteria. Design information included, but was not limited to the following:

- 1) Basic Design Report
- 2) Design Specifications
- 3) the Safety Analysis Report
- 4) Technical Baseline Documentation
- 5) Project Drawings
- 6) Project Files
- 7) Operating and Emergency Procedures
- 8) Du Pont Engineering Design Standards
- 9) Site Specifications
- 10) Related Correspondence

The UNH Storage Tank was divided into the following areas for review against the design criteria provided in the General Design Criteria; the tank and support structure, associated piping into and out of H-Canyon, auxiliary systems electrical power supplies, electrical control circuits, and instrumentation (i.e. sensors, detectors, indicators, alarm units, etc.).

The results of the compliance review are summarized in tabular form. The table includes the following information: the section number, the design criterion, the status (compliance or non-compliance), additional comments, and references. The review, documented in this report, demonstrates that the design and construction of the UNH Storage Tank are in compliance with the DOE Order 6430.1A, General Design Criteria

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0110 0110-5 0110-5.2	<p style="text-align: center;">Division 1 General Requirements</p> <p><u>ARCHITECTURAL AND SPECIAL DESIGN REQUIREMENTS</u></p> <p><u>HEALTH AND SAFETY</u></p> <p><u>Safety Analysis</u></p> <p>All DOE facilities shall be evaluated for potential risks to the operators, the public, and the environment.</p> <p>Areas to be addressed in the safety analysis include, but are not necessarily limited to, the following:</p> <ul style="list-style-type: none"> • Form, type, and amount of hazardous materials (nuclear or other) to be stored, handled, or processed • Principal hazards and risks that can be encountered in facility operation, including potential accidents and predicted consequences of fire, explosion, radiation, toxic exposure, structural failure, wind, flood, earthquake, tornado, operating error, failure of essential operating equipment, and failure of safety systems • Selected design basis accidents such as DBF, DBW, DBE, DBT, DBA, and DBFL. These shall be postulated and quantified, including the rationale for selection • Principal design, construction, and operating features selected for preventing accidents or reducing risks to acceptable levels, including the safety margins used 	C	<p>A safety evaluation of the EU-S tank is included in Safety Analysis Report (SAR) DPSTSA-200-10, SUPP 11. This report addresses risk to operators, the public and the environment.</p> <p>Uranyl nitrate hexahydrate (UNH) is discussed in terms of form, type and quantity in the SAR.</p> <p>Principal hazards and their associated risks are evaluated in the SAR.</p> <p>Frequencies of occurrence along with consequence have been evaluated to determine associated risk. Risks of potential accidents are listed in SAR.</p> <p>Design basis accidents are selected and quantified in SAR. Rationale for their selection is included.</p> <p>Facility design, construction and operating features that prevent or mitigate accident consequences are included in DPSTSA-200-10, SUPP 11.</p>	Ref. 1
0110-5.3	<p><u>Emergency Preparedness Planning</u></p> <p>Each facility that has potential on-site or off-site effects during normal or abnormal operations shall have an Emergency Plan prepared which shall be incorporated with the Site Emergency Preparedness Plan.</p>	C	<p>Emergencies involving the EU-S tank will be managed with the existing facility emergency procedure.</p>	Ref. 2 Ref. 3 Ref. 4

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0110-6 0110-6.1	FIRE PROTECTION General Facilities shall comply with the following: <ul style="list-style-type: none"> • DOE 5480.4 Attachment 2, Section 2C • NFPA Codes • UL Product Directories • FM Approval Guide • DOE 5480.7 	C	National Fire Protection Association (NFPA) codes and Underwriters Laboratory (UL) standards are referenced throughout site specifications, engineering standards and design standards.	Ref. 5
0110-7	ENVIRONMENTAL PROTECTION AND POLLUTION CONTROL The construction of all DOE facilities shall comply with the environmental protection and pollution control portions of the following: <ul style="list-style-type: none"> • DOE 4700.1, Chapter V • DOE 5480.4 • DOE 5480.1B • DOE 5440.1C (5440.1D) 	C	A National Environmental Protection Act (NEPA) environment evaluation and National Emissions Standards for Hazardous Air Pollutants (NESHAP) permit review were performed. These reviews show the EU-S tank can be operated without any adverse environmental impact.	Ref. 8 Ref. 9

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0110-9	<p>OPERATION, MAINTENANCE, REPAIR, AND REPLACEMENT</p> <p>Planning and design of buildings and other structures, including their operating components and systems, shall take into account all aspects of operation and maintenance including:</p> <ul style="list-style-type: none"> • Equipment accessibility • Dismantling • Replacement • Repair • Frequency of preventive maintenance • Inspection requirements • Personnel safety • Day-to-day operation 	C	<p>The listed aspects of operation and maintenance have been considered in the planning and designing of the EU-S tank and discussed in the following documents:</p> <ul style="list-style-type: none"> • Basic Data Report #88-17, Rev. 2 • Specification 2-246020 • Design Process Hazards Review 8244505-1 • Operational Safety Requirements, Uranyl Nitrate Storage Facility 	<p>Ref. 10 Ref. 11 Ref. 12 Ref. 13</p>
<p>0110-13</p> <p>0110-13.2</p> <p>0110-13.2.1</p>	<p>PHYSICAL PROTECTION</p> <p><u>Access Control and Security Areas</u></p> <p>General</p> <p>Security areas shall be established when the nature, size, revealing characteristics, sensitivity, or importance of classified matter or associated security interests is such that access to them cannot be effectively controlled by other internal measures. The type of security area established depends on the nature of the security interests to be protected, with following types required for the protection of the listed security interests:</p> <p><i>Protected Area to control Category I and II quantities of special nuclear material</i></p>	C	<p>The EU-S tank contains Category II quantities of Special Nuclear Material (SNM) in accordance with criteria of DOE Order 5632.2A. The tank is constructed within the H-Area limited area. Project S-2891 is intended to bring the UNH tank into compliance. A Temporary Security Plan, TSP-90/04/03-2-H-04-013, to allow operation of the tank in limited area until security upgrades are accomplished has been approved by WSRC. This plan is based on the graded safeguards concept, and is in compliance with the site CSA (WSRC-RP-90-12) for DOE Order 5632.2.</p>	<p>Ref. 14</p>

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0110-99 0110-99.0 0110-99.0.1	SPECIAL FACILITIES <u>Nonreactor Nuclear Facilities-General</u> General The type and level of hazard shall be determined for each functional area of the special facility, the attendant degree of risk established, and the possibility of cross-contamination considered.	C	Hazards associated with the EU-S tank have been determined and reviewed in the following Process Hazard Reviews (PHRs): · PHR 200-H-437 · UE&C 8244505-1 · WSRC-PH-90-104 The risk associated with selected hazards are evaluated in DPSTSA-200-10, SUPP 11.	Ref. 1 Ref. 12 Ref. 15 Ref. 16
	Radioactive and hazardous materials (chemicals, feed wastes, etc.) shall be segregated from each other to minimize the generation of mixed waste.	C	UNH contained in EU-S tank is segregated from other hazardous materials used in 211-H. Nitric acid and water are the only service lines tied into the EU-S tank.	Ref. 1
	In addition, areas where radioactive materials are used shall be designed for ease of decontamination during building usage and also for decommissioning after the building life cycle.	C	Contamination control and ease of decontamination during tank life were incorporated into tank design. The tank and associated piping are constructed of stainless steel to limit corrosion. An enclosed sample station drains any spillage back to the tank. The tank is surrounded by a curbed area which drains to a pumpable sump. Stainless steel construction, drainable piping and placement of High Efficiency Particulate Air (HEPA) filters will ease decommissioning of the tank. A decommissioning plan will be developed for EU-S tank before shutdown.	Ref. 1 Ref. 10 Ref. 11 Ref. 38 Ref. 39
0110-99.0.4	Building Layout The design of the facility shall include controlled access to areas of potential hazards within the facility.	C	The EU-S tank is located inside the H-Area limited area, which limits access to those personnel authorized to enter the area. The tank is also located inside the A-line Radiologically Controlled Area (RCA) boundary. Entry to the RCA is controlled by Health Protection personnel and procedures.	Ref. 1 Ref. 14

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0110-99.0.4 (continued)	The arrangement and location of process equipment and its maintenance provisions shall ensure that exposure to radiation and other hazardous materials is within the requirements of DOE 5480.11 and DOE 5480.10, respectively. In addition, exposures shall be maintained ALARA. The design shall protect workers sufficiently from hazards to ensure that workers can perform actions required during normal operations, anticipated operational occurrences, and postulated DBAs. The design shall ensure prompt, safe shutdown in emergencies, and allow ready access to areas where manual corrective actions are required and to areas that contain radiation monitoring equipment.	C	The amount of process equipment to be operated at the tank is minimal. Minimum operations at the tank and the low radiation hazard of UNH will maintain exposure to radiation and other hazardous materials ALARA and within the requirements of DOE 5480.11 and 5480.10. The tank is designed to maintain confinement for all postulated DBAs. Access to Nuclear Incident Monitor (NIM) gamma readout is provided in the 221-H control room.	Ref. 1 Ref. 10 Ref. 37
	Storage facilities shall be physically separated from process operations, areas for the storage of nonnuclear materials or equipment, and functions not directly required for storage operations. Physical protection of stored SNM shall comply with the DOE 5632 series.	C	The EU-S tank is physically separated from the USF and H-Canyon and the 211-H chemical storage facility. A Safeguards and Security Plan and Material Accountability and Control Plan have been generated and approved by DOE.	Ref. 1 Ref. 14 Ref. 17
0110-99.0.8	<p>Personnel and Public Safety</p> <p>The design of special facilities shall reduce the consequences of normal and DBA events by incorporating ALARA design concepts. Occupancy time, spacing, remote handling equipment, and shielding shall be considered. Automatic monitoring and alarm devices shall be provided (where required by the form and potential hazard of the material being handled or stored) to detect the presence of significant levels or increases of radioactivity and, if feasible, any other hazardous materials, either released in the special facility or escaping from it. (Where monitoring devices are not available for specific contaminants, sampling devices shall be substituted and be evaluated on a frequency sufficient to detect release levels of interest.) Cautionary systems or interlocks shall prevent inadvertent entry into hazardous areas. All safety alarm systems shall annunciate inside of the special facility so as to identify hazardous areas. The need for visual alarm devices within the special facility, in addition to audible alarm devices, shall be considered. Where alarms can preclude or minimize exposures outside of the facility, they shall be provided (such as criticality alarms or evacuation alarms).</p>	C	The tank is designed to withstand the forces of earthquake and tornado. Routine operation of the tank is performed remotely. HEPA filter housings are provided with testing provisions and bag in-bag out capability to minimize testing time and limit spread of contamination. Level detection and alarm is provided for the tank annulus and curbed area to detect tank leakage. NIM unit is provided to warn personnel of inadvertent criticality. The NIM alarms locally and in 221-H control room. Tank access is controlled by Health Protection personnel and procedures.	Ref. 1 Ref. 10 Ref. 11 Ref. 35

