ENGINEERING CHANGE NOTICE

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1. ECN 608356

Proj. ECN

2. ECN Category (mark one) Supplemental [] Direct Revision [x] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	3. Originator's Name, Organization, MSIN, and Telephone No. H. W. Henrikson, WHC QE, E6-50, 376-7903		4. Date 12-12-94
	5. Project Title/No./Work Order No. MWTF 236A	6. Bldg./Sys./Fac. No. NA	7. Approval Designator SQ
	8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-W236A-SDRD-001 Rev. 0	9. Related ECN No(s). ~~None~~ ECN 193213 12-21-94	10. Related PO No. NA

11a. Modification Work	11b. Work Package No.	11c. Modification Work Complete	11d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 11b) [X] No (NA Blks. 11b, 11c, 11d)	NA	NA Cog. Engineer Signature & Date 12/20/94	NA Cog. Engineer Signature & Date

12. Description of Change

General revision to SDRD. See page ~~2~~ 4 for summary list of changes.

Incorporated supplemental ECN 193213. 12/21/94

13a. Justification (mark one)

		Criteria Change	[x]	Design Improvement	[]	Environmental	[]
As-Found	[]	Facilitate Const.	[]	Const. Error/Omission	[]	Design Error/Omission	[]

13b. Justification Details

General revision to update FDC revision, changes due to letters of instruction, issued reports, criteria documents, and reference updates.

14. Distribution (include name, MSIN, and no. of copies)

See attached
OSTI (2 copies) L8-07

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A-7900-013-2 (06/94) GEF095

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A-7900-013-1 (06/92)

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15. Design Verification Required	16. Cost Impact		17. Schedule Impact (days)
	ENGINEERING	CONSTRUCTION	
[] Yes	Additional [] $	Additional [] $	Improvement []
[X] No	Savings N/A [] $	Savings N/A [] $	Delay N/A []

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]		[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision

20. Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog Engineer B.D. Groth *B.D. Groth*	12/21/94	PE	
Cog. Mgr. R.L. Fritz	12/22/94	QA	
QA L.R. HALL *Larry R. Hall*	12-21-94	Safety	
Safety P. L. SMITH *Pete L. Smith*	12/22/94	Design	
Security		Environ.	
Environ.		Other	
Projects/Programs			
Tank Waste Remediation System			
Facilities Operations		DEPARTMENT OF ENERGY	
Restoration & Remediation		Signature or Letter No.	
Operations & Support Services			
IRM		ADDITIONAL	
Other			

General Summary of changes:

1.0 Terminology changes: "Primary tank" changed to "Primary Storage Tank"; "Water Service Building" changed to "Service Building"; "Air Compressor Building" changed to "Air Compressor Room"; "Flush Pit" changed to "Flush Building".

2.0 FDC Appendixes renamed.

3.0 Safety Classes of the following changed: Annulus Ventilation changed to 2 from 3; Instrument Air system change to 3 from 2; Pit covers changed from 2 to 1S.

4.0 Heat loads for the heat removal ventilation system changed.

5.0 Material of Primary Storage Tank and Secondary Liner changed to Carbon Steel.

6.0 Independent Primary Ventilation system eliminated.

7.0 Spare trains of ventilation equipment reduced.

8.0 Documents: SDC 4.1 Revision 11 changed to Revision 12; ASME Sections III and VIII changed to 1993 Addenda.

9.0 Corrosion/Erosion values added.

10.0 Tables 3.3, 4.4, 4.5, 9.2 updated.

11.0 Safety Class differences with the PSAR resolved.

12.0 FDC ECN 193215 on vessel pressure criteria and primary tank gases incorporated (includes Tables 3.1 and 4.1).

13.0 FDC ECN 193212 (direct revision ECN resulting in revision 1 to the FDC) was incorporated as addressed in the descriptions above.

14.0 Air compressor description revised based on LOI 27.

15.0 Reference subsections reorganized to have one reference subsection per SDRD section. References originally appearing only in the references were added to the text.

16.0 Thermal hydraulic analysis report use added per LOI 39.

17.0 Drip ring added per LOI 32.

18.0 Correlation Matrix updated.

19.0 Acronym list updated.

20.0 Approved Material Selection Report (WHC-SD-W236A-ES-003) added.

21.0 Use of TSIP guidelines report on development of structural integity programs added.

22.0 Tank penetrations updated.

23.0 Supporting Pad terminology revised to show a two part supporting pad.

24.0 Replacement of CM 4-9 by WHC-SD-GN-DGS-30011 incorporated.

25.0 Service room and Sample Cell added to Table 9.2.

26.0 Sewage system designated as SC-3.

27.0 Use of FM 5-4/14.8 added for oil filled transformers.

28.0 Use of 0.2 to 0.3 chromium in primary tank steel added.

29.0 WAC code references corrected as to applicable dates.

RELEASE AUTHORIZATION

Document Number:	WHC-SD-W236A-SDRD-001, Rev. 1
Document Title:	Supplemental Design Requirements Document, Multifunction Waste Tank Facility, Project W-236A
Release Date:	1/6/95

This document was reviewed following the procedures described in WHC-CM-3-4 and is:

APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

V. L. Birkland   1/6/95
V.L. Birkland

SUPPORTING DOCUMENT

1. Total Pages ~~189~~ 190		
2. Title Supplemental Design Requirements Document, Multi-Function Waste Tank Facility, Project W-236A	3. Number WHC-SD-W236A-SDRD-001	4. Rev No. 1
5. Key Words Tanks, Multi-Function, MWTF	6. Author Name: B.D. Groth Signature Organization/Charge Code 7F230/DPMTF	

7. Abstract

This document provides supplemental design requirements to the Multi-Function Waste Tank Facility, Project W-236A.

8. RELEASE STAMP

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DATE JAN 1 1 1995

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RECORD OF REVISION

(1) Document Number: WHC-SD-W236A-SDRD-001

Page 1

(2) Title

SUPPLEMENTAL DESIGN REQUIREMENTS DOCUMENT, MULTI-FUNCTION WASTE TANK FACILITY, PROJECT W-236A

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release: (5) Cog. Engr.	Authorized for Release: (6) Cog. Mgr. Date
0	(7) Initial Issue, EDT 602357, 12/20/94	V.J. Cruz	J.M. Light
1	Provides for numerous minor changes as outlined in the ECN 608356. Incorporates supplemental ECN 193213.	B.D. Groth B.D. Groth	G.G. Renfro R.L. Fritz 12-22-94
W-236A IMT RS			

Supplemental Design Requirements Document

Revision 1

Multi-Function Waste Tank Facility
Project W-236A

prepared by ICF Kaiser Hanford Company
for Westinghouse Hanford Company

December 1994

Approval Sheet

Technical Author	H. W. Henrikson	12-20-94 Date
ICF KH Engineering Manager	T. C. Oten	12/20/94 Date
ICF KH Project Manager	J. D. Cloud	12-20-94 Date
WHC Approval	R.L. Fritz. Project Manager	12-22-94 Date

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Acronyms

ACI	American Concrete Institute
A/E	architect/engineer
AISC	American institute of Steel Construction
ALARA	as low as reasonably achievable
ANS	American Nuclear Society
ANSI	American National Standards Institute
AP	annulus pressure
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASIL	acceptable source impact level
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
BARCT	best available radionuclide control technology
BAT	best available technology
B&PV	boiler and pressure vessel
CADD	computer-aided design and drafting
CAM	continuous air monitors
CASS	computer automatic surveillance system
CDS	certified design specification
CFR	Code of Federal Regulations
DAC	derived air concentration
DBA	design basis accident
DBE	design basis earthquake
DCG	derived concentration guidelines
DCS	distributed control system
D/CS	design/construction specification
D/G	diesel generator
DOE	U.S. Department of Energy
DOS	di-octyl-sebacate
DR	design report
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
FACP	fire alarm control panel
FDC	Functional Design Criteria
FHA	fire hazards analysis
FIPS	Federal Information Processing Standards
FSAR	Final Safety Analysis Report
GPM	gallons per minute

Acronyms (Continued)

HEGA	high-efficiency gas adsorbers
HEME	high-efficiency mist eliminators
HEMF	high-efficiency metal fiber
HEPA	high-efficiency particulate air
HIS	Hydraulic Institute Standards
HPS	Hanford Plant Standards
HPT	health physics technician
HSRCM	Hanford Site Radiological Control Manual
HVAC	heating, ventilation, and air conditioning
HWS	Hanford work standard
ICEA	Insulated Cable Engineers Association
ICF KH	ICF Kaiser Hanford Company
ICRP	International Commission on Radiological Protection
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IOM	interoffice memorandum
ISA	Instrumentation Society of America
ISO	International standardization Organization
LCCA	life cycle cost analysis
LCU	local control unit
LOI	letter of instruction
MRP	management requirements and procedures
MWSF	Multi-Tank Waste Storage Facility
MWTF	Multi-Function Waste Tank Facility
NACE	National Association of Corrosion Engineers
NCRPM	National Council on Radiation & Measurement
NDE	nondestructive examination
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NSC	normal service category
NUREG	Nuclear Regulation
OSHA	Occupational Safety and Health Act
PCB	polychlorinated biphenyls
PIC	person in charge
PMF	probable maximum flood
PSAR	preliminary safety analysis report
PTP	primary tank pressure
PVC	polyvinyl chloride
QAP	quality assurance plan
QAPP	quality assurance program plan

Acronyms (Continued)

RAM	reliability, availability, and maintainability
RCRA	Resource Conservation and Recovery Act
RFAR	radio fire alarm reporter
RL	Department of Energy-Richland Operations Office
RLID	Richland Laboratories Implementing Directive (DOE)
RLIP	Richland Laboratories Implementing Procedure (DOE)
RTD	resistance temperature device
SAR	safety analysis report
SCADA	supervisory control and data acquisition
SDC	standard design criteria
SDRD	supplemental design requirements document
SPC	special protective coating
T-BACT	best available control technology for toxics
TAPS	toxic air pollutants
TEDF	Treated Effluent Disposal Facility
TEMA	Tubular Exchanger Manufacturing Association
TMACS	tank monitor and control system
TSEP	Tank Seismic Experts Panel
UCRL	University of California Research Lab (Lawrence Livermore National Laboratory)
UL	Underwriters Laboratory
UPS	uninterruptible power supply
UT	ultrasonic testing
WAC	Washington Administrative Code
WHC	Westinghouse Hanford Company
WSDOE	Washington State Department of Ecology
WSDOH	Washington State Department of Health
ZPA	zero period acceleration

1.0 Introduction

The Multi-Function Waste Tank Facility (MWTF) consists of four, nominal one million gallon, underground double-shell tanks, located in the 200-East area, and two tanks of the same capacity in the 200-West area. The MWTF will provide environmentally safe storage capacity for wastes generated during remediation/retrieval activities of existing waste storage tanks. The MWTF contains systems and structures required to support the function of the storage tanks for the duration of their 50-year design life. The facility will be designed to comply with all applicable U.S. Department of Energy, Richland Operations Office (RL), and state and federal regulations.

The design requirements for the facility are delineated in the Functional Design Criteria (FDC), WHC-W236A-FDC-001, Rev. 1. The requirements set forth in the FDC establish baseline criteria which shall be complied with in the design.

This Supplemental Design Requirements Document (SDRD) delineates in detail the information to be used for effective implementation of the requirements in the FDC. The SDRD contains 25 main sections. Sections 1 and 2 are introductory; sections 3 through 14 are each devoted to a major system or structure of the facility; sections 15 through 25 give the requirements on safety, environmental protection, quality assurance, and other elements of the facility design.

Each main section of sections 3 through 12 is further divided into subsections to address specific subsystems of the main system or structure. Each subsection delineates the requirements for the physical design of the subsystem and the functions the subsystem should perform. Additionally, design features that support the operation and maintenance of the facility are specified for each subsystem.

Each subsection of the SDRD contains a list of source documents that should be applied in the design. The source document list includes U.S. Department of Energy (DOE) Orders, DOE Richland Operations Office Orders, industry codes and standards, Hanford Plant Standards (HPS), Westinghouse Hanford Company (WHC) manuals, and project-specific reports. To avoid generalities, the SDRD further lists individual paragraphs of a referenced document that are specifically applicable to a subsection of the SDRD.

Lower-tier referencing is particularly useful if the referenced document covers all or several aspects of the facility design, such as DOE Order 6430.1A, General Design Criteria. Similarly, the American Society of Mechanical Engineers (ASME) codes are extensive and only certain sections of those codes are appropriate for the MWTF design. Listing of specific applicable sections of those codes will avoid confusion or uncertainty in the design and save facility designers' time and effort.

Some requirements in the FDC, such as those relating to site selection and location, are excluded from this issue of the SDRD. These requirements are addressed in separate topical reports. A table showing a correlation between the FDC and the SDRD is provided on page vi.

2.0 Purpose and Scope

The SDRD contains an upper-level synthesis of FDC requirements and lower-level requirements that will allow compliance with all applicable design requirements. This document will serve as a source of information for design and functional requirements delineated in DOE Orders, federal and state regulations, and industry standards that are considered applicable to the MWTF. However, the SDRD should not be considered as an all-inclusive document. Documents or regulations not covered in the SDRD may be used by the project if found applicable within the scope of the FDC, provided the additional applications are well documented in the project files.

The SDRD shall be used by the project as a supplemental baseline document in conjunction with the FDC. Any deviations from the SDRD requirements must have WHC approval. Should any discrepancies or contradictions occur between the FDC and the SDRD, the FDC shall take precedence.

This document shall serve as a guide for the designers to comply with the FDC requirements, while providing outside reviewers the opportunity to determine the soundness and completeness of the design without the need to examine each drawing or design document developed by the project. It also serves as a concise forum for the external reviewers to make comments and suggestions to expedite and enhance the design process, and to compare the MWTF design with similar facilities at other DOE sites.

Safety classification designations given in this SDRD are taken from the Preliminary Safety Analysis Report (PSAR), WHC-SD-W236-PSAR-001.