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0110-99.0.8 (continued)	Proper consideration shall also be given to chemical toxicity protection, as well as radiation protection. As an example, for unirradiated enriched uranium, under postulated accident conditions, chemical toxicity exposure will often be the controlling factor.	C	The EU-S tank will be operated under the requirements of the existing 211-H Industrial Hygiene Program and site documents DPSOP 40-5 and WSRC 8Q.	Ref. 18 Ref. 19
0111 0111-1	<u>STRUCTURAL DESIGN REQUIREMENTS</u> GENERAL The structural design drawings shall indicate the design criteria, the structural materials and their strengths with applicable materials standards, the design loads including loads that can occur during construction, and the allowable foundation loads that were used in the design.	C	Structural drawings include design criteria, materials, standards and foundation design loads.	Ref. 20
	Where earthquake resistance is required, the cognizant DOE authority should consult LBL-9143 for practical guidelines for engineering earthquake safety and management planning and technical procedures for design of new facilities or evaluation of existing ones. This document provides a process for a cost-effective plan check or third-party review of the design approach.	C	Third-party review was performed by the U.S. Army Corps of Engineers.	
0111-2 0111-2.1	<u>LOADS</u> <u>General Requirements</u> Structures and their elements shall be designed for the loads prescribed in these criteria.	C	A review of the EU-S tank design against Section 0111, "Structural Design Requirements," was performed by Army Corps of Engineers. It was determined that design of EU-S tank incorporated the requirements of DOE Order 6430.1A.	Ref. 21 Ref. 22
0111-2.2 0111-2.2.1	<u>Dead Loads</u> General Dead loads shall include the weights of all permanent materials and equipment, including the structure's own weight, supported in, or on, a structure. Load calculations shall include an allowance for any loadings anticipated to be added at a later date. Initially assumed loads shall be reviewed so that the final design reflects the configuration shown on the drawings.	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0111-2.2.2	Unit Weights The unit weights of materials and construction assemblies for buildings and other structures shall be those given in ANSI A58.1. Where unit weights are neither established in that standard nor determined by test or analysis, the weights shall be determined from data in manufacturers' drawings or catalogs.	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
0111-2.2.3	Service Equipment Design dead loads shall include the weight of all permanent service equipment.	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
0111-2.3 0111-2.3.1	Live Loads General Live loads shall include all loads resulting from the occupancy and use of the structure, whether acting vertically down, vertically up, or laterally. Operating, moving, stopping, and impact forces shall be considered part of the live loads. Live loads shall include neither dead loads nor loads from the environment, such as wind, tornado, earthquake, thermal forces, earth pressure, and fluid pressure.	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
0111-2.3.2	Buildings and Other Structures Live loads for buildings and other structures shall be those produced by the intended use or occupancy. In no case shall they be less than the minimum uniform load or concentrated load stipulated in ANSI A58.1.	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
	Live loads on roofs shall be as stipulated in ANSI A58.1. They shall include the minimum roof live loads or the snow loads and snow drifts or possible rain loads stipulated therein, whichever produces the more severe effect.	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0111-2.4 0111-2.4.1	<p><u>Wind Loads</u></p> <p>General</p> <p>The structural frame and exterior components of all buildings, signs, tanks, towers, and other exposed structures shall be designed to resist pressures due to wind assumed to act from any direction. Partial wind loading shall be considered if it produces a more severe effect.</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
0111-2.4.2	<p>Buildings and Other Structures</p> <p>Wind load design for buildings and other structures shall be determined in accordance with procedures in ANSI A58.1 with the basic wind speed being obtained from UCRL 15910.</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
	<p>The basic wind speed shall be derived from DOE site-specific hazard model studies summarized in UCRL 53526, Rev. 1 (available at DOE Field Offices or from the Office of Nuclear Safety, DOE Headquarters). If site-specific hazard model studies are not available, a hazard model shall be developed that is consistent with the approach used in UCRL 53526, Rev. 1.</p> <p>The basic wind speeds for any specific site shall be determined following the procedures in UCRL 15910, except that Exposure "C" should be used for all construction unless it can be shown that the necessary permanent shielding will be provided by natural terrain (not including shielding from trees or adjacent buildings).</p> <p>To determine the design wind loads, all factors and coefficients stipulated in ANSI A58.1 shall be applied to the site-specific basic wind speeds.</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
0111-2.5	<p><u>Tornado Loads</u></p> <p>The basic wind speed and missile parameters shall be derived from DOE site-specific hazard model studies summarized in UCRL 53526, Rev. 1. If site specific hazard model studies are not available, a hazard model shall be developed consistent with the approach used in UCRL 53526, Rev. 1.</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0111-2.5 (continued)	Facilities for radioactive material handling, processing, or storage, and other facilities having high value or vital importance to DOE programs that are classified as critical facilities, shall require special tornado loading criteria as stipulated in Section 0111-99.0, Nonreactor Nuclear Facilities--General.			
0111-2.7 0111-2.7.1	<p><u>Earthquake Loads</u></p> <p>Buildings and Other Structures</p> <p>The basic seismic parameters shall be derived from DOE site-specific hazard model studies summarized in UCRL 53582. If site-specific hazard model studies are not available, a hazard model shall be developed that is consistent with the approach used in UCRL 53582. In applying UCRL 53582, specific guidance on relating frequency of occurrence to facility hazard levels shall be obtained from UCRL 15910.</p> <p>Earthquake load design for buildings and other structures shall be determined in accordance with the procedures contained in the UBC and UCRL 15910. The provisions and design procedures of TM 5-809-10 for the application of seismic loadings to conventional buildings shall also apply. For critical facilities, the provisions and design procedures of TM 5-809-10.1 shall be used.</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
	Facilities for radioactive material handling, processing, or storage, and other facilities having high value or vital importance to DOE programs that are classified as critical facilities, shall require application of dynamic analysis in determining structural requirements for earthquake loading as stipulated in Section 0111-99.0, Nonreactor Nuclear Facilities--General.	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
	An independent review of the seismic design shall be made for facilities and buildings where a seismic event can have a potential risk to operator lives, to public safety, or of large economic loss. The review shall be made in two stages, the first at the end of preliminary design and the second before final design is complete. For additional guidance on independent reviews, see LBL-9143 and UCRL 15910.	C	An independent review of the EU-S tank seismic design was performed by the Army Corps of Engineers.	Ref. 21 Ref. 22

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0111-2.8 0111-2.8.1	<p><u>Other Loads for Buildings and Other Structures</u></p> <p>Vibratory Loadings</p> <p>Equipment supports shall be designed to avoid resonance resulting from the harmony between the natural frequency of the structure and the operating frequency of reciprocating or rotating equipment supported on the structure. The operating frequency of supported equipment shall be determined from manufacturer's data prior to completion of structural design. Resonance shall be prevented by designing equipment isolation supports to reduce the dynamic transmission of the applied load to as low a level as can be economically achieved in the design.</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
0111-2.8.3	<p>Fluid and Gas Pressures</p> <p>The design of components of buildings and other structures shall include the effects of fluid and gas pressures, both internal and external.</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
0111-2.8.4	<p>Thermal Forces</p> <p>The design of structures shall include the effects of stresses and movements resulting from variations in temperature. The rise and fall in the temperature shall be determined for the localities in which the structures are to be built. Structures shall be designed for movements resulting from the maximum seasonal temperature change. The design shall provide for the lags between air temperatures and the interior temperatures of massive concrete members or structures.</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
0111-2.8.5	<p>Creep and Shrinkage Forces</p> <p>Concrete and masonry structures shall be investigated for stresses and deformations induced by creep and shrinkage.</p> <p>For concrete and masonry structures, the minimum linear coefficient of shrinkage shall be assumed to be 0.0002 inch/inch, unless a detailed analysis is undertaken. the theoretical shrinkage displacement shall be computed as the product of the linear coefficient and the length of the member.</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0111-2.10	<p><u>Combination of Loads and Design Requirements for Buildings and Other Structures</u></p> <p>Combination of loads, allowable stresses, and strength requirements for buildings and other structures shall be as stipulated in the UBC, except as otherwise indicated in 0111-99, Special Facilities.</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
0111-3.4 0111-3.4.1	<p><u>Foundations</u></p> <p><u>General Requirements</u></p> <p>The provisions of the UBC shall be the minimum requirements for foundations design. The potential adverse effects of frost heave and movements due to expansive soils shall also be considered in the design.</p> <p>For all structures, Section 0201, Subsurface Investigations, shall be complied with to determine subsurface conditions, recommended foundation type, allowable design soil bearing pressure, seismic potential, and differential settlement.</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
0111-99 0111-99.0 0111-99.0.1	<p><u>SPECIAL FACILITIES</u></p> <p><u>Nonreactor Nuclear Facilities--General</u></p> <p><u>General</u></p> <p>Facilities containing plutonium, other radioactive material, or other material that would be likely to produce significant health or safety hazards shall be evaluated as to the degree of risk, and more stringent criteria applied in structural design, as necessary.</p> <p>The design of structures, including their supports, that are confinement system barriers shall ensure satisfaction of the functional requirements for the specific confinement system they are part of.</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0111-99.02	<p>Tornado and Extreme Wind</p> <p>Determination of Design Basis Tornado</p> <p>DOE site-specific hazard model studies summarized in UCRL 53526, Rev.1 (available at DOE Field Offices or from the Office of Nuclear Safety, DOE Headquarters), shall be used to select the DBT and extreme wind characteristics for the design of structures. If site-specific hazard model studies are not available, a hazard model shall be developed consistent with the approach used in UCRL 15910.</p> <p>In applying UCRL 53526, Rev. 1, specific guidance on relating frequency of occurrence to facility hazard levels shall be obtained from UCRL 15910.</p> <p>In designing for tornado or extreme wind resistance:</p> <ul style="list-style-type: none"> • The tornado rotational speed shall be appropriately combined with the translational speed. • Resulting loads from the rate of pressure drop, taking into consideration any pressure equalization due to permissible venting, shall be combined with velocity-induced pressure loads as stipulated in UCRL 15910. • Both small high-velocity missiles and massive low-velocity missiles shall be considered separately in terms of penetration, perforation, or crushing effects. The horizontal and vertical velocities of the missiles shall be combined in the design. • The minimum wind speed used shall be 70 mph. <p>Loads resulting from the DBT shall be assumed capable of occurring at any time. However, for design purposes, DBT loads need not be assumed to occur simultaneously with other severe site-related events such as earthquake, fire or flood, except where the simultaneous occurrence is related (e.g., fire from lightning or other wind related causes).</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0111-99.0.4	<p>Earthquakes</p> <p>General</p> <p>The systems, components, and structures that shall be designed to meet these special facility criteria shall be identified through a written evaluation (see Section 0111-99.0.1, General). Such systems, components, and structures shall be designed to provide their passive or active functions as required by the SAR in accord with their designated safety classes.</p> <p>Site-specific seismic parameters shall be determined for a DBE. The SSE shall be equivalent to the DBE.</p> <p>New seismic design, including additions or modifications to existing structures, shall be reviewed by a qualified, independent organization. This review must include evaluation of the design approach, the lateral force resisting system, and the design detailing, per UCRL-15910. TM-5-809-10 can be used for design detail guidance.</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
	<p>Earthquake Occurrence</p> <p>The DBE shall be assumed capable of occurring at any time, except that the simultaneous occurrence with any other limiting site-related event such as a tornado, fire, or flood need not be considered for design purposes, except where the joint occurrence is causally related (e.g., fire or flood).</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
	<p>Determination of DBE</p> <p>Generally, a DBE shall have a ground acceleration of 0.1g or greater. To determine the DBE, site-specific earthquake hazard models and response spectra given in UCRL 53582, Rev. 1, shall be used to select the appropriate seismic ground acceleration. Design guidance in UCRL 15910 shall be used in applying UCRL 53582, Rev. 1. Site-specific studies can be substituted for the UCRL 53582, Rev. 1, data where no data exist or where a higher level of detail is required. The DBE shall be defined by design response spectra, appropriate for the site, or by acceleration time histories, representative of the anticipated ground motions.</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0111-99.0.4 (continued)	<p>Seismic Analysis</p> <p>The adequacy of systems, components, and structures to withstand a seismic event shall be verified by a dynamic analysis, except where it can be demonstrated that the use of a simplified approach, such as a static load method, component testing, or a combination of testing and analysis provides assurance of adequate seismic design. The ratio of vertical-to-horizontal acceleration shall be two-thirds, unless site-specific data justify the use of a different ratio.</p>	C	See comment at 0111-2.1, "General," concerning Army Corps of Engineers review.	Ref. 21 Ref. 22
0140	<p>QUALITY ASSURANCE</p> <p>Facility design shall be conducted under QA requirements to ensure that the established program and project quality objectives are satisfied. A QA program shall be developed and implemented in compliance with DOE 5700.6B and using the elements of DOE 4700.1 and ANS ANSI/ASME NQA-1.</p>	C	The USF project Quality Assurance (QA) plan (applicable to EU-S tank) is based upon the Savannah River QA Plan and the Savannah River Plant QA Manual. DPSPM-SITE-1 and DPW-83-111-3, SR QA Plan and SRP QA Manual respectively, were reviewed to determine compliance. The documents were prepared to implement requirements of DOE 5700.6.B. Elements of 4700-1 and ANS ANSI/ASME NQA-1 were used in development.	Ref. 23
	<p>Control mechanisms shall be established to ensure that:</p> <p>(1) design inputs are correctly translated into design documents in a timely manner; (2) organizational and physical interfaces are identified and controlled; (3) changes to design are controlled in a manner commensurate with the original design; (4) the design is independently verified to be adequate; (5) documentation and records of the design verification process are maintained in accordance with the QA program.</p>	C	The USF Project QA Plan complies with these items.	Ref. 24
	<p>The QA program shall include quality control functions in the following areas:</p> <ul style="list-style-type: none"> • The design will satisfy program and project requirements. • The prepared drawings and construction specifications adequately incorporate QA, design, and codes and standards requirements and are available in timely manner. • Construction can be performed in accordance with design. 	C	The USF Project QA Plan complies with these items.	Ref. 24

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0140 (continued)	<ul style="list-style-type: none"> Tests, reviews, or inspections confirm the adequacy of design and quality of construction and manufactured components, where appropriate. Lock and tag systems are provided for turnover acceptance, maintenance, and system outages. <p>Provisions shall be made for review and checking design calculations, drawings, and construction specifications by qualified personnel other than those responsible for the original design.</p>			
0200 0200-2	<p style="text-align: center;">Division 2 Site and Civil Engineering</p> <p><u>SITE DEVELOPMENT</u></p> <p>BUILDING LOCATION</p> <p>New buildings and building additions shall be located in accordance with the site development plan. During site selection for new buildings the following conditions and requirements shall be considered:</p> <ul style="list-style-type: none"> Architectural and functional compatibility with the environment Operation and service functional relationships Natural topographic and geologic conditions Existing cultural and archeological resources Historical sites Abandoned mines or wells and potential for subsidence Endemic plant and animal species Availability of existing utility services Building setback requirements Availability of existing road systems Traffic volume 	C	Applicable siting criteria are addressed in the Basic Data Report and Safety Analysis Report.	Ref. 1 Ref. 10

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0200-2 (continued)	<ul style="list-style-type: none"> Refuse handling and loading zone requirements Adequacy for parking, future expansion, and other land use requirements Health, safety, and environmental protection requirements Indoor air quality impacts (e.g., presence of radon in foundation soils, building materials that off-gas irritating chemical vapors and the need to "bake out" new buildings prior to occupancy) Physical protection requirements Security and safeguard requirements Energy conservation requirements Impact of site selection Minimum fire separation between buildings (in accordance with NFPA 80A) 			
0200-99 0200-99.0 0200-99.0.1	<p>SPECIAL FACILITIES</p> <p>Nonreactor Nuclear Facilities--General</p> <p>General</p> <p>Site evaluation and studies necessary to provide the technical basis for location, design, and operation (under normal conditions, severe and extreme environmental conditions, and DBA conditions) of the facility shall include but not be limited to the items indicated below. In addition, appropriate consideration shall be given to the long-term and immediate consequences of releases of radioactive or other hazardous materials to the environment.</p>	C	Site evaluation were made to provide technical basis for location design and operation of EU-S tank. In addition, release of radioactive and hazardous materials to environment were considered.	Ref. 1 Ref. 10

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0200-99.02	<p>Other Facilities and Operations</p> <p>The potential hazards from other on-site facilities and off-site sources of hazards that could affect the safety operation of the special facility shall be considered. Typical on-site hazards are fire, explosion, radioactive materials, gas mains, large quantities of explosives, flammable gases, and other hazardous materials. Off-site hazards can be due to the facility's proximity to airports, transportation routes (highways, railways, and waterways), private industrial facilities, and military facilities.</p>	C	On and off-site hazards were considered.	Ref. 1 Ref. 10
0200-99.03	<p>Services</p> <p>The proximity of the facility to utilities, the fire department, and other services shall be considered.</p> <p>The design of utility services shall provide reliability consistent with operational requirements, the value of in-process product, and the potential hazard for identifiable probable conditions. Utility systems essential to the support of safety class items shall be designed as safety class items.</p>	C	Location and design of services was considered in design and location of EU-S tank.	Ref. 1 Ref. 10
0200-99.04	<p>Meteorology</p> <p>Available meteorological data shall be considered to identify conditions that may influence the design and operation of the facility.</p>	C	Meteorologic data were considered in the safety analysis of EU-S tank and 211-H.	Ref. 1
0200-99.05	<p>Hydrology</p> <p>Site studies shall be performed to determine ground water levels, flood runoff, drainage, and other hydrological characteristics that could influence the design or operation of the facility.</p>	C	Existing hydrologic studies were considered in the safety analysis of EU-S tank and 211-H.	Ref. 1
0200-99.06	<p>Seismology</p> <p>Studies shall be performed to determine site features such as ground failure under dynamic loading, surface faulting, liquefaction, vibratory ground motion, and site amplification that could influence the design or operation of the facility.</p>	C	Existing seismologic studies were considered in the safety analysis of EU-S tank and 211-H.	Ref. 1

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0201	SUBSURFACE INVESTIGATIONS			
0201-1	GENERAL For permanent structures, subsurface conditions shall be determined by means of borings or other methods that adequately disclose solid and groundwater conditions. Data and other information obtained from prior subsurface investigations shall be used, supplemented by additional investigations at the specific location as deemed necessary by the design professional. Subsurface investigations shall be made for critical facilities.	C	A sample boring was made at the site of the EU-S tank. The information from this boring and previous site subsurface investigations was used to evaluate subsurface conditions.	Ref. 25
	Subsurface investigations shall be performed under the direction of a qualified soils engineer.	C	Subsurface investigations were performed under the direction of a qualified soils engineer.	Ref. 25
0201-2	DRILLING AND SAMPLING METHODS Drilling and sampling shall comply with ASTM standards, including ASTM D1586, ASTM D1587, and ASTM D2113. Soil samples shall be taken below existing grade and at each change in soil stratification or soil consistency. The depth of soil samples shall be determined by the solid engineer after consulting with the project engineer on site-specific design requirements.	C	The Army Corps review states that subsurface investigation complies with 6430.1A. ASTM standard D1586 was invoked as a requirement for the 1988 subsurface investigation sub-contractor, Law Engineering of Atlanta. ASTM standards D1587 (Thinwall Tubing) and D2113 (Diamond Core Boring) do not apply to this contract.	Ref. 22 Ref. 25
0201-3	FIELD AND LABORATORY REPORTS All data required to be recorded according to the ASTM or other standard test methods used shall be obtained, recorded in the field, and referenced to boring number. Soil shall be visually classified in the field logs in accordance with ASTM D2488, but the classification for final logs shall be based on the field information, the results of tests, and further inspection of samples in the laboratory by the soils engineer preparing the report. As a minimum the report shall:	C	The documented used in the reference report meet the requirements of ASTM D2488.	Ref. 25
	<ul style="list-style-type: none"> Include a chart illustrating the soil classification criteria and the terminology and symbols used on the boring logs 	C	Chart included.	Ref. 25
	<ul style="list-style-type: none"> Identify the ASTM or other recognized standard sampling and test methods used 	C	Test methods identified.	Ref. 25 Ref. 26
	<ul style="list-style-type: none"> Provide a plot plan giving dimensioned locations of test borings 	C	Plot plan provided.	Ref. 25

DOE 6430.1A Section				DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0201-3 (continued)				<ul style="list-style-type: none"> - Provide vertical sections for each boring plotted and graphically presented showing number of borings, date of test and finish, surface elevations, description of soil and fluid, hydraulic pressure required or number of blows per foot (N value), and, where applicable, depth to wet cave-in, depth to artesian head, groundwater elevation and time when water reading was made and presence of gases - Note the location of strata containing organic materials, weak materials or other inconsistencies that might affect engineering conclusions 	C	Information included in report.	Ref. 25
				Describe the existing surface conditions	C	Surface conditions described.	Ref. 25
				Summarize the subsurface conditions present	C	Surface conditions summarized.	Ref. 25
				<ul style="list-style-type: none"> - Provide pavement structural design data including California Bearing ratio tests or modulus of subgrade reaction tests 	C	Information provided.	Ref. 25
				<ul style="list-style-type: none"> - Provide a profile and/or topographic map of rock or other bearing stratum 	C	Profile provided.	Ref. 25
				<ul style="list-style-type: none"> - Analyze the probable variations in elevations and movements of subsurface water due to seasonal influences 	C	Subsurface water analyzed.	Ref. 25
				<ul style="list-style-type: none"> - Report all laboratory determinations of soil properties including shrinkage and expansion properties 	C	Soil property determinations provided.	Ref. 25
				0201-4			
				FOUNDATION ENGINEERING EVALUATION AND RECOMMENDATIONS			
				<p>The soils engineer shall analyze the information developed by investigation or otherwise available, including any aspect of the soil conditions that might affect design and construction of proposed structures, and shall consult with the engineer on the design requirements of the project. The soils engineer shall submit a professional evaluation, recommendations, and recommended construction specifications, and recommendations.</p>	C	An evaluation of subsurface conditions was made and submitted to EU-S tank project design recommendations and construction considerations.	Ref. 25

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0235 0235-1	<u>BUILDING FOUNDATIONS</u> GENERAL Building foundations shall be designed in accordance with the requirements of the UBC and ACI 318.	C	Chapter 26 of the UBC-1988 code states that it was "patterned after and in general conformity with" ACI 318. Project specification 2-246020 specifies ACI 318-83 for design of concrete tank foundation.	Ref. 11
0235-2 0235-2.2	<u>FOUNDATION DESIGN CRITERIA</u> <u>Adverse Subsurface Conditions</u> One of the following procedures shall be used to ensure satisfactory foundation performance where poor soil conditions are encountered: <ul style="list-style-type: none"> • Bypass the poor soil by means of deep foundations extending to or into a suitable bearing material • Design structure foundations to accommodate anticipated differential settlements • Remove the poor material, and either treat and replace it or substitute good compacted fill material • Treat the soil in place before construction to improve its properties 	C	The old fill was removed and reused. Fill was compacted to minimum 95% of standard Proctor maximum dry density.	Ref. 26 Ref. 27
0235-3	CONCRETE Concrete for building foundations shall be designed in accordance with Section 0330, Cast-In-Place Concrete.		See Section 0330, "Cast-In-Place Concrete."	
0320 0320-1	Division 3 Concrete <u>CONCRETE REINFORCEMENT</u> MATERIALS FOR REINFORCEMENT Reinforcement materials for buildings and other structures shall comply with ACI 318.	C	Project Specification 2-246020 specifies ACI 318-83 for design of concrete tank foundation.	Ref. 11