This SDRD contains references to interfaces with other projects. The design, construction, and operation of the MWTF (Project W-236A) shall be coordinated with and integrated with applicable projects. The following projects list is a representation of such projects:

- Project W-058, Cross Site Transfer System Replacement
- Project W-049H, 200 Area Treated Effluent Disposal Facility

3.0 Primary Storage Tank

This section delineates the design requirements for the components of the primary storage tank to meet the requirements of the FDC. This section also addresses the design and functional parameters for the primary storage tank given in Table 1 of the FDC, and summarizes the design criteria and requirements delineated in DOE Order 6430.1A, other DOE and RL Orders, the Environmental Protection Agency (EPA), the Washington State Regulations, and Industry Codes and Standards, as applicable to the design of the primary storage tanks.

In addition, this section references the design analysis reports specifically prepared for the MWTF, the Hanford Plant Standards, and the WHC Manuals, as applicable to the primary storage tank design.

The applicable FDC sections are listed below:

- Section 2.2, Waste Storage and Confinement.
- Section 2.2.1, Primary Storage Tank.
- Section 2.3, Tank Dome and Penetrations.
- Section 2.10, Design Life.
- Section 2.6, Capacities.
- Section 2.7, Tolerances.
- Section 2.8, Range of Design/Operating Conditions.
- Section 3.4.3, Tank Corrosion Monitoring.
- Section 3.4.5, Mixing System.

3.1 Primary Storage Tank

General

The underground double-shell waste storage tanks shall be designed in accordance with the criteria specified in the Functional Design Criteria (FDC), Sections 2.2.1 and 3.4.5. The inner tank is designated as the primary storage tank. The design requirements, including the structural, functional, and operational requirements, are summarized in Table 3.1, which is reproduced from the FDC.

Safety Classification

The primary storage tanks shall be designed to Safety Class 1 criteria.

Structural Requirements

- The primary storage tank design shall meet the requirements of DOE Order 6430.1A, Section 1300-3.2 for application of ASME Code. The code selection has been documented in Project W-236A document, WHC-SD-WM-ER-190.

- The primary storage tanks shall be designed and constructed in accordance with the ASME Boiler and Pressure Vessel code (ASME B&PV), Section III, Division 1, Subsection NC, Subarticle NC-3900.

- The A/E shall perform the design analysis for primary and secondary stresses, seismic, thermal, sloshing, fatigue, and dead loads for stress loading in accordance with ASME B&PV, Section III, Division 1, Subsection NC, Subarticle NC-3200. Allowable stress values used in the design analysis shall be from Tables 1A, 1B, and 3, of ASME Section II, Part D, Subpart 1. The constructor shall be responsible for the design per NC 3900.

- The A/E shall use the thermal hydraulic analysis results of WHC-SD-W236A-ER-010 in the structural analysis of the primary storage tanks.

- The A/E shall prepare a Design/Construction Specification (D/CS) which will provide the constructor with a Certified Design Specification (CDS) in accordance with the ASME Section III, Subsection NCA, and ICF KH Interoffice Memorandum (IOM), W236A-243. The CDS will include any information that may be required by the constructor to perform his design responsibilities, including the development of the Design Report (DR), in compliance with ASME Section III, Division 1, Subsection NC and Subsection NCA.

- The DR shall be certified by the constructor's Registered Professional Engineer (RPE) qualified to the requirements of ASME/ANSI N 626.3.

- An Overpressure Protection Report shall be prepared as specified in the CDS, to meet the requirement of DOE Order 6430.1A, Section 0111-99.0.7, and ASME Section III, Division I, NC-7000.

- The primary storage tanks shall be constructed of carbon steel per ASME SA-516 grade 70, normalized, in accordance with WHC-SD-W236A-ES-003 and the ASME B&PV Code, Section III, Division 1, NC-2000, and Section II, part D. A preliminary evaluation of material thicknesses is given in ICF KH Letter Report W-236A-T1-TR11.

- The chromium content of 0.2 to 0.3%, as recommended by WHC-SD-W236A-ES-003, shall be used.

- Design requirements given in Project W-236A document, "Structural Design Requirements Synthesis for the MWTF Waste Tanks" (WHC-SD-W236A-ER-004), shall be applied in the design of the primary storage tanks.
- The design requirements implicit in the above-named Synthesis Document are described in a WHC document, "Structural Design Guidelines for Multi-Function Waste Tank Facility Underground Tanks and Piping for Project W-236A" (WHC-SD-W236A-DGS-001).
- Design shall meet the requirements of Guidelines for the Development of Structural Integrity Programs for DOE High-Level Waste Tanks.
- Design shall meet the requirements of UCRL 15910, referenced in DOE Order 6430.1A, Section 0111, Structural Design Requirements, and in Hanford Plant Standard, SDC 4.1, as modified by Table 18.1 (see Section 18.0, Natural Forces).
- The primary storage tank and associated supports shall be designed to perform their safety function following a design basis earthquake (DBE) as required by DOE Order 6430.1A, Section 1323-5.1.
- Load cases and combinations specified in WHC-SD-GN-DGS-30008 and summarized in Table 3.2 shall be used in the design to meet the requirements of DOE Order 6430.1A, Section 0111-99.0.8.
- ASME Code Case N-511 shall be used to justify that the design temperature limitation of 200° F in Subparagraph NC-3921.2 of the ASME Code may be raised to 250° F.
- There shall be no mechanical attachment between the primary storage tank dome and the secondary tank liner.
- Hydrodynamic effects of the stored fluid shall be taken into consideration in the design in accordance with BNL-52361 Tank Seismic Experts Panel (TSEP) guidelines.
- In accordance with the Washington Administrative Code (WAC) and Environmental Protection Agency (EPA) requirements, provisions shall be made for inspection of the double-shell tank confinement system (tank, secondary confinement and piping) during construction to demonstrate that it will meet its intended function. The double-shell tank confinement system and ancillary equipment must be tested before use (see Section 25.0, Materials, Welding, and Inspection).
- Effects of thermal transients due to liquid level cycling in the primary storage tank shall be analyzed and included in the design. The analysis will assume the tank ventilation systems are operating as designed.
- The relationship of tank freeboard space and the resulting primary storage tank loads from fluid sloshing during seismic events shall be considered during the design. See WHC-SD-W236A-CN-001 for sloshing loads due to sloshing fluids impacting the primary storage tank dome.

Functional Requirements

- Provisions shall be made for transferring waste in and out of the primary storage tanks, mixing the tank contents, and adding water or chemicals into the tanks. The primary storage tanks shall be designed for installation of mixing and transfer pumps and in-tank instrumentation.

- Provisions shall be made for flushing, decontamination, and cleaning of the primary storage tanks, as required, to avoid mixing different wastes with incompatible characteristics. The pumpout from the tanks will be within 2% of the nominal tank volume.
- The primary storage tank, in conjunction with the secondary liner, secondary confinement structure, and the tank ventilation system, shall perform the function of a confinement system as defined in DOE Order 6430.1A, Sections 1300-7 and 1323-5.2.
- Potential for nonuniform distribution of decay heat caused by solids in the waste shall be considered in the design of the primary storage tank (DOE Order 6430.1A, paragraph 1323-5.2).
- Monitoring and leak detection devices essential to safe operations shall be provided to ensure operability under emergency conditions (DOE Order 5820.2A, Chapter I, paragraph 3.b.(3)(d)).
- The primary storage tank functional requirements are included in Table 3.1.
- The design shall prevent contamination of surface water, groundwater, soil, or other environmental resources per DOE Order 6430.1A, Section 0275-4.

Operational and Maintenance Requirements

- The operational requirements for normal and abnormal conditions are included in Table 3.1. Provisions shall be made for inspection and monitoring erosion and corrosion effects to assess primary storage tank integrity during the 50-year design life of the tanks (see Section 3.3 and Section 25.3, Inspections).
- An evaluation shall be performed to determine bounding thermal loads as a function of the waste level, assuming the tank ventilation system is unavailable (also assuming the mixer pumps are running in one case and not running in another case), and to establish the maximum length of time the tank ventilation system could remain out of service without exceeding the thermal load limits indicated by the design.
- Provisions shall be made in the design for in-service inspection of waste storage systems, as required by DOE Order 6430.1A, Section 1325-5.2, and WAC 173-303-640, paragraph (4)(i) and 40 CFR 264 (see Section 3.3 and 4.3, and Section 25.0, Materials, Welding, and Inspection).

3.2 Primary Storage Tank Dome Penetrations

General
Primary storage tank dome penetrations including risers shall be provided for installation of equipment required for in-tank monitoring, mixing, sampling, waste transfer, and other functions as specified in the FDC, Section 2.3. Penetrations shall also be provided for drains from various pits and encasements located on or near the tank, and for temporary construction access. Spare penetrations shall be provided. A list of the primary storage tank penetrations is given in Table 3.3.

Safety Classification
The primary storage tank dome penetrations (i.e., nozzles) that are within the Code boundary of the primary storage tanks shall be designed as Safety Class 1. The risers welded to the nozzles shall be designed to Safety Class 2 criteria, using Safety Class 1 seismic criteria from the code boundary to the first rigid anchor, unless designated differently in subsequent PSAR or safety equipment lists.

Structural Requirements

- The maximum dimensions and allowable shapes of the penetrations and the minimum distance between the penetrations and reinforcement requirements shall be in accordance with subarticle NC-3300 of ASME, Section III, Division 1.
- The tank dome penetrations shall be designed in accordance with the same ASME code as the primary storage tank.
- The risers above the ASME, Section III Code boundary shall be designed according to the rules of ASME B31.3, Category "M" (see Table 3.1 for pressure range). Applicability of the rules for normal fluid service conditions in lieu of Category "M" will be evaluated during the detailed design.
- Openings in the tank walls below the liquid level shall not be allowed.
- At least one spare for each size penetration shall be provided, or 10% of the total of each size, whichever is greater.
- The risers shall function as the secondary confinement to meet the requirements of WAC 173-303.
- Gasket seal material shall have a minimum radiation rating of 5 x 10 E+07 rads, be compatible with the waste materials, and have a permanent set of less than 10% in 15 years.
- Risers extending up from the penetrations in the primary storage tank that are not enclosed in pits, shall terminate at or below grade and shall be protected from traffic by traffic pads or a concrete floor with manhole covers.
- Flanged riser connections to process piping or equipment extensions shall be provided with insulated flange connection devices to provide corrosion protection, if the connections involve dissimilar metals.
- Observation risers shall have airlock valves, and the risers not in use shall be sealed to withstand the same pressure range as defined for the primary storage tank (see Table 3.1 for pressure range).
- Flanged riser extensions shall be used to accommodate equipment that extends above grade.

- Risers with above-grade equipment shall be located so as to permit crane access to all pits.

Functional Requirements

- The primary storage tank penetrations and risers shall be provided in sufficient quantities to allow all functional and operational requirements for the primary storage tank.

- Functional requirements for each penetration/riser are specified in Table 3.3.

Operational and Maintenance Requirements

- The design of the dome penetrations will allow for the operation of the primary storage tank and the installation and removal of equipment and instrumentation.

3.3 Tank Corrosion Monitoring

General
The primary storage tank shall be monitored for corrosion effects for the life of the tank, as specified in the FDC, Section 3.4.3.

Safety Classification
N/A

Structural Requirements

- Corrosion coupons shall be installed inside the tank to measure localized corrosion effects such as pitting and stress corrosion cracking.
- The corrosion coupons shall be of the same material and be made from the same heats of material as used in the primary storage tank.
- The corrosion coupons shall be prepared with welds similar to those on the primary storage tank and using the same welding material and procedures as used on the primary storage tank.
- One of the two corrosion assemblies shall be designed to rest on the bottom of the tank, and the other shall float to uphold the corrosion coupons at the normal operational level of the liquid/gas surface interface in the tank.
- Remotely replaceable electronic resistance corrosion probes with associated monitoring instrumentation shall be designed for installation inside the tank. The probe shall be designed for a minimum life of 5 years.
- The primary storage tank shall be designed with configuration to allow for internal visual inspection above the liquid level and external visual inspections of the upper and lower knuckles and tank side wall (see Section 4.3 and 25.3).
- The design shall provide for visual and UT examination of the secondary liner wall as part of inservice monitoring. Five percent of the lower knuckle region welds and five 1 ft^2 areas of the wall shall be accessible for UT examination.
- The primary storage tank exterior wall, bottom plate, and lower knuckle shall be partially UT-examined as part of inservice monitoring. The primary storage tank exterior wall shall be accessible for visual examination. The external wall surface will require approximately 5% of the liquid-vapor interface region and five 1 ft^2 areas of the cylindrical wall between the vapor area and the lower knuckle area to be accessible for UT examination, optimized for detection of pitting, at approximately 5-year intervals. Further examination requirements for the bottom and lower knuckle are given in Section 4.3.
- The overall corrosion monitoring system shall be designed based on the program described in WHC-SD-WM-EV-054.

Functional Design Requirements

- The corrosion coupon assemblies shall be easily retrievable during tank inspections.

Operational and Maintenance Requirements

- Provisions shall be made for remote installation and removal of corrosion coupons to meet the ALARA objectives and guidelines as specified in WHC-CM-1-6, Radiological Control Manual.

3.4 Tank Corrosion Protection

General
The primary storage tank design and material selection shall take into consideration the effect of corrosion to assure the structural integrity of the tanks for the life of the facility, as required by the FDC, Sections 2.2.1 and 3.4.3.

Safety Classification
N/A

Structural Requirements

- The tanks shall be of welded construction. (100% butt-welded plate joints).)
- The exterior of the tanks shall not be in contact with the soil.
- The tank material shall be compatible with the characteristics of the waste to be stored.
- The tanks shall be post-weld heated during construction to mitigate the potential for weld-stress corrosion cracking.
- Adequate corrosion allowance shall be provided in the design based on the historical and current corrosion test data. The chromium content of 0.2 to 0.3%, as recommended by WHC-SD-W236A-ES-003, shall be used.
- A drip ring shall be installed above the maximum liquid level in the tanks, as recommended by WHC-SD-W236A-ES-006.
- Cathodic protection shall be provided for the risers in contact with the soil. The need for cathodic protection for the primary and secondary tanks shall be evaluated during the design as required by DOE Order 6430.1A, Section 262 and in accordance with recommendations in the DACCO report.
- Adequate erosion protection of the primary storage tank bottom shall be provided to meet the requirements of Table 3.1 as recommended by WHC-SD-W236A-ES-002.

Functional Requirements
N/A

Operational and Maintenance Requirements
N/A

3.5 Section 3.0 References

FDC

- Section 1.0, Introduction.
- Section 2.2, Waste Storage and Confinement.
- Section 2.2.1, Primary Storage Tank.
- Section 2.3, Tank Dome Penetrations.
- Section 3.4.3, Tank Corrosion Monitoring.