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
0330	<u>CAST-IN-PLACE CONCRETE</u>			
0330-2	MATERIALS, TESTING, AND QUALITY CONTROL Materials, testing, and quality control for cast-in-place concrete shall comply with ACI 318 for buildings and other structures.	C	Project Specification 2-246020 specifies ACI 318-83 for design of concrete tank foundation.	Ref. 11
	Tolerances for formed concrete shall be as suggested in ACI 347.	C	Concrete was accepted within design tolerances as set by site specifications. These tolerances are the same as ACI 347.	Ref. 11
0330-3	<u>SELECTING PROPORTIONS FOR CONCRETE MIXES</u>			
0330-3.1	<u>Normal, Heavyweight, and Mass Concrete</u> The selection of proportions of concrete mixes for normal, heavyweight, and mass concrete shall comply with ACI 211.1.	C	Project Specification 2-246020 specifies ACI-301 for materials, proportioning and constructions of structural concrete. ACI 301 is a sponsoring document for ACI 211.1. Specification 2-246020 specifies a 28 day concrete strength of 4000 psi which meets ACI 211.1.	Ref. 11
0330-4	MIXING, TRANSPORTING, AND PLACING The mixing, transporting, and placing of cast-in-place concrete shall comply with ACI 304.	C	ACI 318 and ACI 304 are sponsoring documents for ACI 211.1. Specification 2-246020 specifies a 28 day concrete strength of 4000 psi which meets ACI 304.	Ref. 11
0512	Division 5 Metals			
0512-6	<u>STRUCTURAL STEEL</u> FUEL STORAGE TANKS Fuel storage tanks shall comply with American Petroleum Institute (API) 650.	C	Project Specification 2-246020 specifies API 650 for design of EU-S tank.	Ref. 11

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1300	Division 13 Special Facilities			
1300-1	<u>GENERAL REQUIREMENTS</u>			
1300-1.4	<u>COVERAGE AND OBJECTIVES</u>			
1300-1.4.2	<u>Guidance on Limiting Exposure of the Public</u>			
	Accidental Releases			
	Releases of hazardous materials postulated to occur as a result of DBAs shall be limited by designing facilities such that at least one confinement system remains fully functional following any credible DBA.	C	The EU-S tank is designed to remain functional following credible DBAs.	Ref. 1 Ref. 10
	Facility design shall provide attenuation features for postulated accidents (up to and including DBAs) that preclude offsite releases that would cause doses in excess of the DOE 5400 series limits for public exposure. To the extent practical, ALARA concepts shall be applied when designing special facilities to mitigate post-DBA releases of hazardous materials.	C	The EU-S tank is designed to limit public exposure to levels less than DOE 5400 series limits for all postulated accidents up to and including DBA.	Ref. 1 Ref. 10 Ref. 28
1300-1.4.3	Routine Releases			
	The annual dose resulting from postulated, planned, or expected releases from the proposed facility shall be considered in combination with the annual doses resulting from planned or expected releases from other facilities at the same site. The sum of the doses from the site shall be limited according to DOE Radiation Standards of Protection of the Public in the Vicinity of DOE Facilities or subsequent guidance included in the directive on Radiation Protection of the Public and the Environment in the DOE 5400 series.	C	The annual expected dose from EU-S tank is considered in combination with remainder of the site. The cumulative dose from the site is limited in accordance with DOE 5400 series.	Ref. 29
1300-1.4.4	Releases shall be monitored in accordance with the directive on Radiological Effluent Monitoring and Environmental Surveillance in the DOE 5400 series.	C	Operation of existing equipment exhausting through the 291-H stack is currently authorized by an interim Federal Facility Compliance Agreement between DOE and EPA. Full compliance with regulatory requirements will be achieved by completion of stack monitor upgrades per Project S-4652 scope which is scheduled to be complete by June, 1992. This compliance date precedes the present UNH startup schedule.	Ref. 30

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1300-2	SAFETY ANALYSIS Safety analysis shall comply with DOE 5481.1B. See also Section 0110-5.2, Safety Analysis.	C	The SAR, DPSTSA-200-10, SUPP 11 for EU-S tank complies with DOE Order 5481.1B.	Ref. 1
1300-3 1300-3.2	SAFETY CLASS CRITERIA Safety Class Items Safety class items are systems, components, and structures, including portions of process systems, whose failure could adversely affect the environment or the safety and health of the public. Specifically, safety class items are those systems, components, and structures with the following characteristics: <ul style="list-style-type: none"> • Those whose failure would produce exposure consequences that would exceed the guidelines in Section 1300-1.4, Guidance on Limiting Exposure of the Public, at the site boundary or nearest point of public access • Those required to maintain operating parameters within the safety limits specified in the OSRs during normal operations and anticipated operational occurrences • Those required for nuclear criticality safety • Those required to monitor the release of radioactive materials to the environment during and after a DBA • Those required to achieve and maintain the facility in a safety shutdown condition • Those that control the safety class items described above 	C	These criteria, along with consequence criteria from DOE/TIC 11603 were used to determine safety class items associated with the EU-S tank. The methodology established for selection of safety class items is presented in WSRC-RP-89-441. Based on this methodology, only the NIM units are safety class.	Ref. 31 Ref. 32
	Safety class items shall be subject to appropriately higher-quality design, fabrication, and industrial test standards and codes such as those specified in Section 0106, Regulatory Requirements, and Section 0109, Reference Standards and Guides, to increase the reliability of the item and allow credit to be taken for its capabilities in a safety analysis. Safety class items shall be design to the ASME Boiler and Pressure Vessel Code (Section III) or to other comparable safety-related codes and standards that are appropriate for the system being designed.	C	NIM units are designed, installed and tested in accordance with approved site specifications.	Ref. 33 Ref. 34

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1300-3.2 (continued)	Safety class and non-safety class items shall comply with Section 0140, Quality Assurance. The design of systems, components and structures that are not safety class items shall, as a minimum, be subject to conventional industrial design standards, codes, and quality standards. Failure of these items shall not adversely affect the environment or the safety and health of the public. In addition, their failure shall not prevent safety class items from performing their required functions.	C	The project QA plan controls all aspects of design, procurement, inspection and testing. The only safety class items are the NIMs. Failure of non-safety class items will not prevent NIMs from performing required functions.	Ref. 24
1300-3.3	<u>Single Failure Criterion and Redundancy</u> The design shall ensure that a single failure does not result in the loss of capability of a safety class system to accomplish its required safety functions. To protect against single failures, the design shall include appropriate redundancy and shall consider diversity to minimize the possibility of concurrent common-mode failures of redundant items.	C	NIM units are supplied in pairs to ensure that the failure of one does not result in loss of monitoring capability.	Ref. 1 Ref. 34
1300-3.4 1300-3.4.1	<u>Equipment Environment Considerations</u> <u>General</u> Safety class items shall designed to withstand the effects of, and be compatible with, the environmental conditions associated with operation, maintenance, shutdown, testing, and accidents. The environmental capability of equipment shall be demonstrated by appropriate testing, analysis, and operating experience, or other methods that can be supported by auditable documentation, or a combination of these methods.	C	NIM units are designed and installed to withstand expected environmental conditions.	Ref. 33
1300-3.4.2	<u>Environmental Qualification of Equipment</u> Equipment qualification shall provide assurance that safety class items will be capable of performing required safety functions under DBA conditions. The qualification shall demonstrate that the equipment can at least perform for the period of time that its safety functions are required. Subsequent equipment failure, after its safety function is no longer required, may be allowable.	C	Environmental qualification of NIMs is not addressed explicitly. DPSTM-NIM, Nuclear Instrument Alarm System Technical manual states that NIM units should be placed so as not to be affected by steam or radio frequency interference. The NIMs installed at the EU-S tank are sheltered from the weather and capable of performing required safety functions under DBA conditions.	Ref. 34

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1300-3.4.2 (continued)	Temperature, pressure, and humidity environments shall be based on the most severe postulated accident affecting the particular item. The postulated environment shall reflect an environment that considers both radiological composition (e.g., elements, isotopes, total radioactivity) and chemical composition (e.g., abrasives, acids, smoke, caustic vapors) of all material physical forms likely to affect the equipment.			
1300-3.4.3	Equipment Operability Qualification Testing or a combination of testing and analysis shall be the preferred method of demonstrating the operability of fluid system components, mechanical equipment, instrumentation, and electrical equipment that are required to operate during and following a DBE. Seismic experience data may be used as an alternative to testing or dynamic analysis where such data have been documented and validated.	C	Site Specification 9765 requires NIM installation to remain operational following SRS design basis earthquake.	Ref. 33
1300-3.5	Maintenance Safety class items shall be designed to allow inspection, maintenance, and testing to ensure their continued functioning, readiness for operations, and accuracy.	C	NIMs are designed to allow inspection, maintenance and testing.	Ref. 34
	The design of all process equipment shall include features to minimize self-contamination of the equipment, piping and confinement areas. The design of process equipment shall also include features to minimize the spread of contamination out of local areas.	C	All piping and connections are welded to minimize leakage. Piping runs are designed to drain following transfer of UNH. The sample enclosure drains back to the tank to contain any spillage.	Ref. 10
1300-3.6	Testing The design shall include provisions for periodic testing of monitoring, surveillance, and alarm systems. In addition, the design shall provide the capability to test periodically, under simulated emergency conditions, safety class items that are required to function under emergency conditions.	C	The design allows for periodic testing of monitoring, surveillance and alarm systems.	Ref. 34
	The facility design shall allow for routine in-place testing of HEPA filtration systems as outlined by ASME N510.	C	Design of HEPA filtration systems allows for in place testing as outlined in ASME N510.	Ref. 35

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1300-4	NUCLEAR CRITICALITY SAFETY The design of nuclear criticality control provisions, including equipment and procedures, shall meet, as a minimum, the requirements of DOE 5480.5 and the ANS 8 series on Nuclear Criticality Safety.	C	DOE 5480.5 is referenced in criticality analysis of the EU-S tank, while applicable parts of ANS 8 are referenced in analysis of NIM placement and Operational Safety Requirements.	Ref. 13 Ref. 36
	Nuclear criticality safety shall be achieved by exercising control over both the quantity and distribution of all fissile materials and other materials capable of sustaining a chain reaction, and over the quantities, distributions, and nuclear properties of all other materials with which the fissile materials and other materials capable of sustaining a chain reaction are associated. Design considerations for establishing such controls shall be mass, density, geometry, moderation, reflection, enrichment, interaction, material types, and nuclear poison.	C	Nuclear criticality safety is achieved by exercising control over U-235 concentration in UNH.	Rev. 13
	The design shall ensure that material shall not be displaced or allowed to accumulate to form a critical mass in the event of an internal or external accident. The design shall emphasize geometrically favorable compartments or spacing to minimize reliance on administrative control, and shall prevent the unsafe accumulation of moderator or reflection materials (e.g., water from a fire sprinkler system).	C	The tank is designed to maintain confinement of UNH for all postulated accidents up to and including DBAs. Design of the tank does not emphasize favorable geometrically. The primary nuclear criticality safety control is concentration control. The concentration of U-235 in UNH is maintained well below that concentration required for criticality.	Ref. 1 Ref. 13
	Process designs shall incorporate sufficient factors of safety so that at least two unlikely and independent concurrent changes must occur in process conditions before a criticality accident is possible.	C	Double contingency criticality analyses of UNH tank were performed to determine sufficient safety factors in process design.	Ref. 1
	Nuclear criticality safety shall be controlled, in decreasing priority, by geometric spacing, density and/or mass limitation, fixed neutron absorber, soluble neutron absorber, and administrative control. The design of the facility shall emphasize engineered safeguards and shall not rely strictly on administrative controls.	C	The primary nuclear criticality safety control for the UNH tank is concentration control. The concentration of U-235 in UNH is maintained well below that concentration required for criticality.	Ref. 13