DOE Order 6430.1A (1989)

- Section 0111-99.0.1, Nonreactor Nuclear Facilities - General.
- Section 0111-99.0.2, Tornado and Extreme Wind.
- Section 0111-99.0.4, Earthquakes.
- Section 0111-99.0.7, Explosion, Internal Pressurization, Criticality, and Other DBA Causes.
- Section 0111-99.0.8, Load Combinations.
- Section 0262, Corrosion Control.
- Section 0275-4, Control of Pollution from Other Sources.
- Section 1300-3.2, Safety Class Items.
- Section 1300.7, Confinement Systems.
- Section 1323-5.1, Confinement Systems - General.
- Section 1323-5.2, High-Level Liquid Waste Confinement.
- Section 1325-5.2, Radioactive Liquid Waste.

Other DOE Orders

- DOE Order 5820.2A, Radioactive Waste Management Chapter I, High-Level Waste, Paragraph 3 Requirements, 1988.

Hanford Plant Standards

- SDC 4.1, Rev. 12, Design Loads for Facilities.

Westinghouse Hanford Company

- WHC-SD-GN-DGS-30008, Rev. 0, Design Loads for New Underground Double-Shell Tanks and Associated Underground Process Piping, November 28, 1993.
- OSD-T-151-00007, Rev. H-5, Operating Specifications for the 241-AN, AP, AW, AY, AZ, and SY Tank Farms.
- WHC-CM-1-6, Radiological Control Manual, May 1993.
- WHC-SD-WM-EV-054, Double-Shell Waste Tank In-Tank Corrosion Monitoring Program, 1991.

Industry Codes and Standards

- ASME B&PV Code, Section III, Division 1, Subsection NC, American Society of Mechanical Engineers, NY, 1992 Edition with 1993 Addenda; Code Case N-511, Design Temperature for Atmospheric and 0-15 psi Storage Tanks, Section III, Classes 2 and 3.
- ASME B&PV Code, Section II, Part D, Material-Properties, 1992 Edition with 1993 Addenda.
- ASME B&PV Code, Section III, Subsection NCA, 1992 Edition with 1993 Addenda.
- ASME B31.3, Chemical Plant and Petroleum Refinery Piping, 1993.
- ASME/ANSI N626.3-88, Qualifications and Duties of Specialized Professional Engineers, Addenda through 1992.

- UCRL-15910, Design and Evaluation Guidelines for Department of Energy Facilities Subject to Natural Phenomena Hazards, 1990.
- BNL 52361, Seismic Design and Evaluation Guidelines for the Department of Energy High-Level Waste Storage Tanks and Appurtenances, prepared by Tank Seismic Experts Panel for the Department of Energy, January 1993.
- DACCO SCI, Inc. Report, Corrosion Evaluation and Protection Programs of External Surfaces for High-Level Waste (HLW) Underground Storage Tanks and Piping at the Hanford and Savannah River Sites, 1993.
- BNL Structural Integrity Panel, Guidelines for Development of Structural Integrity Programs for DOE High-Level Waste Storage Tanks, March 1994.

Codes of Federal Regulations

- 40 CFR 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, 1992; Subpart J, paragraph 264.192, Design and Installation of New Tank Systems and Components.

Washington Administrative Codes (WAC)

- WAC Chapter 173-303, Dangerous Waste Regulations, Washington State Department of Ecology, Section WAC-173-303-640, Tank Systems, December 1993.

W-236A Project Reports

- ICF KH Letter Report W-236A-T1-TR11, Primary Storage Tank Evaluation, September 1, 1994.
- W236A-243, ASME Certified Design Specification, KEH Interoffice Memorandum (IOM), April 23, 1993.
- WHC-SD-W236A-ER-004, Rev. 0, Structural Design Requirements Synthesis for the MWTF Waste Tanks, March 1993.
- WHC-SD-WM-ER-190, Rev. 0, Code Selection for Primary Tank, Secondary Confinement, and Process Piping of the Multi-Function Waste Tank Facility, March 1993.
- WHC-SD-W236A-DGS-001, Structural Design Guidelines for Multi-Function Waste Tank Facility Underground Tanks and Piping for Project W-236A, February 1994.
- WHC-SD-W236A-CN-001, Primary Tank Slosh Loads for MWTF, July 1994.
- WHC-SD-W236A-ER-010, Rev. 0, Multi-Function Waste Tank Facility Thermal Hydraulic Analysis for Title II Design, November 10, 1994.
- WHC-SD-W236A-ES-003, Multi-Function Waste Tank Facility Tank Carbon Steel Evaluation Report, 1994.
- WHC-SD-W236A-ES-006, Rev. 0, Corrosion Control in the MWTF Tank Vapor Zone, August 29, 1994.
- WHC-SD-W236A-ES-002, Rev. 0, MWTF Tank Erosion-Corrosion Recommendations, June 1994.

TABLE 3.1

PRIMARY STORAGE TANK DESIGN PARAMETERS

DESIGN PARAMETER	VALUE
Capacity	1,160,000 gal maximum
Specific Gravity	1.6
OH^-, NO_2^-, NO_3^- conc.	per OSD-T-151-00007
Temperature Limit for Stress	250° F maximum in primary storage tank steel 250° F maximum at lower knuckle of primary storage tank steel 200° F maximum in haunch and dome steel
Heat Generation	See FDC Appendix C
Stress	Refer to ASME Section III
Bottom Slope	3% minimum
Bottom Flatness	Per industry practice
General Corrosion	1 mil/yr
Pressure	Maximum: +60 in. water Minimum: -6 in. water Operating: Typically -2 to -4
Seismic	See Section 18.0 and Table 18.1
Bottom Erosion within 15 feet of Mixer Pump Nozzles	3 mil/yr
Tank Level Cycling	Maximum fill and drain rate = 160 gpm Fluid temperature = 200°F Viscosity = 30.0 cp maximum Solids, by volume = 30% Four filling cycles* per year
Material	Carbon steel

* A cycle consists of emptying and refilling the tank.

TABLE 3.2
PRIMARY STORAGE TANK DESIGN LOADS AND LOAD COMBINATIONS

Load Case		D (1)	L (2)	H_s	H_d	H_v	F_s	F_d	P_d	P_t	W_c	C_h	C_v	R_o	E_{db} or DBA or PMF	T_o
P1 (3)	Construction	1.0	(4)							1.0	1.0		1.0			
P2 (3)	Design	1.0					1.0		1.0	1.0				1.0		
P3 (3)	Operating	1.0	1.0			1.0	1.0		1.0					1.0		1.0
P4 (3)	Extreme Environmental	1.0					1.0	1.0	1.0					1.0	1.0	

D = dead loads
L = live loads, surface
H_s = lateral soil load, static
H_d = lateral soil load, dynamic
H_v = vertical soil load, static
F_s = slurry load, hydrostatic
F_d = slurry load, hydrodynamic
P_d = vapor space design pressure
P_t = leak test hydrostatic pressure
W_c = wind load, construction
C_h = concrete pour load, lateral
C_v = concrete pour load, vertical
R_o = pipe reactions
E_{db} = design basis earthquake
T_o = operating thermal loads

Notes:

1) The structural effects of creep and shrinkage shall be included with the dead load.

2) The live load shall be considered to vary from zero to full value for all load conditions.

3) Stress limits for Load Cases P1 and P2 shall be ASME Service Level A. Stress limits for Load Case P3 shall be ASME Service Level B. Stress limits for Load Case P4 shall be ASME Service Level D. For general membrane and bending stress limits P1, P2, and P4, discontinuity effects are not included. Gross structural discontinuity effects shall be included in P3 when local membrane stresses are evaluated.

4) Load combinations during construction shall be considered to be applicable during all stages of construction. It shall be the responsibility of the designer/fabricator to design all phases of construction.

TABLE 3.3

PRIMARY STORAGE TANK DOME PENETRATIONS			
RISER NO.	FUNCTION	RISER NO.	FUNCTION
1	Spare	31	Primary Vent-Through
2	Liquid Level (LIT)	32	Corrosion Sample
3	Mixing Pump	33	Corrosion Sample
4	Observation Port	34	Thermocouple
5	Gas Sample Return	35	Spare **
7	Liquid Sample Return	36	Spare
10	Spare	37	Spare *
11	Transfer Pump	38	Spare
12	Process Return	39	Gas Sample
13	Tank Pressure	40	Spare
14	Transfer Return	41	Liquid Sample Pit Drain
21	Spare *	42	Chemical Addition
22	Sludge Level	43	Cell Seal Pot Drain
25	Liquid Level (High LE)	44	Primary Air Inlet
26	Liquid Level (LI)	45	Transfer Pit Drain
29	Liquid Sample	46	Liquid Sample Return
30	Construction Opening		

NOTES:

- Unlisted riser numbers are for annulus penetrations, listed separately in Table 4.4.
- There may be more than one riser per function.
- Definitive design will determine final quantities, size, and location of all risers.

* Drain pit drain for 200-East tanks.

** Thermocouple for certain 200-East tanks.

4.0 Secondary Confinement Structure

This section delineates design requirements for the secondary confinement structure in accordance with the FDC.

This section also summarizes the design criteria and requirements delineated in DOE Order 6430.1A, other DOE and RL Orders, the Environmental Protection Agency (EPA), the Washington State Regulations, and Industry Codes and Standards, as applicable to the design of the secondary confinement structure.

In addition, the design analysis reports specifically prepared for the MWTF, the Hanford plant standards, and the WHC manuals, as applicable to the design of the secondary confinement structure are addressed in this section.

The applicable FDC sections are listed below:

- Section 2.2, Waste Storage and Confinement.
- Section 2.2.2, Secondary Confinement Structure.
- Section 2.3, Tank Dome and Penetrations.
- Section 2.4, Supporting Pad.
- Section2.8, Range of Design/Operating Conditions.

4.1 Concrete Structure

General
The secondary confinement structure is a reinforced concrete structure with a carbon steel liner as specified in the FDC, Section 2.2.2. This structure is provided for confinement of radioactive material or other hazardous liquids in the event of a leak from the primary storage tank until the liquids are removed. The concrete structure shall be designed to comply with all applicable federal, state, and Hanford site codes and standards. The design requirements including the structural, functional, and operational requirements are given in Table 4.1.

Safety Classification
The secondary confinement reinforced concrete structure shall be designed to Safety Class 2 criteria, using Safety Class 1 seismic criteria.

Structural Requirements

- The secondary confinement reinforced concrete structure shall be designed in accordance with WHC-SD-WM-ER-190 to meet the requirements of DOE Order 6430.1A, Sections 0111-99.0.8 and 1300-3.2.

- The secondary confinement reinforced concrete structure shall be designed in accordance with ACI-349 code requirements. The applicability of the ACI-349 Code is documented in the ICF KH Engineering Report W236ER5.

- The secondary confinement reinforced concrete structure shall be designed in accordance with the guidelines delineated in the TSEP Guidelines, BNL 52361.

- The A/E shall use the thermal hydraulic analysis results of WHC-SD-W236A-ER-010 in the structural analysis of the secondary confinement structure.

- Design requirements given in Project W-236A document, WHC-SD-W236A-ER-004, "Structural Design Requirements Synthesis for the MWTF Waste Tanks," shall be applied in the design of the secondary confinement reinforced concrete structure.

- The design techniques used to satisfy the requirements of the above-named Synthesis Document are described in a WHC document, " Structural Design Guidelines for Multi-Function Waste Tank Facility Underground Tanks and Piping for Project W-236A" (WHC-SD-W236A-DGS-001).

- The design shall meet the requirements of UCRL 15910, referenced in DOE Order 6430.1A, Section 0111, "Structural Design Requirements," and in Hanford Plant Standard SDC 4.1, as modified by Table 18.1 (see Section 18.0, Natural Forces).

- Load cases and combinations specified in WHC-SD-GN-DGS-30008 and summarized in Table 4.2 shall be used in the design to meet the requirements of DOE Order 6430.1A, Section 0111-99.0.8.

- There shall be no mechanical attachment between the primary storage tank dome and the secondary liner.

- The secondary liner will serve as the form for the inner surface of the concrete structure during construction.

- The secondary confinement concrete structure and associated ventilation systems shall be designed to remain functional during normal operations, anticipated operational occurrences, and the accidents as applicable to Safety Class 2 items, to meet the requirements of DOE Order 6430.1A, paragraph 1323-5.2.

- The design shall meet the requirements of Guidelines for Development of Structural Integrity Programs for DOE High-Level Waste Storage Tanks.
- The secondary confinement base slab shall be designed to the same criteria as the remainder of the structure.

Functional Requirements

- Provisions shall be made to detect leaks from the primary storage tank and to transfer the leaked liquid to other tanks on the site (see Section 16.0, Environmental Protection).
- The secondary confinement reinforced concrete structure, in conjunction with the primary storage tank, the secondary liner, and the primary and annulus tank ventilation systems, shall perform the function of a confinement system as defined in DOE Order 6430.1A, Section 1300-7.
- The functional requirements of the secondary confinement reinforced concrete structures and secondary liners are included in Table 4.1, which is reproduced from the FDC.

Operational and Maintenance Requirements

- Operational parameters are included in Table 4.1.
- Effects of thermal transients on the secondary liner and reinforced concrete structure due to liquid-level cycling in the primary storage tank shall be analyzed and included in the design. The number of such thermal cycles will be based on a 50-year life and maximum of four fill and drain cycles per year. The analysis will assume the ventilation systems are operating at the design capacity.

  However, an evaluation shall be performed to determine bounding thermal loads as a function of the waste level, assuming the tank ventilation system is unavailable, and to establish the maximum length of time the tank ventilation system could remain out of service without exceeding the thermal load limits indicated by the design for the concrete and the liner.
- In accordance with the Washington State Administrative Code (WAC) and Environmental Protection Agency (EPA) requirements, the tank system (primary storage tank, secondary confinement and piping) must be inspectable during construction to demonstrate that it will perform its intended safety function. The tank and ancillary equipment must be tested before use.
- In accordance with the Washington Administrative Code (WAC) and Environmental Protection Agency (EPA) requirements, accessible portions of the tank system must be inspected routinely for evidence of erosion, corrosion, or leakage (see Section 16.0, Environmental Protection).

4.2 Secondary Liner

General
The secondary confinement structure consists, in part, of a reinforced concrete structure with a carbon steel liner as specified in the FDC, Section 2.2.2. The liner shall be designed to comply with all applicable federal and state regulations, and industry codes and standards to perform its leak confinement function. The design parameters are included in Table 4.1.

Safety Classification
The secondary liner shall be designed to Safety Class 2 criteria, using Safety Class 1 seismic criteria.

Structural Requirements

- The carbon steel liner shall be designed and constructed in accordance with ASME Code, Section III, Division 2, Subsection CC. The applicability of the ASME Code is documented in the ICF KH Engineering Report W236ER5.
- The secondary liner shall meet the requirements of DOE Order 6430.1A, Section 1300-3.2, for application of industry codes.
- The secondary liner design shall be in accordance with the guidelines delineated in the TSEP Guidelines, "Seismic Design and Evaluation Guidelines for the Department of Energy High-Level Waste Storage Tanks and Appurtenances" (BNL 52361).
- Design requirements given in Project W-236A document WHC-SD-W236A-ER-004, "Structural Design Requirements Synthesis for the MWTF Waste Tanks," shall be applied in the design of the secondary liner.
- The design techniques used to satisfy requirements of the above-named Synthesis Document are described in a WHC document, WHC-SD-W236A-DGS-001, "Structural Design Guidelines for MWTF Underground Tanks and Piping for Project W-236A."
- The A/E shall use the thermal hydraulic analysis results of WHC-SD-W236A-ER-010 in the structural analysis of the secondary liner.
- The design shall meet the requirements of UCRL 15910, referenced in DOE Order 6430.1A, Section 0111, Structural Design Requirements, and in Hanford Plant Standard, SDC 4.1, modified by Table 18.1 (see Section 18.0, Natural Forces).
- The load cases and combinations that will be considered in the design of the secondary liner are given in WHC-SD-GN-DGS-30008, and summarized in Table 4.3.
- There shall be no direct mechanical attachment between the primary storage tank dome and the secondary liner.
- The secondary liner will serve as the form for the inner surface of the secondary confinement reinforced concrete during construction.
- The liner shall be designed to withstand strains due to reinforced concrete deformation and movement without losing its functional requirement of leak confinement.
- The liner shall be anchored to the concrete. The anchoring shall be designed in accordance with ASME Code, Section III, Division 2, Subsection CC.

Functional Requirements

- Provisions shall be made to detect leaks from the primary storage tank and to transfer the leaked liquid (see Section 16.0, Environmental Protection).

- The annular space between the primary storage tank and the secondary liner shall be sufficient enough to allow penetrations from the top for inserting liquid level and leak detection devices; equipment for visual and UT inspections of the primary storage tank and the liner; ventilation air supply and exhaust duct-work; and pumping equipment to transfer leaked material to another tank.

- Provisions shall be made for inspection and examination of the inner wall surface of the secondary liner.

- In conjunction with the primary storage tank, the secondary concrete structure, and the tank ventilation system, the secondary liner shall perform the function of a confinement system as defined in DOE Order 6430.1A, Section 1300-7, and WAC 173-303.

Operational and Maintenance Requirements

- See Operational and Maintenance Requirements in Section 4.1.

4.3 Insulating/Supporting Pad

General
An insulating/supporting pad shall be installed between the primary storage tank bottom and the secondary liner as specified in the FDC, Section 2.4.

Safety Classification
The insulating/supporting pad structure shall be designed to Safety Class 1 criteria unless designated differently in subsequent PSAR or safety equipment lists.

Structural Requirements

- The top surface of the pad shall be sloped to match the 3% slope of the bottom of the primary storage tank.

- Cooling air supply ducts terminating in an air-distribution chamber at the center of the pad shall be embedded in the insulating/supporting pad.

- The top surface of the pad shall have formed ventilating slots to serve as leak-collection channels and passages for annulus ventilation airflow. Thermocouples in conduits shall also be provided in the design.

- The insulating/supporting pad shall be designed to withstand a service temperature of 250° F.

- The design shall address the potential problem of passage obstruction due to possible degradation of the concrete or refractory material.

- There shall be no structural attachments to the insulating/supporting pad.

- The insulating/supporting pad shall be designed to withstand loads from dead weight of the primary storage tank and its contents and overburden (see Table 4.1).

- The insulating/supporting pad structure shall be designed for loads induced by a seismic event, including overturning moment and base shear response.

- The outer reinforced concrete support ring component of the insulating/supporting pad shall be designed according to the rules of ACI Code 349. Special provisions given in Appendix A of the Code with respect to limitations on concrete temperatures during normal and abnormal operating conditions shall be applied. The temperature limit specified in the Code for normal operation is 150° F. A justification for operating temperature of 250° F shall be provided by applying reduction in concrete strength in the design allowables. The reduction in concrete strength applied in the design shall be verified by testing. Evidence shall be provided to verify that the increased temperatures do not cause deterioration of the concrete with or without loads.

- The outer reinforced concrete support ring material shall be normal weight reinforced concrete with a compressive strength as required to support the design loads (see Letter Report W236LR6).

- The inner insulating refractory pad component of the insulating/supporting pad shall support the tank structure during its service life and shall protect the concrete base slab from excessive temperature during any heat treating operation on the primary storage tank.

- The outer edges of the outer and inner pad components will be restrained or otherwise protected from spalling or encroaching into the annular space.

- Slots shall be provided for inservice ultrasonic examination of the bottom of the primary storage tank. The slot configuration must provide access for UT examination to a minimum of 5% of the bottom plate of the primary storage tank. The slots shall be lined or otherwise protected to prevent degradation and loss of function during the service life of the tank (see Letter Report W236LR6).

- For inservice examination of the lower knuckle of the primary storage tank, 5% of the upper weld, at least 2.5% of the predicted maximum stress region of the knuckle base metal, and 2.5% of the lower weld, if accessible, shall be subject to UT examination. If the lower weld is not accessible, one square foot sections whose length adds up to 5% of the circumference shall be examined.

Functional Requirements

- The insulating/supporting pad shall not cause corrosion of the primary storage tank and secondary liner surfaces.

- The insulating/supporting pad shall provide a space sufficient to route the ventilation ducts to the central air distribution chamber.

Operational and Maintenance Requirements

- N/A

4.4 Annulus Penetrations

General

Secondary confinement penetrations including risers shall be provided for all secondary confinement annulus monitoring and processing operations as specified in the FDC, Section 2.3. These penetrations will serve the annulus pump pits, ventilation air inlets and exhaust, instrumentation leads, primary storage tank outside wall and secondary liner for inspection and corrosion monitoring, and for access during construction. A list of the annulus penetrations is given in Table 4.4.

Safety Classification

The annulus penetrations including risers shall be designed to Safety Class 2 criteria, using Safety Class 1 seismic criteria.

Structural Requirements

- The annulus penetrations shall be designed to the same codes and standards as the secondary liner.
- The maximum dimensions and allowable shapes of the penetrations, and the minimum distance between the penetrations shall be in accordance with ASME Code, Section III, Division 2, Subsection CC, CC-3700 and CC-3800.
- Risers that are above the secondary liner code boundaries shall be designed to ASME B31.3, Normal Service Category (NSC) rules, and form the pressure boundary for the annulus (see Table 3.1 and 4.1 for pressure range).
- The penetrations and risers shall be of the same material as the secondary liner.
- At least one spare for each size penetration shall be provided or 10% of the total of each size, whichever is greater.
- Gasket seal material shall have a minimum radiation rating of 5 x 10 E+07 rads, and have a permanent set of less than 10% in 15 years.
- Risers extending up from the penetrations in the secondary confinement that are not enclosed in pits shall terminate at or below grade, and shall be protected from traffic by traffic pads or a concrete floor with manhole covers.
- Flanged riser extensions shall be used, as needed, to accommodate equipment that extends above grade.
- Flanged riser connections to process piping or equipment extensions, shall use insulated flange connection devices to provide corrosion protection, if the connections involve dissimilar metals.
- Risers with above-grade equipment shall be located so as to permit crane access to all pits.
- The risers not in use shall be sealed in a manner to withstand the same pressure range as defined for the primary storage tank (see Table 3.1 and 4.1 for pressure range).
- Need for airlock valves for observation risers in the annulus shall be evaluated before providing them in the design.
- Openings below the haunch level are not permitted.

Functional Requirements

- Enough secondary confinement structure penetrations and risers shall be provided to allow all functional and operational requirements for the primary storage tank.

- Functional requirements for each penetration/riser are specified in Table 4.4.

Operational and Maintenance Requirements

- The annulus penetrations will support the operation of the primary and secondary confinement systems during normal and abnormal conditions.

4.5 Section 4.0 References

FDC

- Section 2.2.2, Secondary Confinement.
- Section 2.3, Tank Dome Penetrations.
- Section 2.4, Supporting Pad.
- Section 2.8, Range of Design/Operating Conditions.

DOE Order 6430.1A (1989)

- Section 0111-99.0.1, Nonreactor Nuclear Facilities - General.
- Section 0111-99.0.2, Tornado and Extreme Wind.
- Section 0111-99.0.4, Earthquakes.
- Section 0111-99.0.7, Explosion, Internal Pressurization, Criticality, and Other DBA Causes.
- Section 0111-99.0.8, Load Combinations.
- Section 1300-3.2, Safety Class Items.
- Section 1300.7, Confinement Systems.
- Section 1323-5.2, High-Level Liquid Waste Confinement.

Hanford Plant Standards

- SDC 4.1, Rev. 12, Design Loads for Facilities.

Westinghouse Hanford Company

- WHC-SD-GN-DGS-30008, Design Loads for New Underground Double-Shell Tanks and Associated Underground Process Piping.

Industry Codes and Standards

- ACI 349-90, Code Requirements for Nuclear Safety Related Concrete Structures.
- ASME B&PV Code, Section III, Division 2, Subsection CC, 1992 Edition with 1993 Addenda.
- ASME B31.3, Chemical Plant and Petroleum Refinery Piping, 1993.
- UCRL-15910, Design and Evaluation Guidelines for Department of Energy Facilities Subject to Natural Phenomena Hazards, 1990.
- BNL 52361, Seismic Design and Evaluation Guidelines for the Department of Energy High-Level Waste Storage Tanks and Appurtenances, prepared by the Tank Seismic Experts Panel for the Department of Energy, January 1993.
- BNL Structural Integrity Panel, Guidelines for Development of Structural Integrity Programs for DOE High-Level Waste Storage Tanks, 1994 (draft).

Washington Administrative Codes (WAC)

- WAC Chapter 173-303, Dangerous Waste Regulations, Washington State Department of Ecology, Section 173-303-640, Tank Systems, December 1993.

W-236A Project Documents

- ICF KH Engineering Report W236ER5, Codes and Standards Evaluation for Secondary Confinement Structure, May 1993.
- ICF KH Letter Report W236LR6, Material Selection for Supporting Pad, July 1993.
- WHC-SD-W236A-DGS-001, Structural Design Guidelines for Multi-Function Waste Tank Facility Underground Tanks and Piping for Project W-236A, February 1994.

- WHC-SD-W236A-ER-004, Rev. 0, Structural Design Requirements Synthesis for the MWTF Waste Tanks, March 1993.
- WHC-SD-WM-ER-190, Rev. 0, Code Selection for Primary Storage Tank, Secondary Confinement, and Process Piping of the Multi-Functional Waste Tank Facility, March 1993.
- WHC-SD-W236A-ER-010, Rev. 0, Multi-Function Waste Tank Facility Thermal Hydraulic Analysis for Title II Design, November 10, 1994.

TABLE 4.1

DESIGN PARAMETERS FOR SECONDARY CONFINEMENT STRUCTURE WITH SECONDARY LINER

DESIGN PARAMETER	VALUE
Pressure	+60 in. water -20 in. water Differential pressure between primary tank (PTP) and annulus pressure (AP): (PTP -AP) $\geq$ -6 in. water
Temperature	200° F maximum in haunch and dome 250° F maximum in wall, footing, and supporting pad
Heat Generation	Same as Primary Storage Tank
Seismic	Same as Primary Storage Tank (Table 3.1)
Dead Load	Earth cover will be compacted to maximum density. Depth to be determined by shielding and analysis.
Live Load	A maximum of 125 lb/ft^2 uniform plus 50 ton concentrated at any ground-surface point.
Material	Structure: Reinforced concrete Liner: Carbon steel
Liner Strains	ASME, Section III, Division 2 Subsection CC

TABLE 4.2

SECONDARY CONFINEMENT REINFORCED CONCRETE STRUCTURE DESIGN LOADS AND LOAD COMBINATIONS

Load Case		D (1)	L (2)	H_s	H_d	H_v	F_s	F_d	P_d	P_t	W_c	C_h	C_v	R_o	E_{db} or DBA or PMF	T_o
C1	Construction	1.4	(3)	1.7		1.4					1.7					
C2	Normal	1.4	1.7	1.7		1.4	1.4		1.7					1.7		
C3	Severe Environmental	1.05	1.3	1.3		1.05	1.05		1.05					1.3		1.05
C4	Extreme Environmental	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0					1.0	1.0	1.0

D = dead loads
L = live loads, surface
H_s = lateral soil load, static
H_d = lateral soil load, dynamic
H_v = vertical soil load , static
F_s = slurry load, hydrostatic
F_d = slurry load, hydrodynamic
P_d = vapor space design pressure
P_t = leak test hydrostatic pressure
W_c = wind load, construction
C_h = concrete pour load, lateral
C_v = concrete pour load, vertical
R_o = pipe reactions
E_{db} = design basis earthquake
T_o = operating thermal loads

Notes:

1) Where any load reduces the effects of other loads, the corresponding load factor of 0.9 shall be used for that load if it can be demonstrated that the load either is always present or occurs simultaneously with the other load. Otherwise, the load factor for that load shall be taken as zero.

2) The structural effects of creep and shrinkage shall be included with the dead load.

3) The live load shall be considered to vary from zero to full value for all load conditions.

4) Load combinations during construction shall be considered to be applicable during all stages of construction. It shall be the responsibility of the designer/fabricator to design all phases of construction.