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1300-4 (continued)	Where frequency estimates for a specific operation at a specific location shows the frequency of a criticality accident to exceed 10^{-6} per year, the combination of shield design and facility layout shall minimize radiation doses to adjacent work stations and exit routes. Egress routes shall be provided that take into account the locations where postulated criticality accidents would normally be expected to occur. The design objective should be to provide escape routes that have the lowest potential of radiation exposure to exiting personnel. For facilities where the design cannot avoid evacuation through areas of potentially high exposure, the use of additional shielding in such areas shall be considered. All barriers along egress routes shall be designed to allow crash exiting of evacuating personnel.	C	Nuclear criticality hazard evaluation showed the basin sump to be the only area where a criticality accident could exceed 10^{-6} per year. Egress routes are provided away from the tank to limit the potential of radiation exposure.	Ref. 1 Ref. 36
1300-5	SOURCE AND SPECIAL NUCLEAR MATERIAL When the safety analysis identifies the source and SNM that will be handled, the criteria for the most hazardous material shall be applied to the design. The criteria of ANSI N16.1 shall apply. In-process source or SNM shall be stored in storage containers to be approved by facility management, and simple physical barriers shall be used to segregate materials and provide a level of confinement and safety consistent with the hazard of the material.	C	Special nuclear material (UNH) is stored in double wall tank designed to withstand all postulated DBAs. ANSI N16.1 (ANS 8) was referenced for placement of NIMs and in Operational Safety Requirements.	Ref. 1 Ref. 10 Ref. 13 Ref. 36
1300-6 1300-6.1	RADIATION PROTECTION General Special facilities shall be designed to minimize personnel exposures to external and internal radiological hazards, provide adequate radiation monitoring and alarm systems, and provide adequate space for health physics activities. Primary radiation protection shall be provided by the use of engineered controls (e.g., confinement, ventilation, remote handling, equipment layout, and shielding); secondary radiation protection shall be provided by administrative control. ALARA concepts shall be applied to minimize exposures where cost-effective.	C	The design of the EU-S tank and the low radiation hazard level of UNH minimize internal and external personnel exposures. Health protection facilities in place for A Line will be used for EU-S tank. Confinement of UNH provides primary radiation protection, while administrative control is provided by current Health Protection personnel and procedures.	Ref. 1 Ref. 10 Ref. 11 Ref. 29

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1300-6.5 1300-6.5.1	<p><u>Monitoring, Warning, and Alarm Systems</u></p> <p><u>General</u></p> <p>All monitoring systems shall be calibrated annually with appropriate national standards to ensure validity of reported values. Environmental monitoring is discussed in Section 1300-9, Effluent Control and Monitoring. All radiation monitoring, alarm, and warning systems that are required to function during a loss of normal power shall be provided with an emergency UPS (internal or external on-line) unless it is demonstrated that they can tolerate a temporary loss of function without losing needed data and they are provided with standby or emergency (switched) power. Determination of the power supply type and quality shall be based on the safety classification of the monitoring system or device.</p>	C	Installed NIMs provide criticality warning. They are provided with a battery backup should normal power fail. The NIMs are calibrated with a source traceable to national standards. Other monitoring systems are tested in accordance with surveillance requirements included in the Operational Safety Requirements.	Ref. 13 Ref. 33 Ref. 34
1300-6.5.4	<p><u>Ionizing Radiation Monitoring System</u></p> <p>Where ionizing radiation is present (due to process material, equipment, or operations), an area radiation monitoring and alarm system shall be provided to alert personnel of unexpected increases in ionizing radiation levels.</p>	C	Nuclear incident monitors are provided to warn personnel of inadvertent criticality.	Ref. 1
1300-6.5.5	<p><u>Warning and Alarm System Features</u></p> <p>Warning and alarm systems shall be designed, installed, and tested to ensure that they can be heard in the ambient conditions of the area they are intended to cover.</p>	C	Site Specification 9765 requires NIM units to be installed and tested to ensure they can be heard in ambient conditions.	Ref. 33
1300-6.5.7	<p><u>Central Radiation Monitoring and Alarm Readout</u></p> <p>In addition to a local station alarm, radiation monitoring systems (criticality alarms, CAMSs, alarms associated with stack monitoring systems, and so on) shall have central (i.e., control room or radiation monitoring office) readout and alarm panels that are accessible after a DBA to evaluate internal conditions.</p>	C	Indication of gamma levels at EU-S tank are provided in 221-H control room. This allows evaluation following NIM alarm.	Ref. 37

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1300-7 1300-7.2	<p>CONFINEMENT SYSTEMS</p> <p><u>General</u></p> <p>The number of confinement systems required in different locations of a facility may vary depending on the potential consequences from hazards during normal operation, anticipated operational occurrences, and DBAs. Although individual confinement systems are not required to withstand the effects of every accident, they shall effectively perform their required functions for the DBAs they are required to withstand. Sufficient redundancy shall be provided in the unlikely event of a confinement system failure. At least one of the confinement systems shall be designed to ensure that it can withstand the effects of severe natural phenomena and man-made events (see Section 0111-99.0, Nonreactor Nuclear Facilities-General), including the postulated DBAs and DBF initiated by these events, and remain functional to the extent that the guidelines of Section 1300-1.4.2, Accidental Releases, are not violated. The adequacy of the design of these confinement systems to effectively perform their required functions shall be demonstrated by the safety analysis. To the extent practical, the ALARA concept shall be applied to the design of all confinement systems to minimize exposure to hazardous materials.</p>	C	The EU-S tank is designed to maintain confinement of UNH for all postulated DBAs.	Ref. 1 Ref. 10
1300-8 1300-8.5	<p>WASTE MANAGEMENT</p> <p><u>Spill Prevention and Control</u></p> <p>Spill prevention and control shall be considered in the design stage of the facility to minimize the possibility of accidentally releasing hazardous waste to the environment.</p>	C	A curb is constructed around the EU-S tank to collect any potentially contaminated runoff from the tank. The sample housing drains all spillage back to tank.	Ref. 10 Ref. 38
1300-8.6	<p><u>Approvals and Permits</u></p> <p>The construction of a new facility or modification of an existing facility that either releases hazardous wastes (including airborne radioactive effluents (see 40 CFR 61, Subpart H)) to the environment or manages hazardous wastes shall in most cases be approved by the EPA or authorized State agency prior to the beginning of construction. In addition to obtaining approval for construction or modification of a facility, operating permits shall also be obtained for facilities that manage hazardous wastes as specified in RCRA.</p>	C	The Environmental Protection Agency has reviewed USF (including EU-S tank) air emission estimates and determined that construction of the USF does not constitute a modification as defined in 40 CFR 61.16. Therefore revision to existing NESHAP permit is not required. Actual releases will be monitored to ensure they agree with estimates.	Ref. 8

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1300-8.6 (continued)	Environmental discharges of any effluent, including hazardous and nonhazardous wastes, shall meet applicable Federal and State laws and regulations and DOE orders. The limits specified in discharge permits for these effluents shall be considered during the design of the facility.	C	The construction of USF and EU-S tank will not effect limits contained in existing permits.	Ref. 8 Ref. 28
1300-9	EFFLUENT CONTROL AND MONITORING Routine wastes from special facilities will normally be in the form of solids, liquids, and gases. The waste management systems shall provide facilities and equipment to handle these wastes safely, effectively, and in an environmentally responsible manner.	C	The EU-S tank is vented through HEPA filters to minimize airborne radioactivity release. Rain runoff from the tank is collected and pumped to EU sump for processing.	Ref. 10 Ref. 39
	Hazardous effluents released to the environment (radioactive and nonradioactive) shall not exceed the limits referenced in DOE 5400.1 and the directive on Radiation Protection of the Public and the Environment in the DOE 5400 series. Emphasis shall be placed on reducing effluents released to the environment to ALARA levels using the best technology economically available at the time of design. Effluents shall comply with all applicable Federal, State, and local laws and regulations. State and local laws and regulations shall be carefully consulted, as they may provide more restrictive limits than Federal laws and regulations.	C	Hazardous effluents released to environment by SRS are well within the limits of DOE 5400.5. The EU-S tank will contribute only a very small fraction of this total release.	Ref. 28 Ref. 29
	During normal operations, the effluent concentrations of radionuclides measured at the site boundary shall not exceed the DCGs specified in the directive on Radiation Protection of the Public and the Environment in the DOE 5400 series. At the point of discharge of the facility, i.e., stack or equivalent, the effluent concentration shall not exceed the DCGs specified in DOE 5480.11. The guidance on radiation protection referenced in Section 1300-1.4.3, Routine Releases, shall also apply to effluent treatment and discharge systems.	C	Analysis of USF and EU-S tank source factors shows that release due to EU-S tank is a small fraction of SRS total release. Radionuclide concentrations at site boundary are within limits of DOE 5400 series.	Ref. 28

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1300-10 1300-10.2 1300-10.2.3	PHYSICAL PROTECTION, MATERIAL SAFEGUARDS, AND STORAGE OF SPECIAL NUCLEAR MATERIAL Physical Protection Baseline Protection Requirements Category II Quantities of SNM (Special Nuclear Material) Category II quantities of SNM shall be used, processed, and stored in a protected area.	C	The EU-S tank contains Category II quantities of Special Nuclear Material (SNM) in accordance with criteria of DOE Order 5632.2A. The tank is constructed within the H-Area limited area. Project S-2891 is intended to bring the UNH tank into compliance. A Temporary Security Plan, TSP-90/0403-2-H-04-013, to allow operation of the tank in limited area until security upgrades are accomplished has been approved by WSRC. This plan is based on the graded safeguards concept, and is in compliance with the site CSA (WSRC-RP-90-12) for DOE Order 5632.2.	Ref. 14
	Category II quantities of SNM in use or process shall be under material surveillance procedures, in process under Department-approved alarm protection, or, with the approval of the responsible Head of the Field Element, protected by alternative means which can be demonstrated to provide equivalent protection.	C	A DOE approved Material Control and Access Plan is in effect.	Ref. 17
1300-10.2.5	Detection and Alarm Systems The detection sensor system shall be designed to signal an attempted intrusion, unauthorized attempt at access, or other anomalous situation.	C	The detection system detects unauthorized diversion of SNM from EU-S tank.	Ref. 14
	On detection of an anomaly, the information shall be displayed on an alarm console or the plant protective force shall be signaled in a way to assist in developing timely and appropriate response measures. (See Section 0110-99.8.7, Security Alarm control Centers, Section 0110-99.9.4, Alarm Systems, and Section 0110-99.8.5, Radio Control Centers, for additional security alarm control center requirements.)	C	Detection of unauthorized diversion of SNM from EU-S tank is signaled in 211-H control room.	Ref. 14