TABLE 4.3

SECONDARY LINER DESIGN LOADS AND LOAD COMBINATIONS

Load Case		D (1)	L (2)	H_s	H_d	H_v	F_s	F_d	P_d	P_t	W_c	C_h	C_v	R_o	E_{db} or DBA or PMF	T_o
S1	Construction	1.0	(3)								1.0	1.0				
S2	Operating	1.0	1.0	1.0					1.0					1.0		1.0
S3	Extreme Environmental	1.0	1.0	1.0	1.0				1.0					1.0	1.0	1.0

D = dead loads
L = live loads, surface
H_s = lateral soil load, static
H_d = lateral soil load, dynamic
H_v = vertical soil load, static
F_s = slurry load, hydrostatic
F_d = slurry load, hydrodynamic
P_d = vapor space design pressure
P_t = leak test hydrostatic pressure
W_c = wind load, construction
C_h = concrete pour load, lateral
C_v = concrete pour load, vertical
R_o = pipe reactions
E_{db} = design basis earthquake
T_o = operating thermal loads

Notes:

1) The structural effects of creep and shrinkage shall be included with the dead load.

2) The live load shall be considered to vary from zero to full value for all load conditions.

3) Load combinations during construction shall be considered to be applicable during all stages of construction. It shall be the responsibility of the designer/fabricator to design all phases of construction.

TABLE 4.4

ANNULUS PENETRATIONS			
RISER NO.	**FUNCTION**	**RISER NO.**	**FUNCTION**
6	Annulus Access	19	Annulus Instrumentation
8	Air Inlet To Insulating/ Supporting Pad	20	Annulus Pumpout
9	Annulus Exhaust	23	Annulus Level Detector Indicator
15	Annulus Spare	24	Annulus Spare
16	Annulus Sump Instrumentation	27	Armulus Spare
17	Annulus Inspection	28	Annulus Vacuum Relief
18	Annulus Inspection		

NOTES:
- There may be more than one riser per function.
- Definitive design will determine the quantities, size, and location of all risers.

5.0 Waste Processing Systems

General
This section delineates the design requirements for waste processing systems in accordance with the FDC. The systems include equipment and components required for transferring waste in and out of the primary storage tanks; mixing contents of the waste inside the primary storage tanks; sampling waste stored in the tanks; and the equipment, components, and systems that operate in contact with radioactive or other hazardous materials.

The applicable FDC Sections are listed below:

- Section 2.5, Other Site Facilities Interface.
- Section 3.2, Piping.
- Section 3.2.1, Process Piping.
- Section 3.2.2, Process Pits.
- Section 3.2.3, Jumpers.
- Section 3.2.4, Corrosion Protection.
- Section 3.4.4, Waste Transfer.
- Section 3.4.5, Mixing System.

5.1 Process Piping for DOE High-Level Waste Storage Tanks

General
Process piping includes waste transfer lines, valve pit drain lines, sample lines, primary ventilation system condensate drains, and valves installed on these lines. The process piping design criteria are summarized in Table 5.1. The process piping shall be designed in accordance with Section 3.2.1 of the FDC.

Safety Classification
Process piping is designed to Safety Class 2 criteria. The risers welded to the tank nozzles shall be designed to Safety Class 2 criteria using Safety Class 1 Seismic Criteria per Table 18.1, unless designated differently in subsequent PSAR or safety equipment lists.

Structural and Mechanical Requirements

- The process piping shall be designed in accordance with ASME B31.3, Category "M", "Chemical Plant and Petroleum Refinery Piping" (1993). Piping in contact with the soil shall be designed in accordance with the criteria given in WHC-SD-GN-DGS-30008, WHC-SD-WM-ER-190, BNL 52361, Table 18.1, and the design guidelines given in WHC-SD-W236A-DGS-001. Applicability of Normal Service Category (NSC) rules in lieu of Category "M" will be evaluated during the detailed design.

- Process piping shall meet the requirements of Guidelines for Development of Structural Integrity Programs for DOE High Level Waste Storage Tanks.

- The waste transfer system shall maintain a minimum velocity of 6 ft/sec to preclude solids from settling in the piping.

- Process piping shall be in accordance with DOE Order 6430.1A, Section 0275-99.0.2.

- Separate dedicated incoming and outgoing encased waste transfer lines shall connect the MWTF with existing facilities via cross-site transfer lines at the diversion box. Spare lines shall be provided for each dedicated waste transfer line.

- The process piping shall be encased in secondary piping outside the valve pits and diversion boxes in accordance with DOE Order 6430.1A, Section 1300-7.4.

- All process lines shall be free-draining to prevent fluid accumulation in traps. In cases where low points or traps cannot be prevented by design, a drain and collection system shall be provided at each low point, with the drains routed to an appropriate tank.

- The design shall establish the location of the drainage for each primary piping line.

- The encasement piping shall drain into the process pit or other end point in which it terminates.

- The encasement piping for process lines connecting the valve pits or diversion boxes shall be equipped with a leak detection system. In cases when more than one pipe line terminates in a valve pit or diversion box, the leak detection system shall be designed with the capability to identify the line that is leaking, in accordance with DOE Order 6430.1A, Section 1300-7.4.

- The primary process piping and the encasement piping shall be provided with capabilities for periodic testing. Design shall restrict the use of freeze plugs for pressure testing.

- Transfer lines terminating at the primary storage tank shall be provided with pressure-testing capabilities at the pump pits.

- All underground piping will be buried below the frost line in accordance with Hanford Plant Standards SDC 3.2, or if conditions do not allow, heat tracing and insulation will be used.

- The process piping, including valves and other components, shall be designed in accordance with DOE Order 6430.1A, Sections 1323-5.2 and 1540-99.0.6.

- Design loads for process piping shall be in accordance with WHC-SD-GN-DGS-30008 and/or UCRL-15910. The stress analysis shall be based on the requirements of WHC-SD-GN-DGS-30008 and ASME B31.3.

- The primary process piping shall be constructed of seamless stainless steel Type 304L as addressed in WHC-SD-W236A-TA-001. The encasement for the process piping may be constructed of carbon steel. A minimum of schedule 40 pipe will be used for each piping system.

- All piping shall be supported and anchored in accordance with ASME B31.3 and AISC so that thermal expansion and contraction and operating and seismic reactions could occur without damage to the pipeline or supporting structures. Supports shall be installed to adequately carry the weight of the line and maintain proper alignment. Pipe guides and anchors shall be provided to keep pipes in accurate alignment, direct the expansion movement, and prevent buckling, swaying, and undue strain. Spider-type supports shall be provided inside the encasement piping to permit leak detection.

- All piping components such as fittings, valves, flanges, and other piping specialty items shall be in accordance with ASME B31.3.

- The final nondestructive examination (NDE) of butt welds on the primary piping of the waste handling fluid system will be accomplished by using the radiographic methods. The NDE of tie-in welds will be determined in definitive design.

- The process piping carrying radioactive material shall be buried underground or be otherwise shielded to provide radiation protection as required by DOE Order 5480.11 and RLIP 5480.11. Earth berms shall not be permitted within the tank farm.

- The process system shall meet radiological requirements of WHC-SD-GN-DGS-30011.

- All process piping with surface temperatures exceeding 200° F that penetrate concrete walls shall be installed through sleeves.

- Penetrations through confinement/containment boundaries shall be designed to meet leak confinement requirements.

- Process piping design shall allow for corrosion and consider erosion allowances.

Functional Requirements

- Condensate from each primary storage tank ventilation system shall be returned to the respective tank.

- The design shall minimize the use of flush water for cleaning the piping to minimize waste.

Operational and Maintenance Requirements

- Process piping outside the process pits and confinement shall meet the requirements of 40 CFR 264 (see Section 16.0, Environmental Protection).

- The process piping shall be equipped with valves at appropriate locations to facilitate maintenance within ALARA guidelines.

- The layout and routing of the process piping will be designed for ease of maintenance in achieving ALARA objectives.

- Piping and equipment with a surface temperature higher than 125° F and accessible from normal work areas, platforms, and access ways shall be insulated as required by DOE Order 6430.1A, Section 1525-4.

- Check valves and block valves shall be provided to prevent spills and to reduce contamination and worker exposure as required by DOE Order 6430.1A, Section 1525-4.

5.2 Process Pits

General
Equipment or components which have potential for leaking hazardous material or require access for operation or maintenance shall be located inside the process pits as required by the FDC, Section 3.2.2. Waste transfer connections between the MWTF and other onsite facilities shall be provided.

Safety Classification
Process pits shall be designed to Safety Class 1 criteria, as listed in the Preliminary Safety, Analysis Report, WHC-SD-W236-PSAR-001. The crossover pit and the chemical addition pit are not considered process pits unless changed in later safety equipment lists.

Structural Requirements

- All process pits shall be lined with 304L stainless steel, unless determined otherwise during the design.
- Process pit cover blocks shall be designed with adequate thickness to reduce radiation dose at the outside surface in accordance with the criteria given in Section 15.2.
- The process pits shall drain into the tank on which they are constructed.
- The inside surface of the cover blocks shall be lined with a special protective coating or lined with stainless steel, depending on the need for decontamination and decommissioning (see Section 21.0, Decontamination and Decommissioning).
- The design shall provide provisions for flushing and/or applying fixative to the interior of each process pit with the cover block in place.
- The annulus pump pit shall be designed to accept the transfer pump to meet the criteria of Section 3.4.4 of the FDC.
- The process pits shall be constructed of reinforced concrete and designed in accordance with ACI-349.
- The design loads shall meet SDC 4.1.
- The liner shall be designed to confine contamination in accordance with WAC-173-303-640.

Functional Requirements

- All process pits shall be designed to provide confinement of radioactive and other hazardous materials in conjunction with the pit ventilation system.
- All process pits shall be designed to maintain a negative pressure, except when the cover blocks are removed for maintenance work.

Operational and Maintenance Requirements

- All process pits shall be designed for ease of decontamination and maintainability within ALARA guidelines.

- Provisions shall be made for the storage of jumpers and for placement of cover blocks during equipment or instrument removal or rearrangement.
- Provisions shall be made for placement of a removable safety railing around the perimeter of each pit prior to the removal of the cover block.

5.3 Jumpers

General
Jumpers shall be provided as required by the FDC, Section 3.2.3. Existing Hanford design for jumpers will be used where practical.

Safety Classification
The jumpers shall be designed to Safety Class 2 criteria.

Structural Requirements

- Piping jumpers in process pits, such as valve pits, transfer pump pits shall be designed, fabricated, and tested per SD-RE-DGS-002 and HS-BS-0084, respectively, as modified for Safety Class 2 requirements.
- All valves shall be ball valves with motor operators and limit switches, unless determined otherwise during the design.
- Jumpers shall be designed for standardization to the maximum extent possible for interchangeability.
- Piping flexibility analysis shall be done in accordance with the ASME B31.3 code, paragraph 319.4.1 However, no formal analysis of adequate flexibility is required for the piping in the jumper if the requirements of paragraph 319.4.1 are met.
- Piping jumpers shall be free draining without traps (SD-RE-DGS-002).
- Electrical remote connections may be standard industrial-type electrical connectors rather than Hanford PUREX electrical connectors.

Functional Requirements

- Jumpers shall be designed to preclude breach of confinement function of the waste transfer systems.

Operational and Maintenance Requirements

- Jumpers shall be designed for remote removal, connecting and disconnecting.

5.4 Transfer Pumps

General
Transfer pumps shall be provided in accordance with the FDC, Section 3.4.4. The design shall have provisions for installation of a retrieval pump for future application.

Safety Classification
Transfer pumps shall be designed to Safety Class 3 criteria.

Structural Requirements

- The pumps will be a vertical turbine type with all wetted portions constructed of stainless steel, and designed to Hydraulic Institute Standards (HIS), or an equivalent industry standard.
- Analysis shall be performed to evaluate the impact of force from the mixing pump operations on the transfer pumps' integrity.

Functional Requirements

- The transfer pumps will be designed for minimum flow of 160 gpm with a maximum dynamic head of 190-ft of liquid with specific gravity of 1.6.
- The transfer pumps shall be capable of removing all liquids from the tank except for the remaining heel which is not more than 2% of the tank working volume.
- The retrieval pump shall be designed to empty the tank for tank washing or decontamination. Provisions shall be made for a pump-related jumper and a dummy pump head when the pump is not installed.

Operational and Maintenance Requirements

- The pumps shall be designed to be operated and repaired within ALARA guidelines.
- The retrieval pump shall be remotely installable and removable.
- Provisions shall be made to flush the pumps before removing for maintenance.

5.5 Mixing Pumps

General
Mixing pumps shall be provided in accordance with the FDC, Section 3.4.5.

Safety Classification
Mixing pumps shall be designed to Safety Class 3 criteria, using Safety Class 1 seismic criteria from Table 18.1 to preclude damage to the tank and to be consistent with the design of the primary storage tank.

Structural Requirements

- Provisions shall be made to alleviate the potential for damage to the tank structure in the unlikely event of a pump falling into the tank during pump installation or removal operation.

- The pump geometry shall be compatible with the geometry of the tank riser designated for the pump.

Functional Requirements

- Mixing pumps shall be designed to operate at a variable speed when required to mix contents of the primary storage tank.

- The pumps shall be able to perform the mixing function to achieve a desired level of homogeneity at different levels of waste in the tank. The desired level of homogeneity will be defined during the detailed design.

- The pump size shall be as delineated in WHC-SD-W236A-ER-005.

Operational and Maintenance Requirements

- The pumps shall be designed to be operated and repaired within ALARA guidelines (see Sections 15.2, "Radiation Protection," and 15.2.1, "Occupational Worker Protection").

- The pumps shall be remotely installable and removable with minimum spread of contamination to meet ALARA objectives.

- Provisions shall be made to flush the pumps before removing for maintenance to maintain radiation dose within ALARA guidelines during maintenance and pump removal activities.

5.6 Pipe Corrosion Protection

General
The underground portions of all piping in contact with the soil shall be provided with corrosion protection systems to meet the requirements of the FDC, Section 3.2.4.

The design requirements for the corrosion protection systems are given in Section 12.5, "Cathodic Protection System."

5.7 Section 5.0 References

FDC

- Section 3.2.1, Process Piping.
- Section 3.2.2, Process Pits.
- Section 3.2.3, Jumpers.
- Section 3.2.4, Corrosion Protection.
- Section 3.4.4, Waste Transfer.
- Section 3.4.5, Mixing System.

DOE Order 6430.1A (1989)

- Section 0275-99.0.2, Process Wastes.
- Section 1300-7.4, Transfer Pipes and Encasements.
- Section 1323-5.2, High-Level Liquid Waste Confinement.
- Section 1525-4, Safe Surface Temperatures.
- Section 1540-99.0.6, Systems Installation.

Other DOE Orders

- DOE Order 5480.11, Radiation Protection for Occupational Workers, 1988.
- DOE RLIP 5480.11, Radiation Protection for Occupational Workers, 1991.

Hanford Plant Standards

- SDC 3.2, Rev. 2, Minimum Depth of Underground Waterlines.
- SDC 4.1, Rev. 12, Design Loads for Facilities.
- SD-RE-DGS-002, Rev. 3A, Jumpers Design Standard.
- HS-BS-0084, Rev. B, Jumper Fabrication.

Westinghouse Hanford Company

- WHC-SD-GN-DGS-30008, Design Loads for Underground High-Level Waste Tanks and Associated Underground Process Piping, September 1993.
- WHC-SD-GN-DGS-30011, Radiological Design Guide, September 1994.

Industry Codes and Standards

- ASME B31.3, Chemical Plant and Petroleum Refinery Piping, 1993.
- UCRL-15910, Design and Evaluation Guideline for DOE Facilities - Subjected to Natural Phenomena Hazards, 1990.
- BNL 52361, Seismic Design and Evaluation Guidelines for the Department of Energy High-Level Waste Storage Tanks and Appurtenances, prepared by the Tank Seismic Experts Panel for the Department of Energy, January 1993.
- AISC, American Institute of Steel Construction, Manual of Steel Construction, Ninth Edition.
- Hydraulic Institute Standards, 14th Edition, 1983, Centrifugal Pumps, (pages 10-34).
- ACI 349-90, Code Requirements for Nuclear Safety Related Concrete Structures.
- BNL Structural Integrity Panel, Guidelines for Development of Structural Integrity Programs for DOE High-Level Waste Storage Tanks, 1994 (draft).

Code of Federal Regulations

- 40 CFR 264, Section 264.192, Design and Installation of New Tank Systems and Components, 1992.

Washington Administrative Codes (WAC)

- WAC Chapter 173-303, Dangerous Waste Regulations, Washington State Department of Ecology, Section WAC-173-303-640, Tank Systems, December 1993.

W-236A Project Reports

- WHC-SD-W236A-DGS-001, Structural Design Guidelines for Multi-Function Waste Tank Facility Underground Tanks and Piping for Project W-236A, February 1994.
- WHC-SD-W236A-ER-005, Rev. 0, MWTF Subscale Mixing Report, 1994.
- WHC-SD-WM-ER-190, Rev. 0, Code Selection for Primary Storage Tank, Secondary Confinement, and Process Piping of the Multi-Function Waste Tank Facility, March 1993.
- WHC-SD-W236A-TA-001, Technical Assessment for Project W-236A, Multi-Function Waste Tank Facility Process Piping Material Selection, June 1994.
- WHC-SD-W236A-PSAR-001, Preliminary Safety Analysis Report, Multi-Function Waste Tank Facility, March 1994.

TABLE 5.1

PIPING DESIGN PARAMETERS

DESIGN PARAMETER	VALUE
WASTE TRANSFER PIPING	
Process Piping, Size	3 in. to 2 in.
Temperature	Operating - 200° F
Pressure	400 psig
Slope	0.25% minimum
Encasement Piping, Size	6 in. and 4 in.
Temperature	Same as primary
Pressure	Same as primary
Slope	Same as primary
Cathodic Protection	In accordance with recommended practices of NACE
Corrosion Rate (for 304L)	.4 mil/yr
Other Fluid Piping	As required by Industry Codes and Standards

6.0 Tank Ventilation System

General
This section specifies the design requirements for the primary storage tank and annulus ventilation systems in accordance with the FDC, Section 3.4. Also included in this section are the design requirements for the condenser cooling system.

The applicable FDC Sections are listed below:

- Section 3.4, General Mechanical Process.
- Section 3.4.1, Primary Storage Tank Ventilation System and Heat Removal System.
- Section 3.4.2, Annulus Ventilation System.

6.1 Primary Storage Tank Ventilation and Heat Removal System

General
Primary storage tanks shall be connected to a ventilation system to remove heat from the waste stored in the tank and to maintain the tank at a negative pressure and below the design temperature, as specified in Section 3.1, Primary Storage Tank. The design of the primary storage tank ventilation system will meet the requirements of the FDC, Section 3.4.1.

Contaminated and vapor-saturated air is cooled by a condenser, passed through a moisture eliminator, and filtered by a filter train before exhausting to the environment through a stack. The condenser is cooled by a chilled water system (see Section 6.3).

Safety Classification
The primary storage tank ventilation system shall be designed to Safety Class 2 criteria.

Structural Requirements

- The primary ventilation system shall be connected to a riser on the dome of the primary storage tank via underground encased piping.

- The primary exhaust piping outside the Support Facility shall be constructed of stainless steel type 304L, and be designed in accordance with requirements specified in Section 5.1, as applicable. The exhaust encasement piping may be constructed of carbon steel.

- The primary intake piping outside the Support Facility may be constructed of carbon steel, and shall be designed in accordance with the applicable requirements in Section 5.1. The need for intake encasement piping shall be determined during design.

- To meet ALARA requirements, the system components containing high concentrations of radioactive materials shall be located in concrete cells and connected by pipelines located in concrete pipe trenches in the Support Facility (see Section 15.2, "Radiation Protection"). The design requirements for the Support Facility, cells, and the pipe trenches are specified in Section 8.0, Buildings and Structures.

- All system components in contact with the exhaust waste stream shall be constructed of stainless steel type 304L.

- The condensers shall be designed in accordance with ASME Section VIII, Division I.

- The design loads for natural forces shall be in accordance with SDC 4.1, as modified by Table 18.1 (see Section 18.0, Natural Forces).

- The high-efficiency mist eliminators (HEMEs) shall be vertical cylinders containing two concentric stainless steel screens packed with filter media. The HEMEs shall have a 99% removal efficiency for mist and other particulates that are less than 3 microns in their longest dimension.

- The air downstream of the HEMEs shall be heated to prevent moisture accumulation on the HEPAs in the air filter train. The heater will be designed in accordance with ASME N509 and tested in accordance with ASME N510.

- High-efficiency metal fiber (HEMF) filters shall be installed to remove radioactive and other particulate contaminants and to minimize contaminant build-up on the HEPA filters. The HEMFs shall be provided with a remotely operated backwash system to prevent plugging and for decontamination.

- The HEMFs shall have a particle removal efficiency of at least 99.97% for 0.3 micron sized particles of di-octyl-sebacate (DOS), or equivalent.

- The exhaust stream shall be further cleaned using HEPA filter trains before discharge to the environment. The HEPA filter housing shall be designed in accordance with the requirements of ASME N509 and tested in accordance with ASME N510, with a bag-in/bag-out arrangement.

- The HEPA filters shall meet the requirements of one or more of Hanford Plant Standards HPS-157-M, HPS-158-M, HPS-159-M, and HPS-160-M.

- High-efficiency gas adsorbers (HEGA) shall be provided to minimize the release of toxic gases to the environment.

- Ductwork and supports above grade and located in the Support Facility shall be designed in accordance with ASME AG-1.

- Equipment supports shall be fabricated from ASTM A 36 carbon steel. These components shall be coated to facilitate decontamination. The use of stainless steel in place of carbon steel shall be evaluated based on a cost/benefit analysis, including decommissioning.

- Valves and dampers shall be designed in accordance with ASME N509, and tested in accordance with ASME N510.

- Exhaust fan selection shall be made for stable fan operation. The fan motors shall be in accordance with NEMA MG1.

- Instrumentation for measuring pressure differential across and for in-place testing of individual HEPA and HEMF filters shall be provided. Gauges and instruments shall be appropriately located and protected to prevent moisture accumulation (see Section 7.0, Instrumentation and Control).

- Vacuum breaker devices shall be included in the design to prevent under pressurization of the primary storage tank. The design of the tank shall provide over pressurization protection.

- The primary storage tank ventilation system shall meet the requirements of Section 1550, and specifically Section 1550-99 of DOE Order 6430.1A.

- Backup power shall be available for the primary storage tank ventilation system.

- The system shall be designed to provide protection against interactive seismic hazards and other failures, such as a Safety Class 3/2 situation.

- Components that are sensitive to the operating environmental conditions shall be selected for their ability to perform required functions in the specified environment.

- The design shall provide features to prevent moisture and frost accumulation on intake filters.

- The design shall indicate the boundaries for the application of ASME N509.

Functional Requirements

- The primary ventilation system shall meet the general requirements of Section 1300-7 of DOE Order 6430.1A, for performing the function of a confinement system.

- The primary storage tank ventilation system shall be designed to control the release of radioactive and other hazardous materials to the environment in accordance with the requirements specified in Section 16.0, Environmental Protection.
- The primary storage tank ventilation system shall meet the specific requirements set forth in the second paragraph of Section 1323-5.2 of DOE Order 6430.1A.
- Each primary storage tank ventilation system, in conjunction with the annulus ventilation system, shall be designed to remove heat generated in the primary storage tank (see Table 3.1). See W236A-TI-PP3, PP4, and PP8 for flow rates and temperatures.
- Adequate system redundancy shall be incorporated in accordance with WHC-CM-1-3, MRP 5.46 to meet the requirements of single-failure criteria for a Safety Class 2 system.

Operational and Maintenance Requirements

- Components of the tank ventilation system shall be located and arranged to reduce radiation exposures during operation, maintenance, and post-accident conditions.
- Space provisions shall be adequate for in-place maintenance activities and for the removal or replacement of components and equipment.
- Lifting equipment and facilities shall be provided for the removal and transfer of equipment and components from the installed area to the maintenance area.
- Equipment drainage provisions, if required, shall be made to minimize contamination spread during maintenance.
- Lighting, shielding, and equipment mounting shall be designed to provide ease of inspection, troubleshooting and maintenance.
- Design that facilitates rapid disconnect for removal and replacement of equipment or ease of in-place maintenance shall be provided.
- Instrumentation, electrical, and piping connections or miscellaneous duct runs shall not be attached to, or mounted on, the equipment in a manner that results in excess time for, or interference of, maintenance.
- Components that require surveillance and periodic in-service inspection shall be provided with access panels and other inspection features.
- Provisions shall be made for temporary installation of portable ventilation equipment during abnormal or emergency conditions.

6.2 Annulus Ventilation System

General
The annulus ventilation system shall be designed in accordance with FDC Section 3.4.2, to remove heat from the annulus area, the supporting pad, and the secondary confinement concrete structure. The system shall be equipped with radiation monitoring instruments to detect radiation, thus indicating a leak in the primary storage tank. In normal conditions, the air in the annulus is relatively clean and free of contamination.

Safety Classification
The annulus ventilation system shall be designed to Safety Class 2 criteria.

Structural Requirements

- The annulus ventilation system piping need not be encased nor constructed of stainless steel.
- Provisions shall be made to divert the annulus exhaust to the primary ventilation system in a crossover pit in the event of a leak from the primary storage tank to the annulus.
- The design shall provide features to prevent moisture and frost accumulation on intake filters.
- The annulus exhaust may be connected to the Support Facility ventilation system exhaust stack.

Functional Requirements

- The annulus ventilation system shall be designed to remove heat at a rate to be determined during the design.
- All other requirements are the same as for the primary storage tank ventilation system.

Operational and Maintenance Requirements

- The same as listed in Section 6.1, Primary Storage Tank Ventilation System.

6.3 Condenser Cooling System

General
The condenser cooling system shall be provided in accordance with the FDC, Section 3.4.1. The primary storage tank ventilation and cooling system consists of a system equipped with a condenser to cool and remove vapors from the ventilation air stream. Vapors in the ventilation stream are condensed on the shell side of the condenser by a chilled water system.

Safety Classification
The condensers shall be designed to Safety Class 2 criteria. The heat exchangers, pumps, and chillers shall be designed to Safety Class 2 criteria.

Structural and Mechanical Requirements

- The chilled water system shall be designed in accordance with DOE Order 6430.1A, Section 1550-2.
- The structural assembly shall be designed to withstand loadings due to natural forces in accordance with ASCE 7 and SDC 4.1, as modified by Table 18.1 for the appropriate Safety Class (see Section 18.0 Natural Forces).
- The airflow from the primary storage tank passing through the condensers shall be cooled from a temperature of 200° F to 40° F by water from chiller units.
- The chiller units shall be designed to remove an amount of heat at ventilation flow rates to be determined during design.
- The chiller units shall be located in the Support Facility.
- The chiller system design and fabrication shall comply with the requirements of ASME Section VIII, Division 1.
- Piping for the chiller system shall comply with the requirements of ASME B31.3 NSC, and ASTM A 106.

Functional Requirements

- Adequate redundancy shall be included in the design to allow for repair/replacement of components to enhance reliability and availability of the condenser cooling system.

Operational and Maintenance Requirements

- The chilled water system shall be designed to operate at a pressure higher than the pressure in the primary storage tank ventilation system to prevent contamination of the cooling water system in the event of a leak in the condenser.

6.4 Section 6.0 References

FDC

- Section 3.4.1, Primary Storage Tank Ventilation System.
- Section 3.4.2, Annulus Ventilation System.

DOE Order 6430.1A (1989)

- Section 1300-7, Confinement Systems.
- Section 1323-5.2, High-Level Liquid Waste Confinement.
- Section 1550, Heating, Ventilating, and Air-Conditioning Systems.
- Section 1550-2, Heating, Ventilating, and Air-Conditioning Systems Selection.
- Section 1550-99, Special Facilities.

Hanford Plant Standards

- HPS-157-M, Rev. 1, Standard Specification for Fire and Moisture-Resistant Nuclear-Grade HEPA Filters.
- HPS-158-M, Rev. 1, Standard Specification for Hydrogen Fluoride and Caustic-Resistant Nuclear-Grade HEPA filters.
- HPS-159-M, Rev.1, Standard Specification for Fire, Moisture, and Chemical-Resistant Nuclear-Grade HEPA Filters.
- HPS-160-M, Rev. 1, Standard Specification for Fire and Moisture-Resistant, High-Temperature, and High-Humidity Nuclear-Grade HEPA Filters.
- SDC 4.1, Rev. 12, Design Loads for Structures.