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1300-10.3 1300-10.3.2	<u>Material Control and Accountability (MCA) Safeguards</u> Material Control Systems Storage Areas and Vaults Material awaiting processing shall be stored in a graded system with appropriate access controls.	C	A security plan providing access controls has been submitted and approved by WSRC management. The security plan describes access controls.	Ref. 14
1300-10.3.3	<u>Material Accounting Systems</u> Measurement Systems In vessels holding solutions containing special nuclear material at inventory, volume measurement and sampling capability are necessary to establish the contents of the tank. The following shall be considered in designing such systems: · The capability should be available to mix the tank to a state of homogeneity.	C	Tank mixing capability provided.	Ref. 10
	· The sampling systems used should not dilute or concentrate the sample they are generating.	C	Sample is drawn directly from pump recirculation line.	Ref. 10
	· Tanks containing nuclear material at the time of an inventory or tanks used to establish the input or output values for an MBA (Material Balance Area) shall be recalibrated regularly (liquid level measurement).	C	EU-S tank level instrumentation will be calibrated before tank operation. The tank will be filled once and then drained as UNH is processed by USF.	Ref. 39 Ref. 40

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1300-II 1300-II.1	<p>DECONTAMINATION AND DECOMMISSIONING</p> <p><u>Decontamination</u></p> <p>Design of the areas in a facility that may become contaminated with radioactive or other hazardous materials under normal or abnormal conditions shall incorporate measures to simplify future decontamination. Such items as service piping, conduits, and ductwork shall be kept to a minimum in these areas and shall be arranged to facilitate decontamination. Filters shall be positioned in ventilation systems in locations that minimize contamination of ductwork. Walls, ceilings, and floors shall be finished with washable or strippable coverings. In some areas, metal liners shall be required. If necessary all cracks, crevices, and joints shall be caulked or sealed and finished smooth to prevent contaminated material accumulation in inaccessible areas. Finishes shall comply with Section 0900-99, Special Facilities.</p>	C	Contamination control and ease of decontamination during tank life were incorporated into tank design. The tank and associated piping are constructed of stainless steel to limit corrosion. An enclosed sample station drains any spillage back to the tank. The tank is surrounded by a curbed area which drains to a pumpable sump.	Ref. 1 Ref. 10 Ref. 11 Ref. 38 Ref. 39
1300-II.2	<p><u>Decommissioning</u></p> <p>Designs consistent with the program requirements of DOE 5820.2A shall be developed during the planning and design phases based on a proposed decommissioning method or a conversion method leading to other uses.</p> <p>Decommissioning of special facilities is of utmost importance. The facility design shall include features that will facilitate decontamination for future decommissioning, increase the potential for other uses, or both. In addition to the requirements of Section 0205, Demolition, Decontamination, and Decommissioning, the following design principles shall be considered for facilities handling radioactive and other hazardous materials:</p> <ul style="list-style-type: none"> Use of modular, separable confinements for radioactive and other hazardous materials to preclude contamination of fixed portions of the structure. 	C	Tank and piping are constructed of stainless steel. Installed piping systems are designed to drain following transfer. HEPA filters are situated close to the tank to minimize contaminated ducting. In accordance with 5820.2A, 9/26/88, a decommissioning plan will be developed prior to tank shutdown.	Ref. 1 Ref. 10 Ref. 11 Ref. 38 Ref. 39

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1306-11.2 (continued)	<ul style="list-style-type: none"> - Use of localized liquid transfer systems that avoid long runs of buried contaminated piping; emphasis on localized batch solidification of liquid waste. Special provisions should be included in the design to ensure the integrity of joints in buried pipelines. - Location of exhaust filtration components of the ventilation system at or near individual enclosures so as to minimize long runs of internally contaminated ductwork. - Equipment, including effluent decontamination equipment, that precludes, to the extent practicable, the accumulation of radioactive or other hazardous materials in relatively inaccessible areas including curves and turns in piping and ductwork. Accessible, removable inspection covers are encouraged to allow visual inspection. - Materials that reduce the amount of radioactive and other hazardous materials requiring disposal and that are easily decontaminated. - Designs that ease cut-up, dismantlement, removal and packaging of contaminated equipment from the facility (e.g., removal and dismantlement of gloveboxes, air filtration equipment, large tanks, vessels, equipment and ductwork). - Use of modular radiation shielding, in lieu of or in addition to monolithic shielding walls. - Use of lifting lugs on large tanks and equipment. - Fully drainable piping systems that carry contaminated or potentially contaminated liquids. 			
1306 1306-4	<p><u>UNIRRADIATED ENRICHED URANIUM STORAGE FACILITIES (UEUSF)</u></p> <p>RADIATION PROTECTION</p> <p>Radiation protection provisions for UEUSF shall take into account that the combination of the radioactivity level of UEU (Unirradiated Enriched Uranium), its confinement in cladding or storage containers, and the lack of significant operations involving the UEU may reduce the radiation hazards at UEUSF.</p>	C	Radiation protection is addressed in DPSTSA-200-10, SUPP 11.	Ref. 1

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1306-5	SPECIAL DESIGN FEATURES UEUSF systems, components, and structure shall be designed to provide confinement of radioactive materials under normal operations, anticipated operational occurrences, and the DBA conditions they are required to withstand. The design shall ensure that the degree of confinement is sufficient to limit releases to the environment to the extent that the dose guidelines referenced in Section 1300-1.4, Guidance on Limiting Exposure of the Public, are not exceeded. The design shall incorporate ALARA concepts to minimize overall impacts on operations, the public, and the environment.	C	EU-S tank is designed to maintain confinement for all postulated DBAs. Releases are limited to those guidelines in Section 1300-1.4, "Guidance on Limiting Exposure of the Public."	Ref. 1 Ref. 10
	Design of storage tanks for aqueous solutions of enriched uranium shall ensure that they are geometrically favorable with respect to nuclear criticality safety. When there is a tendency for solids to precipitate, vessels shall be instrumented to detect the buildup of solids and designed to facilitate removal of solids.	C	"Geometrically favorable" means that criticality safety is maintained by controlling vessel geometry in conjunction with one or more other parameters. The storage tank is geometrically favorable because geometry is controlled in conjunction with the concentration of U-235.	Ref. 13
1306-6 1306-6.1	CONFINEMENT SYSTEMS General The degree of confinement required shall suit the most restrictive hazards anticipated. Therefore, consideration shall be given to the type, quantity, and physical and chemical form of the materials to be stored. For materials in a form that is not readily dispersible, a single confinement barrier may be sufficient. However, for more readily dispersible materials such as liquids and powders and for materials with inherent dispersal mechanisms, such as pressurized cases and pyrophoric forms, multiple confinement barriers shall be considered.	C	Primary and secondary confinement is provided by EU-S tank.	Ref. 1 Ref. 10
1306-6.2	Primary Confinement System The UEU cladding or storage containers, as appropriate, shall provide primary confinement during normal operations, anticipated operational occurrences, and for all DBAs they are required to withstand.	C	The EU-S tank provides confinement for all postulated DBAs.	Ref. 1 Ref. 10
	The UFU cladding or storage containers shall be designed to provide a corrosion-resistant confinement for the fuel assemblies and other UEU to prevent an uncontrolled release of radioactive material.	C	The EU-S tank is constructed of stainless steel for corrosion resistance.	Ref. 1 Ref. 10

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1540-99 1540-99.0 1540-99.0.3	<p>Division 15 Mechanical</p> <p>SPECIAL FACILITIES</p> <p><u>Nonreactor Nuclear Facilities-General</u></p> <p>Other Collection Systems</p> <p>Consideration shall be given to the collection and monitoring of radioactive and nonradioactive contaminants in natural runoff (e.g., roof drainage).</p>	C	A curbed area is provided around the EU-S tank to collect rainwater runoff. Collected runoff is processed by the general purpose evaporator.	Ref. 10 Ref. 38
1540-99.0.6	<p>System Installation</p> <p>The following design features represent recommended practices for the installation of piping and valves carrying hazardous process fluids. In addition, the design professional shall consider the applicability of the criteria in R.G. 8.8 for piping systems carrying radioactive materials.</p>	C	<p>Site Specification 4482, Piping, is the only piping specification authorized for use at the SRS. Spec 4482 is used to establish requirements for the design, material selection, fabrication, examination, testing, installation, modification, repair and certification of piping systems at SRS. Within the context of this project, 4482 was used in the manner intended above. R.G. 8.8, "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations will be as Low as is Reasonably Achievable", provides information relevant to attaining goals and objectives for planning, designing, constructing, operating and decommissioning a light water nuclear reactor power station to meet ALARA goals regarding exposure criteria. R.G. 8.8 does not specifically require any action which shall be called out on any design specification. This guide merely provides guidance information that can be generically applied to design and installation of a facility or project involving the piping of radioactive materials. The DOE Order indicates the design professional shall "consider" the applicability of this criteria for these piping systems. The eight items under this criteria have been "considered" by actually walking down this project (3/2/92) in the field to ascertain the applicability of each statement. The results are as follows:</p>	Ref. 43

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1540-99.0.6 (continued)	<ul style="list-style-type: none"> · Pipe and valve locations as specified on approved drawings (not located at the discretion of the installer) · Valves designed and installed to operate in the stem-up orientation · Valves and other connections located to minimize the consequences of leaks · Block valves in pipes that enter or exit a process area · Piping not embedded in concrete slabs · Process valves not located at low points in the piping · Corrosion resistance of block valve and/or check valve and associated process piping equivalent and adequate · Welded joints rather than flanged connections wherever possible; butt-welded joints rather than socket-welded joints 		<p>All design drawings for this project were approved for construction in accordance with prevailing site procedures. The "installer" could not alter or change a pipe or valve location other than by following the appropriate change procedures.</p> <p>All observable valves were situated in the stem-up orientation. A few of what appeared to be sample valves (or equivalent) were oriented in the 90 to 180 degree off stem-up position.</p> <p>All connections with valving originate from the top surface of the tank. Observation also indicates the valving is located directly above the tank within the catwalk decking. Any leak would be contained by the dike immediately around the tank at its base.</p> <p>This is a common design practice and is observed as being included in this design.</p> <p>There are no observable pipes embedded in concrete. A sump pump services this tank.</p> <p>The valving associated with the tank does not appear to be situated at low points. No observable process valves were at low points.</p> <p>Although not observable, Spec 4482 inherently satisfies this concern.</p> <p>Based upon the observable connections, this item is satisfied.</p>	

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1550 1550-2 1550-2.5 1550-2.5.5	<u>HEATING, VENTILATING AND AIR- CONDITIONING SYSTEMS</u> HEATING, VENTILATING AND AIR- CONDITIONING SYSTEMS SELECTION <u>Air Handling and Air Distribution Systems</u> Air Cleaning Devices High-Efficiency Particulate Air Filters HEPA filter assemblies shall comply with ASME N509.	C	The HEPA filter assembly is considered to be the filter itself, along with the filter housing within which the filters are contained. The HEPA filters associated with this project, per Specification #03-3752, have already been procured and installed. The supplier of these filters, Flanders Filters, Incorporated, is a recognized HEPA filter manufacturer for the nuclear industry. Flanders utilizes and certifies compliance with ASME N509-1989 as well as the prevailing ANSI/ASME standards associated with the material selection, manufacturing, testing, installing and quality control associated with HEPA filters. Thus, the HEPA filters for this project are in compliance with ASME N509.	Ref. 35
	HEPA filtration system shall be used to minimize the release of particulate contaminants such as carcinogens, infectious agents, radioisotopes, or highly toxic materials when determined by safety analysis to be necessary.	C	HEPA filters are used to limit release of radionuclides.	Ref. 37 Ref. 39