Westinghouse Hanford Company

- WHC-CM-1-3, MRP 5.46, Rev. 4, Appendix A, Design/Analysis Criteria for WHC Safety Class Systems, Components, and Structures.

Industry Codes and Standards

- ASME AG-1, Code on Nuclear Air and Gas Treatment, 1991, with Addenda AG-1b 1993.
- ASME N509, Nuclear Power Plant Air Cleaning Units and Components, 1989.
- ASME N510, Testing of Nuclear Air Treatment Systems, 1989.
- NEMA MG-1, Motors and Generators, 1987.
- ASME Section VIII, Division 1, Boiler and Pressure Vessel Code, 1992 with 1993 Addenda.
- ASTM A36, Standard Specification for Structural Steel, 1989.
- ASTM A106, Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service, 1991.
- ASME B31.3, Chemical Plant and Petroleum Refinery Piping, 1993.
- ASCE 7-88 (formerly ANSI A58.1), Minimum Design Loads for Buildings and Other Structures.

W-236A Project Reports

- W236A-TI-PP3, Position Paper, Tank Inlet Air Temperatures, May 1994.
- W236A-T1-PP4, Position Paper, Tank Ventilation System Design Air Flow Rates, May 1994.
- W236A-TI-PP8, Position Paper, Tank Heat Loading, Rev. 1, March 1994.

7.0 Instrumentation and Control

General

This section describes the design requirements for instrumentation and control systems required by the FDC, Section 3.1.

The applicable FDC Sections are listed below:

- Section 3.1, Instrumentation and Control.
- Section 3.4.1, Primary Storage Tank Ventilation System and Heat Removal System.
- Section 3.4.2, Annulus Ventilation System.
- Section 3.4.3, Tank Corrosion Monitoring.
- Section 5.1.2, Radiation Protection.
- Section 5.2, Environmental Protection.
- Section 5.10, Automatic Data Processing.

7.1 Distributed Control System (DCS)

General

A distributed control system (DCS) shall be provided for monitoring, control, data acquisition, and alarming of all process parameters in the facility, as required by the FDC, Section 3.1. The DCS shall meter energy for the Support Facility and Weather Enclosure in accordance with 10 CFR 435. The DCS shall be a functionally distributed, microprocessor-based modular system consisting of multi-station control consoles, local control units (LCUs), an engineering console, and a redundant communications network. The LCUs shall be located in the field and can operate independently of the control consoles.

Process instrumentation shall be tied via the DCS to the Supervisory Control and Data Acquisition (SCADA) system by means of a serial digital communication link. SCADA is a sitewide system for monitoring all facilities at the Hanford Site. Alarm and shutdown signals shall be transmitted to the respective tank farm area (200-East or 200-West) Computer Automatic Surveillance System (CASS) and/or the Tank Monitor and Control System (TMACS). Cross-site transfer alarm and shutdown signals shall be connected directly to Project W-058 DCS.

Safety Classification

The DCS shall be designed to Safety Class 2 criteria. Components of the DCS that do not perform Safety Class 2 functions shall be designed to Safety Class 3 criteria.

Structural Requirements

- The DCS equipment shall be qualified for temperature, pressure, humidity, radiation, and chemical environments. The expectation of the equipment is that it shall function for the life of the facility, including the environment created by DBA conditions, as specified in WHC-CM-1-3, MRP 5.46 Appendix A, and in DOE Order 6430.1A, Section 1300-3.4. If the equipment or a component is not qualified for the life of the facility, a replacement schedule shall be specified.

- The DCS equipment shall be designed to meet the requirements of DOE Order 5820.2A, DOE Order 6430.1A, Section 1300-6.5, and Human Factors Engineering (see Section 23.0).

- The design shall provide protection against interactive hazards such as a Safety Class 3/2 seismic situation, in accordance with WHC-CM-1-3, MRP 5.46, Appendix A.

- Adequate physical separation of redundant equipment shall be incorporated in the design to meet the single-failure criteria specified in WHC-CM-1-3, MRP 5.46, for Safety Class 2 systems.

- The control consoles shall be designed in accordance with MIL-STD-1472D.

- Space shall be provided for future interface with monitoring and control processes of other related projects.

- The DCS shall be designed for "fail safe" operation and alarm in the control room if the system or a component fails due to electric outage or other cause.

- NFPA 75 shall be applied for fire protection of the DCS and other instrumentation in the Control Room.

- ANSI, IEEE, Instrumentation Society of America (ISA), and other industry standards to be applied to the instrumentation and DCS system are listed in Table 7.1.

- Pneumatic instrumentation shall operate with 3 to 15-psi signals and be capable of withstanding 100 psi.

- Electronic instrumentation shall be designed to operate at 24-volt DC with 4 to 20 MA signals. The instrumentation cables shall contain shielded pairs of wires. All instrumentation cables shall be housed in raceways for separation from AC power lines and from wires carrying voltages greater than 80-volts.

- The thermocouple shall be K-type (chromel-alumel). Platinum resistance temperature detectors (RTD) shall be used if a higher accuracy or a tighter control span is required.

- Instrumentation design shall interface with other design disciplines, as required.

- The design shall incorporate an alarm hierarchy to screen and prioritize critical alarms during off-normal conditions.

- DCS hardware and software shall have proven reliable performance in comparable or similar facilities.

Functional Requirements

- Safety Class 2 components of the DCS shall remain functional in postulated accident conditions, including conditions created by natural hazards, in accordance with WHC-CM-1-3, MRP 5.46, and SDC 4.1, as modified by Table 18.1.

- Malfunction or failure of a major component of the DCS shall be annunciated in the control room.

- Valve position indicators and interlocks with limit switches, pressure switches, and flowmeters shall be provided on the waste transfer piping jumpers to prevent waste misrouting or an uncontrolled flow.

- The DCS shall have data processing capabilities for data trending, historical data archival or retrieval, alarm summaries, and energy management reports.

Operational and Maintenance Requirements

- Local control and operator interface panels shall be provided.

- The local control panels shall be accessible without undue hazard to the operators in the event the control room becomes uninhabitable.

- Automatic isolation bypass instrumentation and devices shall be installed to switch to standby or redundant systems or components in the event the normal system or component malfunctions.

- Both visual and audible annunciations along with DCS computer logging shall be provided for all abnormal conditions, except for screening and prioritization of critical alarms for immediate notification.

- The equipment layout and location shall be arranged for safe and efficient testing and maintenance to achieve ALARA objectives.

- The design shall consider maintainability as a requirement (i.e., equipment physical layout, radiation shielding, and work environment) for the DCS, per DOE Order 6430.1A, Section 1300-3.5.

- See Section 10.3 for DCS requirements on the steam condensate collection and discharge system (Safety Class 3).

7.2 Tank Monitoring

General
Tank monitoring shall be provided to measure the condition of the waste storage and confinement systems and components to meet the requirements of the FDC, Sections 3.1 and 3.4.3.

Safety Classification
The tank monitoring system shall be designed to Safety Class 2 criteria. Components that do not perform Safety Class 2 functions shall be designed to Safety Class 3 criteria.

Structural Requirements

- Instrumentation shall be provided for monitoring, alarming, and control of the liquid waste level, temperature, specific gravity, and pressure in the primary storage tank to meet the requirements of DOE Order 6430.1A, Section 1323-5.2 (see Sections 7.1, 16.0, 24.0).

- Instrumentation shall be provided to monitor the sludge level at a minimum of one location in the primary storage tank. Risers with installed air and power services for three additional sludge level indicators shall be provided.

- Instrumentation shall be provided to monitor the temperature of one quadrant of the tank exterior wall, dome, haunch, base, supporting pad, and the reinforced concrete structure of the secondary confinement.

- Removable corrosion probes and corrosion analyzers shall be provided to measure stress cracking, pitting, and average corrosion on the inner wall of the primary storage tank.

- Programmable instrumentation shall be provided to monitor and control the size and frequency of the liquid waste samples to be taken from the tank. Samples shall be taken at three different levels.

- Hydrogen, ammonia, and total organic (hydrocarbon) analyzers shall be installed to analyze and measure concentration of gases in the vapor space of the primary storage tank (see Section 24.0, Waste Characterization and Processing). Provisions shall be made in the gas sampling system for offsite analysis of samples.

- Transmitters shall be installed on the mixing pumps for monitoring pump power, vibration, bearing temperature, and motor temperature. The pump speed signal shall be derived from the motor frequency originating from the variable frequency drive. High-pump vibration, high- and low-pump speed, and high-motor temperature shall be alarmed at the local panels and in the control room. The pump operation, including rotational positioning, shall be remotely controlled by the DCS.

- Requirements specified in Section 7.1, Distributed Control System (DCS), shall be used as applicable.

- High-level probes shall be used to protect the primary tank from overfilling. Hydrostatic level sensors shall detect the minimum heel level in the tank. Primary tank and annulus differential pressure shall be monitored to protect the primary tank from structural failures.

Functional Requirements

- The same as listed in Section 7.1, Distributed Control System (DCS).

Operational and Maintenance Requirements

- The same as listed in Section 7.1, Distributed Control System (DCS).

7.3 Primary Storage Tank Ventilation Monitoring and Control

General
The primary storage tank ventilation monitoring and control system shall be designed as required by the FDC, Section 3.1 and 3.4.1.

Safety Classification
The same as in Section 7.1, Distributed Control System (DCS).

Structural Requirements

- The same as listed in Section 7.1, Distributed Control System (DCS).

- Automatically controlled dampers shall be provided in the design to transfer the exhaust stream to the redundant filter train in the event that the stack monitoring system senses abnormal releases of radioactive or other toxic materials (see Section 7.4, Stack Monitoring and Control).

- Damper controls shall be adjustable and operate in a "fail safe" mode.

- Control valves shall be designed with allowance for corrosion and selected for high radiation and other harsh operating environmental conditions specified in Section 3.0, Primary Confinement Structure. The control valves shall be sized according to ISA Standard S75.02.

- Heating and cooling coils shall have both inlet, outlet, and differential temperature indicators and alarms.

- Primary intake air flow, primary exhaust air flow, and condenser-chilled water flow rate shall be recorded and controlled.

- Filter plugging or breakthrough, air low flow, system or individual component leak shall be monitored and alarmed. Out-of-range pressure, temperature, and moisture shall also be monitored and alarmed.

- Process upsets and performance shall be detected by monitoring and sampling the primary ventilation exhaust. A near-isokinetic sampling and monitoring device shall be installed to monitor and trend the concentration of the following radioactive materials:

  - Total alpha particulates
  - Total beta particulates
  - Total gamma emissions
  - Tritium (record sample only)
  - Iodine (record sample only)

- Abnormal releases of nonradioactive toxic gases shall be monitored. Concentrations of the following vapors shall be measured:

  - Total organics
  - Ammonia

- The primary storage tank ventilation monitoring shall be in accordance with ASME N509, Table 4-1.

- The system shall meet the requirements of DOE Order 6430.1A, Section 1323-5.2.

Functional Requirements

- The same as listed in Section 7.1, Distributed Control System (DCS).

Operational and Maintenance Requirements

- The same as listed in Section 7.1, Distributed Control System (DCS).

7.4 Stack Monitoring and Control

General
The stack monitoring and control system shall be designed to meet the requirements of the FDC, Section 3.1 and 5.2.

Safety Classification
The stack monitoring and control systems shall be designed to Safety Class 2 criteria.

Structural Requirements

- The same as listed in Section 7.1, Distributed Control System (DCS).
- A near-isokinetic sampling system shall be installed at the stack monitoring facility to monitor and trend the concentration of radioactive materials released to the environment through the stack.
- The stack monitoring system shall be designed and installed in accordance with ANSI N13.1, and shall meet the requirements of the Clean Air Act and other regulations (see Section 16.0, Environmental Protection).
- Specific materials to be monitored are as follows:
    - Alpha, beta, and gamma radioactive particulates
    - Total air mass flow and temperature.
- Low stack sample flow shall be alarmed at the control room.
- Stack monitoring shall meet the requirements of DOE Order 6430.1A, Sections 1300-1.4.4, and 1300-9.

Functional Requirements

- The stack monitoring shall be continuous for record keeping as required by regulations (see Section 16.0, Environmental Protection).

Operational and Maintenance Requirements

- The same as listed in Section 7.1, Distributed Control System (DCS).

7.5 Annulus Monitoring and Control

General
The annulus monitoring and control system shall be designed to perform three main functions: 1) detect leaks from the primary storage tank into the annulus; 2) monitor air flow and inlet and outlet air temperatures to assure adequate cooling of supporting pad and the concrete structure; and 3) measure the amount of heat transmitted from the primary storage tank to the annulus, in accordance with the FDC, Section 3.4.2.

Safety Classification
The annulus monitoring system shall be designed to Safety Class 3 criteria, with the exception of the leak detection equipment, which shall be designed to Safety Class 2 criteria.

Structural Requirements

- The same as given in Section 7.1, Distributed Control System (DCS).
- A leak detection system shall be provided to detect and measure the quantity of liquid in the annulus sump to meet the requirements of 6430.1A, Section 1323-5.2.
- An airflow measuring and alarm system shall be installed on the inlet annulus ventilation system.
- A radiation monitoring system shall be installed at the outlet of the annulus, upstream of the filters, to detect radioactive particulates in the annulus air stream, indicating any leakage from the primary storage tank.
- The air intake and exhaust filter units shall be monitored in accordance with ASME N509.

Functional Requirements

- The same as in Section 7.1, Distributed Control System (DCS).

Operational and Maintenance Requirements

- The same as in Section 7.1, Distributed Control System (DCS).

7.6 Radiation Monitoring

General
Radiation monitors shall be installed throughout the facility to monitor radiation and alarm higher than expected radiation and contamination levels to protect personnel and achieve ALARA objectives, as required by the FDC, Section 3.1 and 5.1.2.

Safety Classification
Radiation monitoring system shall be designed to Safety Class 2 criteria.

Structural Requirements

- The facility design shall establish radiation and contamination zones (high, low, etc.) as specified in *Section 9.0, Heating, Ventilation and Air Conditioning* (HVAC).

- Radiation monitors shall be installed with monitoring and alarm ranges pertinent for each radiation zone, to meet the requirements of DOE Order 6430.1A, Section 1300-6.