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1550-2.5.5 (continued)	The design professional shall design for a location that facilitates in-place testing of HEPA filters, with particular attention given to plenum hardware provisions that allow for testing of the HEPA filter bank without requiring the testing personnel to enter the plenum. Utility services shall be extended to the plenum location (e.g., electrical receptacles and compressed air) to facilitate testing work. In-place testing design requirements shall meet all the recommendations of UL 586, ASME N510, and ERDA 76-21. HEPA filtration systems shall be designed with prefilters installed upstream of HEPA filters to extend the HEPA filter's life. The design professional may eliminate the installation of pre-filters if an analysis of filtration requirements and consideration of the filter assembly justifies omission.	C	The location of HEPA filters facilitates in-place testing. Test ports are provided to allow testing in accordance with ASME 510 and ERDA 76-21.	Ref. 35
1589-99 1589-99.0 1589-99.0.1	SPECIAL FACILITIES <u>Nonreactor Nuclear Facilities-General</u> Radioactive Airborne Effluents All airborne effluents from confinement areas shall be exhausted through a ventilation system designed to remove particulate material, vapors, and gases as needed to comply with the guidance provided in Section 1300-1.4.3, Routine Releases, and, if other hazardous materials are additionally present, with DOE 5400.1. ALARA design principles shall be implemented to minimize effluent concentrations and quantities released for all hazardous materials.	C	The limits of Section 1300-1.4.3 are complied with. ALARA design principles were implemented in design of airborne effluent system.	Ref. 1 Ref. 28

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1589-99.0.1 (continued)	All exhaust ducts (or stacks) that may contain radioactive airborne effluents shall be provided with effluent monitoring systems that are designed in accordance with the applicable requirements contained in the directive on Radiation Protection of the Public and the Environment in the DOE 5400 series and the directive on Radiological Effluent Monitoring and Environmental Surveillance in the DOE 5400 series. Backup capability for monitoring systems shall be considered in the design of each system (e.g., redundant detectors, additional sample line ports, additional sampler trains, etc.). Continuous stack sampling and continuous radiation detection shall be considered. Sampling systems shall be designed in accordance with ANSI N13.1 and associated appendixes to ensure representative sampling of the effluent stream. Isokinetic sampling shall be provided for effluent streams that are expected to contain particulate radionuclides. The range capability of continuous monitors shall cover from routine to potential DBA releases of radionuclides. Nuclear criticality safety shall be considered in the design of equipment used to treat and discharge radioactive airborne effluents.	C	Operation of existing equipment exhausting through the 291-H stack is currently authorized by an interim Federal Facility Compliance Agreement between DOE and EPA. Full compliance with regulatory requirements will be achieved by completion of stack monitor upgrades per Project S-4652 scope which is scheduled to be complete by June, 1992. This compliance date precedes the present UNH startup schedule.	Ref. 30
1605 1605-1	<p style="text-align: center;">Division 16 Electrical</p> <p><u>BASIC ELECTRICAL MATERIALS AND METHODS</u></p> <p>GENERAL</p> <p>All systems shall comply with NFPA 70 and ANSI C2. Electrical systems shall be designed so that all components operate within their capacities for initial and projected loads. Preferred standard voltages in conformance with ANSI C84.1 shall be used, with a single-voltage level characteristic in any classification, to minimize stocks of spare equipment and to standardize operating and maintenance practices and procedures.</p>	C	The Du Pont electrical engineering standards used have been shown to meet or exceed requirements of NFPA 70, National Electric Code, ANSI C2, "National Electric Safety Code," was not referenced in project specifications, however, electrical safety standards are included in the Z series of Du Pont Electrical Engineering Standards. ANSI C84.1 refers to electrical equipment voltage ratings for electrical power systems. Table-1 shows standard nominal system voltages and voltage ranges. Although there was no specific reference to ANSI C84.1 in the Project Specification, the voltages required by the design documentation (Scope of Work) are 480v 3-phase and 208/120v 3-phase, 4 wire which comply with ANSI C84.1, Table 1.	Ref. 44

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1605-1 (continued)	Electrical materials and equipment shall be UL- or FM-tested, with label attached, for the purpose intended, whenever such products are available. Where there are no UL- or FM-listed products of the type, testing and certification by another nationally recognized testing agency may be acceptable. Installation methods shall be in accordance with the manufacturer's instructions, with NFPA 70, and with other applicable requirements.	C	UL tested fixtures are specified throughout the Du Pont Electrical Engineering Standards. Installation is in accordance with NEC.	Ref. 44
	On-site acceptance testing shall be required for each major electrical system. Tests shall be specified to demonstrate that each function and important parameter is implemented. Specific criteria shall be included to determine pass/fail acceptance. Tests shall be performed in the presence of a government representative. Copies of all test results shall be submitted for approval.	C	Project QA plan describes general testing requirements. Specified electrical system tests and results are located in the Test and Inspection Plan filed in the project files.	Ref. 24 Ref. 45
1605-2 1605-2.1 1605-2.1.4 1605-2.1.5	WIRING SYSTEMS Raceways Rigid Steel Conduit and Intermediate Metal Conduit Rigid steel conduit or intermediate metal conduit shall be used in locations classified as hazardous by NFPA 70. Aluminum Conduit Aluminum conduit shall be used for high-frequency circuits where steel will cause magnetic problems or in atmospheres where steel conduit is unsuitable. Aluminum conduit shall not be used to enclose secure conductors carrying classified information (as defined by the cognizant DOE authority). Aluminum conduit shall not be installed underground, encased in concrete, or where the atmosphere is corrosive to aluminum.	C	Aluminum and rigid steel conduit are used. Secure circuits are not used in EU-S tank. Aluminum conduit is not placed in concrete or underground.	Ref. 10 Ref. 46
1605-2.2 1605-2.2.1	Conductors General Conductors for power and lighting branch circuits shall be not smaller than No. 12 AWG. No. 10 and No. 12 AWG conductors for power and lighting branch circuits shall be solid. No. 8 AWG conductors and larger shall be stranded.	C	UE&C scope of work specifies conductor sizes to be used.	Ref. 37

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1605-2.2.1 (continued)	Conductors for Class 2 low-energy remote-control and signal circuits shall be not smaller than No. 18 AWG. Power and lighting conductors shall be 600-volt, Type THW, XHHW, or THWN. Conductors required to be rated 90 degrees C in accordance with NFPA 70 shall be Type RHH, THW, or THHN. Conductors in high-temperature areas shall be NEC Type FEP or TFE as required. Direct-burial conductors shall be Type UF, UL 493. Bonding and grounding conductors shall be ASTM B1 solid, bare copper for sizes No. 8 AWG and smaller and shall be ASTM B8 Class B stranded copper for wire sizes No. 6 AWG and larger.	C	Electrical design standard DETOC specifies the selection and application of insulated cables. The listed NEC and UL designations are included. The P series of electrical design standards specifies the bonding and sizing of ground conductors. These design standards meet or exceed NEC requirements, however ASTM standards were not referenced.	Ref. 47 Ref. 48
1605-2.2.3	Conductor Identification Voltage levels, grounded conductors, equipment grounding conductors, and ungrounded phase conductors shall be identified. Existing field center wire color-code systems shall be used.	C	Electrical Engineering Standard E2T describes the identification of circuit conductors.	Ref. 46 Ref. 49
1605-2.3	Receptacles Receptacles shall comply with general grade as defined in FS W-C-596.	C	Specifications grades are derived from MIL specifications. Both MIL-HDBK-1004/4 and FS W-C-596 define receptacles for installation on 15A and 20A branch circuits that meet the requirements of UL 498 and NEMA WD-1, General Requirements for wiring devices. Therefore, the specification grades derived from MIL are the same as defined in FS W-C-596.	Ref. 50
	Receptacle circuits shall be provided with ground-fault circuit-interrupters as directed by NFPA 70.	C	Ground fault circuit interrupters are installed in accordance with electrical engineering standard E1.6P. Standard E1.6P meets or exceeds requirements of 1984 NEC.	Ref. 51
	Receptacle circuits that serve receptacles installed outdoors (except receptacles that are in secure circuits and are not readily accessible) and within 6 feet of sinks and building entrances shall be provided with ground-fault circuit-interrupters.	C	De Pont Electrical engineering standard E1.6P specifies use of ground fault circuit interrupters outdoors are in kitchens, rest rooms, locker rooms and other wet areas.	Ref. 51

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1630 1630-4 1630-4.1	<p><u>EXTERIOR ELECTRICAL UTILITY SERVICE</u></p> <p>POWER SUPPLY FOR BUILDINGS</p> <p>General</p> <p>The following factors shall be considered in the selection of power supply for buildings:</p> <ul style="list-style-type: none"> Initial and projected demand for motor, lighting, and power loads and their individual proportions to the total facility load Power utilization equipment characteristics Power supply options available from existing on-site distribution systems Available maximum short-circuit current at the service connection to the facility Investment, operating, and maintenance costs of power service options and of the facility's main service equipment 	C	The listed factors were considered and included in Basic Data Report.	Ref. 10
1630-4.2	<p><u>Voltage Levels</u></p> <p>Electric service voltage shall comply with MIL-HDBK-1004/4. For small facilities without three-phase power requirements, 240/210-volt, single-phase service may be used.</p>	C	The standard voltage levels listed in MIL-HDBK-1004/4 are taken from ANSI C84.1. NFPA 70 includes ANSI C84.1 in Article 100, "Voltage Nominal", as reference for Voltage Ratings for Electrical Power Systems and Equipment. Since the Du Pont Electrical Standards meet or exceed the requirements of NFPA 70, electric service voltage requirements are in compliance with MIL-HDBK-1004/4.	
1630-5	<p><u>LIGHTNING PROTECTION</u></p> <p>Electric power and communication services to all buildings and facilities and to underground power cables, where connected by overhead power distribution lines, shall have lightning and surge protection.</p>	C	Surge protection is provided for power services.	Ref. 10

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1639 1639-1	<u>GROUNDING</u> GENERAL Grounding systems shall comply with NFPA 70 and IEEE 142. A separate ground conductor shall be used. Raceway systems shall not be used as ground path.	C	Grounding was performed in accordance with the P series of Du Pont electrical engineering standards. These standards meet or exceed the requirements of NFPA 70 (NEC).	Ref. 44 Ref. 37
1650 1650-1	<u>EXTERIOR LIGHTING</u> GENERAL Exterior lighting systems shall comply with IES Lighting handbook. System control shall use time clock and/or photocell to provide illumination only when needed.	C	Du Pont Engineering Standard DE 2F 3.1 states that the illumination levels are based on those listed in American National Standards Practices (A 11.1-1972). These values, as stated in the above standard, are the same as those recommended by IES.	Ref. 47 Ref. 52
1660 1660-1	<u>SPECIAL SYSTEMS</u> GENERAL Uninterruptible power shall be provided for equipment that cannot sustain functions through the monetary power loss that occurs when an alternate power source comes on line and picks up the load. See Section 1660-3, Uninterruptible Power Systems.	C	Battery backup is provided for NIM circuits.	Ref. 1
	Emergency power shall be provided for protective alarm and communications systems as dictated by the system requirements. Switchover to emergency power shall be automatic on failure of the primary power source and shall be indicated on an annunciator panel. The annunciator shall be located in an occupied area and shall indicate any problems with the emergency system. Definition of "emergency systems," and "optional standby systems" shall be in accordance with NFPA 70.	C	Emergency diesel generator located in Building 292-H supplies emergency power to required equipment. Switchover to emergency power is automatic on failure of primary power.	Ref. 53

DOE 6430.1A Section	DOE 6430.1A Design Criterion	STATUS	Comment	Reference
1660-99 1660-99.0 1660-99.0.2	SPECIAL FACILITIES <u>Nonreactor Nuclear Facilities-General</u> Protection System and Instrumentation and Controls Safety class instrumentation shall sense abnormal conditions affecting safety and subsequently provide an alarm.	C	NIM units are provided to detect inadvertent criticality at the EU-S tank and alarm when setpoint exceeded.	Ref. 1
	Safety class instrumentation and control systems shall provide audible and visual alarms so that the operator can take timely corrective actions to ensure the safety of operating personnel and the public.	C	NIM units provide audio and visual alarms to warn operators of inadvertent criticality.	Ref. 1
	The safety class instrumentation shall be designed to monitor safety-related variables and safety class systems over expected ranges for normal operation, anticipated operational occurrences, DBA conditions, and for safety shutdown.	C	NIM units are designed to operate in all anticipated normal and required DBA conditions.	Ref. 1 Ref. 33
	The design of safety class instrumentation and controls shall provide suitable redundancy and diversity to ensure that safety functions can be completed, when required, and that no single failure will result in the loss of the protective functions. The safety class instrumentation and controls shall fail in a safe state following a component or channel failure or loss of power.	C	Redundant NIM units are provided to ensure safety function completed.	Ref. 1
1660-99.0.3	Qualification Protection systems and safety class instrumentation and control equipment shall be qualified to the environmental qualification requirements in Section 1300-3.4, Equipment Environment Considerations.	C	NIM units are required to be located to avoid the effects of steam and radio frequency interference.	Ref. 33 Ref. 34
1660-99.0.4	Separation and Physical Protection Redundant protection system and safety class instrument channels shall be physically protected or separated to prevent a common external event or failure of one channel from causing a failure in the redundant channel.	C	Redundant NIM units are provided for the EU-S tank. The units are independent of each other.	Ref. 1

DOE 6430.1A Section				
DOE 6430.1A Design Criterion				
STATUS				
Comment				
Reference				
1668-99.A.4 (continued)	The safety class protection system and safety class instrumentation and control system shall be appropriately separated or isolated from other instrumentation and control systems to the extent that a failure (e.g., electrical, control system) in these other systems will not degrade the safety class systems to the extent that they are unable to perform their necessary safety functions.	C	The NIM units are independent of other EU-S tank instrumentation and control	Ref. 1
1668-99.A.5	The design of protection system and safety class instrumentation and control systems shall provide for the periodic in-place testing and calibration of instrument channels and interlocks. The design shall allow periodic testing of protective functions to determine whether failure or loss of redundancy may have occurred.	C	The NIM units are designed to allow periodic testing to ensure proper functioning.	Ref. 33 Ref. 34

REFERENCES

1. Fisk, Patricia L. and Durant, William S. Safety Analysis - 200 Area Savannah River Site: Separations Area Operations Building 211-H Outside Facilities. Internal Report DPSTSA-200-11, DOE Review Draft, Westinghouse Savannah River Company, Savannah River Site, April 1990.
2. Events, Conditions, and Concerns Notifications, SOP OP-1 (U). OP2.07-01, Rev. 2, Procedure Manual SI-1, Separations PMT, Westinghouse Savannah River Company, Aiken, SC.
3. Area Emergency Coordinator Response to Chemical or Oil Spills (U). SOP 200-H-9561, Rev. 20, Procedure Manual 115-H, Westinghouse Savannah River Company, Aiken, SC.
4. Emergency Actions Following Increased Activity in Segregated Cooling Water. SOP 221-H-9406, Rev. 14, Procedure Manual SS5-5, Westinghouse Savannah River Company, Aiken, SC.
5. Du Pont Engineering Standards and Standard Engineering Specifications, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC
6. Fire Hazards Analysis Separations Area Operations. PLC Report #7, H Area, Rev. 0, E. I. du Pont de Nemours & Company, Savannah River Plant, Aiken, SC, April 7, 1988.
7. Fire Hazards Analysis. SE-DP-311, Rev. 1, Westinghouse Savannah River Company Systems Engineering Departmental Procedures, Savannah River Site, Aiken, SC.
8. Smith, Winston A. to Wright, S. R. Determination of Whether or not Addition of the Uranium Solidification Facility (USF) to the Existing H-Area Canyon Processes Constitutes a Modification as Defined in 40 CFR 61.16. United States Environmental Protection Agency, Region IV, Atlanta, GA, December 1, 1988.
9. Moyer, R. A. to Bigler, R. M. NEPA Environmental Evaluation, Uranium Solidification Facility, Project S-2052. Inter-Office Memorandum, Savannah River Site, September 28, 1988.
10. Key, J. A. Uranium Solidification Facility - Uranyl Nitrate (USF-UN) 150,000 Gallon Storage Tank, 211-H. Basic Data Report #88-17, Rev. 2.
11. Specification 2-246020. Rev. 0, Savannah River Plant, Project S-4257, October 10, 1988.
12. Design Process Hazards Review Report. USF-UN 150,000 Gallon Storage Tank, UE&C/SCD Project No. 8244.505, Du Pont Project No. 9S4257, Rev. 0, March 7, 1989.

REFERENCES (Continued)

13. Operational Safety Requirements Separations Area Operations Building 211-H Outside Facilities Uranyl Nitrate Storage Facility Savannah River Site. WSRC-RP-90-568, DOE Final Review Draft, Westinghouse Savannah River Company, Savannah River Site, September 1991.
14. Cupstid, T. J. and Rykken, L. E. Security For 211-H, A-Line Facilities. EPD-NSP-901022, March 12, 1990.
15. Process Hazards Review. PHR-H-437, Uranium Solidification Facility, Savannah River Plant, Aiken, SC, September 1988.
16. Pre-Operational Process Hazards Review. WSRC PH-90-104, Westinghouse Savannah River Company, Aiken, SC.
17. Material Control and Accountability Plan. 150,000 Gallon Storage Tank, Savannah River Site, Aiken, SC, July 1990.
18. Industrial Hygiene. DPSOP 40-5, Rev. 3, Savannah River Plant, Aiken, SC, July 1990.
19. Employee Safety Manual (U). Procedure Manual 8Q, Rev. 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC, April 1, 1991.
20. Storage Tank Design Drawings. BPF 21027, Sheets 1-60, Savannah River Site, Aiken, SC.
21. Smith, Harold, M. to Lowe, Mike. Structural Review of Liquid Uranyl Nitrate Tank. Department of the Army, Charleston, SC, June 27, 1989.
22. Catoe, R. J. to Blanco, S. Final Report on the Uranium Solidification Facility Nitrate Tank. Department of the Army, Jackson, SC, January 23, 1989.
23. Savannah River Quality Assurance Plan. DPSPM-SITE-1, Savannah River Plant, Aiken, SC, March 4, 1987.
24. USF Project Quality Assurance Plan. Project S2052, Uranium Solidification Facility, Savannah River Plant, Aiken, SC, December 14, 1988.
25. Report of Subsurface Soil Conditions for Storage Tank Site. Meuser Rutledge Consulting Engineers, NY, December 6, 1988.
26. Mayson, W. P. to Key, J. A. Inspection Reports for Controlled Backfill. Savannah River Plant Project 4257, UNH Storage Tank, Ebasco Services Incorporated, Savannah River Plant, Aiken, SC, March 24, 1989.
27. Mayson, W. P. to Gentry, S. E. Foundation Excavation. Savannah River Plant Project 4257, UNH 150,000 Gallon Storage Tank, Savannah River Plant, Aiken, SC, January 30, 1989.

REFERENCES (Continued)

28. Rideout, S. P. to Seijo, E. A. and Low, J. M. Source Terms for Environmental Releases from the Uranium Solidification Facility. Project S-2052. DPST-88-822, September 9, 1988.
29. Radiological Controls (U). Procedure Manual 5Q, Rev. 1. Westinghouse Savannah River Company, Savannah River Site, Aiken, SC, August 2, 1991.
30. H Area Canyon Exhaust Particulate Sampling. Project S4652. Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.
31. Nonreactor Nuclear Facilities: Standards and Criteria Guide. DOE/TIC-11603, Rev. 1, United States Department of Energy, September, 1986.
32. Low, J. M. to Cowen, M. L. Methodology Used To Determine Safety Class Items For The Uranium Solidification Facility (USF) (U). WSRC-RP-89-441, Westinghouse Savannah River Company, Aiken, SC, July 10, 1989.
33. Field Installation of Nuclear Incident Monitor (NIM). Site Specification 9765, Rev. 0, Savannah River Plant, Aiken, SC, October 19, 1989.
34. Technical Manual - Nuclear Incident Alarm System. DPSTM-NIM, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC, December 1989.
35. Filters, High Efficiency Particulate Air (HEPA) Equipment Specification. Specification 44505-2800-2802, Rev. 2, Savannah River Plant Project 9S4257, Savannah River Plant, Aiken, SC, August 1, 1989.
36. Determination of Nuclear Criticality Hazard in UNH Interim Storage Tank System. WSRC-TR-90-126, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC, March 27, 1990.
37. Scopes of Work. USF/UNH 150,000 Gallon Storage Tank, File No. 8244.505-44, Document I.D. 505L044, United Engineers and Constructors, Philadelphia, PA, October 17, 1989.
38. 150,000 Gallon Storage Tank, P&ID Process, Process and Instruments. W840219, Rev. 54, Savannah River Plant, Aiken, SC.
39. 150,000 Gal. Tk. Vent System, P&ID Process, Process and Instruments. W840220, Rev. 16, Savannah River Plant, Aiken, SC.
40. Calibration of the 150,000 Gallon Tank - Comparison of RUSKA and Rosemont Liquid Level Measurements. ESH-MCP-900093, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC, December 7, 1990.
41. Uranyl Nitrate Storage Tank (EU-S) Facility Startup Plan (U). NMP-SUF-910015, Rev. 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC, September 30, 1991.

REFERENCES (Continued)

42. General Purpose Evaporator - Processing Waste From Tank 716. DPSOL 231-H-4065, Rev. 13, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.
43. Process and Service Piping. Site Specification No. 4482, E. I. du Pont de Nemours & Co., Inc., Savannah River Plant, Aiken, SC.
44. Du Pont Electrical Engineering Standards. Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.
45. USF UN Storage Tank. Project 9S4257, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.
46. 150,000 Gallon Storage Tank, General Legend, Electrical. W845028, Rev. 4, Savannah River Plant, Aiken, SC.
47. Du Pont Electrical Design Standards. Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.
48. Insulated Electrical Cables, Selection and Application. Electrical Design Standard DE10C, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC, August 1984.
49. Identification of Circuit Conductors. Electrical Engineering Standard E2T, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC, August 1984.
50. Receptacles and Plugs on Sites Established After 1965. Electrical Engineering Standard E1.2N, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC, November 1987.
51. Ground-Fault Circuit Interrupters. Electrical Engineering Standard E1.6P, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC, October 1984.
52. 150,000 Gallon UNH Storage Tank, Lighting, Electrical. W835359, Rev. 2, Savannah River Plant, Aiken, SC.
53. 150,000 Gallon UNH Storage Tank, Power Plan to Fan House, Electrical. W86055, Rev. 15, Savannah River Plant, Aiken, SC.

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