- Continuous air monitors (CAMs), continuous air sampling systems, and other monitoring and alarm devices (area radiation monitors) shall be installed for the detection of contamination in the work areas in accordance with the requirements of DOE Order 6430.1A, Section 1300-6.5 and "Criteria for Westinghouse Hanford Company workplace Air Sampling Program," WHC-SD-GN-TA-30001. The air monitoring system shall comply with ANSI N13.1.

- As a minimum, air sampling heads shall be provided in the operating galleries, liquid sample rooms, and primary exhaust valve rooms. Continuous air monitors shall be provided at the primary air intakes.

- Warning and alarm systems shall be designed and installed to ensure the alarms are audible for the encompassing area, as required by DOE Order 6430.1A, Section 1300-6.5. Evacuation alarm systems shall comply with ANSI/ANS 8.3.

- The radiation monitoring system shall be provided with an UPS.

- Personnel monitoring and warning devices shall be installed to meet the requirements of DOE Order 6430.1A, Section 1300-6.

Functional Requirements

- The same as in Section 7.1, Distributed Control System (DCS), and the requirements of 15.2, Radiation Protection.

Operational and Maintenance Requirements

- The same as in Section 7.1, Distributed Control System (DCS).

7.7 Computer System and Automatic Data Processing

General
In accordance with FDC Section 5.10, the MWTF is not intended to generate any classified information. Therefore, there is no need to provide a computer system to process information or facility data other than the DCS and CASS which will process all facility data and perform control functions as described in Section 7.1 of this document.

7.8 Section 7.0 References

FDC

- Section 3.1, Instrumentation and Control.
- Section 3.4.1, Primary Storage Tank Ventilation System and Heat Removal System.
- Section 3.4.2, Annulus Ventilation System.
- Section 3.4.3, Tank Corrosion Monitoring.
- Section 5.1.2, Radiation Protection.
- Section 5.2, Environmental Protection.
- Section 5.10, Automatic Data Processing.

DOE Order 6430.1A (1989)

- Section 1300-1.4.4, Monitoring of Releases.
- Section 1300-3.4, Equipment Environment Considerations.
- Section 1300-3.5, Maintenance.
- Section 1300-6, Radiation Protection.
- Section 1300-6.5, Monitoring, Warning, and Alarm Systems.
- Section 1300-9, Effluent Control and Monitoring.
- Section 1323-5.2, High-Level Liquid Waste Confinement.

Other DOE Orders

- DOE Order 5820.2A, Radioactive Waste Management, Chapter I, paragraph 3.b.(3), Monitoring, Surveillance, and Leak Detection, 1988.

Hanford Plant Standards

- SDC 4.1, Rev. 12, Design Loads for Facilities.

Westinghouse Hanford Company

- WHC-CM-1-3, MRP 5.46, Rev. 4, Appendix A, Design/Analysis Criteria for WHC Safety Class Systems, Components, and Structures.
- WHC-SD-GN-TA-30001, Rev. 0, Criteria for Westinghouse Hanford Company Workplace Air Sampling Program.

Industry Codes and Standards

- ANSI/ANS 8.3-1986, Criticality Accident Alarm System.
- ANSI N13.1, Guide to Sampling Airborne Radioactive Material in Nuclear Facilities, 1969 (R1993).
- See Table 7.1.

Codes of Federal Regulations

- 10 CFR 435, DOE Energy Conservation, 1994.

TABLE 7.1

CODES AND STANDARDS FOR DCS AND INSTRUMENTATION

ANS 59.3	Safety Criteria for Air Systems. 1984
ANSI/NEMA ICS4	Terminal Block for Industrial Use. 1988
ASME B31.3	Chemical Plant and Petroleum Refinery Piping. 1993
ASME MFC-4M	Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi. 1989
ASME MFC-5M	Measurement of Liquid Flow in Closed Conduits Using Transit Time. (Ultrasonic Flowmeters) 1985
ASME MFC-6M	Measurement of Fluid Flow in Pipes Using Vortex Flow Meters. 1987
ASME MFC-7M	Measurement of Gas Flow by means of Critical Flow Venturi Nozzles. 1987 (R 1992)
ASME MFC-8M	Fluid Flow in Closed Conduits, Connection for Pressure Signal Transmissions between Primary and Secondary Devices. 1988
ASME MFC-9M	Measurement of Liquid Flow in Closed Conduits by Weighing Method. 1988
ASME MFC-10M	Method for Establishing Installation Effects on Flowmeters. 1988
ASME PTC 19.3	Temperature Measurement. 1974
ASME PTC 19.5	Application Part II of Fluid Meters. 1971
ASME N509	Nuclear Power Plant Air Cleaning Units and Components. 1989
IEEE 446	Recommended Practice for Emergency and Standby Power System for Industrial and Commercial Applications. 1987
ISA S5.1	Instrumentation Symbols and Identification. 1992
ISA S5.2	Binary Logic Diagrams for Process Operations. 1992
ISA S5.3	Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems. 1983

TABLE 7.1 (con't)

CODES AND STANDARDS FOR DCS AND INSTRUMENTATION

ANSI/ISA S5.4	Instrument Loop Drawings. 1991
ANSI/ISA S5.5	Graphic Symbols for Process Displays. 1985
ANSI/ISA S7.3	Quality Standard for Instrument Air. 1981
ANSI/ISA S18.1	Annunciator Sequences and Specifications. 1992
ISA S20	Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves. 1981
ISA S26	Dynamic Response Testing of Process Control Instrumentation. 1975
ANSI/ISA S50.1	Compatibility of Analog Signals for Electronic Industrial Process Instruments. 1991
ANSI/ISA S75.02	Control Valve Capacity Test Procedures. 1988
ISA S82.01	Safety Standard for Electrical and Electronic Test, Measuring, Controlling, and Related Equipment. 1994
ISA RP7.1	Pneumatic Control Circuit Pressure Test. 1956
ANSI/ISA RP7.7	Recommended Practice for Producing Quality Instrument Air. 1984
ISA RP16.6	Methods and Equipment for Calibration of Variable Area Meters (Rotameter). 1961
ISA RP42.1	Nomenclature for Instrument Tube Fittings. 1991
ISA RP60.6	Nameplates, Label and Tags for Control Centers. 1978
ISA RP60.8	Electrical Guide for Control Centers. 1978
ANSI MC96.1	Temperature Measurement Thermocouples. 1982
ISO R541	Measurement of Fluid Flow by Means of Orifice Plates, Nozzles, and Venturi Tubes Inserted in Circular Cross Section Conduits Running Full. 1980 (E)
NEMA ICS 6	Industrial Control and Systems Enclosures. 1993
NEMA WC53	Standard Test Methods for Extruded Dielectric Power, Control, Instrumentation and Portable Cables. 1983
NEMA ICS 3.1	Industrial Systems. 1988
NFPA 70	National Electric Code (NEC). 1993
NFPA 75	Protection of Electronic Computer/Data Processing Equipment. 1992

TABLE 7.1 (con't)

CODES AND STANDARDS FOR DCS AND INSTRUMENTATION

NFPA 101	Code for Safety to Life from Fire in Buildings and Structures. 1994
NFPA 110	Emergency and Standby Power Systems. 1993
NCRPM 25	Measurement of Absorbed Dose of Neutron's and of Mixtures of Neutrons and Gamma Rays. 1961
NCRPM 47	Tritium Measurement Techniques
NCRPM 50	Environmental Radiation Measurements. 1976
NCRPM 57	Instrumentation and Monitoring Methods for Radiation Protection. 1978
NCRPM 58	A Handbook of Radioactivity Measurements Procedures. 1978
MIL-STD-1472D	Human Engineering Design Criteria for Military Systems, Equipment and Facility. 1989
UL 508	Industrial Control Equipment. 1989
UL 429	Electrically Operated Valves. 1987
UL 1244	Electrical and Electronic Measuring and Testing Equipment. 1980

8.0 Buildings and Structures

General
The MWTF structures shall be designed in accordance with the criteria specified in the FDC. The applicable FDC sections are listed below:

- Section 3.4.1, Primary Storage Tank Ventilation System.
- Section 3.4.2, Annulus Ventilation System.
- Section 4.1, Architectural.
- Section 4.1.1, Support Facility.
- Section 4.1.2, Control Room.
- Section 4.1.3, Diesel Generator Building.
- Section 4.1.4, Sample Building.
- Section 4.1.5, Service Area.
- Section 4.1.6, Air Compressor Rooms.
- Section 4.1.7, Weather Enclosure.
- Section 4.2.1, Support Facility.
- Section 4.2.2, Other Buildings.

Listed below are the MWTF structures/areas.

Safety Class 2 Structures:

- Support Facility
- Process Pits
- Diesel Generator Building
- Gas Sample Building
- Diesel Fuel Oil Tank Vault *
- Stacks
- Primary Storage Tank and Annulus Ventilation Structures
- Stack Monitoring Facility

The following Safety Class 2 areas are contained in or near the Support Facility:

- Primary Exhaust and Fan Rooms
- Control Room *
- Pipe Trenches *
- Process Cells
- Operating Galleries
- Backup Electric Rooms *
- Cell Exhaust Rooms
- Annulus Exhaust Room
- Condenser Cooling Equipment Room

Safety Class 3 Structures or Areas

- Weather Enclosure *
- Service Room *
- Change Room *
- Liquid Sampling Room
- Administration Building (200-East area only) *
- Administration Area (200-West Support Facility only) *
- Communications Room *
- Contaminated Solid Waste Room *
- Clean Solid Waste Room *
- Building Exhaust Room *

- Electrical Room (normal power)
- Building HVAC Supply Room *
- Corridors and Miscellaneous Services Rooms *
- Pit Ventilation Exhaust Room
- Exhaust Sample Rooms
- Sample Center Exhaust Rooms *
- Cell Supply-Air Filter Rooms *
- Air Compressor Room *
- Flush Building *

* Unless designated differently in subsequent PSAR or safety equipment lists.

Safety Classification
The safety class designations for the structures are shown above.

Structural Requirements

- Design requirements for protection against earthquake and other natural forces are specified in Section 18.0, Natural Forces.

- Design Criteria given in WHC-CM-1-3, MRP 5.46, Appendix A, for Safety Class 2 and 3, shall be applied in the design of the structures and buildings to prevent interactive hazards. DOE Order 6430.1A, Section 1300-3.1 shall be applied to mitigate the consequences of design basis accidents.

- The design of structures and buildings shall comply wit^H^G^H^Gj uirements of DOE Order 6430.1A, Section 0110-99.0.4 on building layout.

- Safety Class 2 concrete structures shall be designed in accordance with ACI 349.

- Safety Class 2 steel structures shall be designed in accordance with AISC/ANSI N690, "Specifications for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities."

- Safety Class 3 concrete structures shall be designed in accordance with ACI-318.

- Safety Class 3 steel structures shall be designed in accordance with the AISC Manual of Steel Construction.

- Floor and wall surfaces of process cells and pipe trenches subject to contamination by liquid spills or sprays of radioactive waste, or those cell or trench surfaces subject to contamination by liquid radioactive waste where maintenance of special protective coatings cannot be performed, shall be lined with stainless steel Type 304L. The inside surface of cell cover blocks and other interior concrete surfaces, subject to gas or vapor containing systems contamination, shall be painted with special protective coating (SPC), or lined with stainless steel.

- The process cell and pipe trench liners shall be designed to meet the requirements of DOE Order 6430.1A, Section 1300-11 for decommissioning and decontamination.

- The SPCs shall comply with the requirements of DOE Order 6430.1A, Sections 0900-3, 0900-99.0, and 1300-11.

- Process cells, pipe tunnels, process pits, and all other Safety Class 2 structures that constitute secondary confinement barriers shall comply with the requirements of DOE Order 6430.1A, Sections 1300-7 and 1323-5.3.

- Liquid sampling cells shall be designed to meet the requirements of DOE Order 6430.1A, Section 1323-5.2.

- The secondary confinement structures shall meet the requirement of WAC 173-303-640, for secondary containments.

- Secondary confinement structures (rooms) designed for hazardous and mixed waste container storage shall meet the requirements of WAC-173-303-630.

- As many process pits as possible shall be located inside the Weather Enclosure to facilitate maintenance in all weather conditions.

- Areas subject to contamination shall be provided with a ventilation system to prevent release of untreated contaminated air to the environment in compliance with DOE Order 6430.1A, Section 1300-7.

- To minimize radiation exposure to workers, the layout of the building, cells, shielding wall, doors, corridors, storage areas, load-out areas, and equipment shall be in accordance with WHC-SD-GN-DGS-30011 (see Section 15.2, "Radiation Protection").

Functional Requirements

- Normal and emergency access, egress, and internal traffic flow requirements shall be considered in the design.

- Separate storage areas for radioactive and chemically hazardous materials shall be provided to prevent cross-contamination.

- Separate change rooms shall be provided for male and female workers.

- The maximum travel distances to the emergency exit doors shall be in accordance with NFPA 101.

- Movement of equipment, including initial installation and future replacement or removal, shall be considered in the design.

- Requirements set forth in DOE Order 6430.1A, Section 0110-99.0 shall be complied with in the design.

- All administrative areas, except changerooms, shall have facilities suitable for physically disabled persons.

Operational and Maintenance Requirements

- Access ways, emergency equipment, automatic emergency door switches and/or crash bars, close circuit television, and warning lights shall be designed and located for safe and efficient operation and maintenance in accordance with DOE Order 6430.1A, Section 1300-7.3 and Section 0110-99.0.

- Separate cells or rooms shall be provided for major components that contain radioactive or other hazardous material for efficient maintenance or replacement of components and minimization of exposure to workers.

- The control room shall be located to provide easy and safe access to the operating gallery in the event of an emergency that may render the control room inoperable or uninhabitable.

8.1 Support Facility

General
The Support Facility is a combined reinforced concrete shear wall and steel frame structure that houses the primary storage tank ventilation system and support systems, as specified in the FDC, Section 4.1.1. The structures, areas, and rooms contained in the Support Facility are listed in Section 8.0.

Safety Classification
The Support Facility contains Safety Class 2 and Safety Class 3 equipment. The safety classification of each structural component is given in the PSAR or in safety equipment lists (under preparation) and shall be designed accordingly.

Structural Requirements

- Design loads for natural phenomena shall be in accordance with Hanford Plant Standard, SDC 4.1, as modified by Table 18.1, taking into consideration the safety function of the equipment in individual structures. Design criteria given in UCRL 15910 shall be applied as required (see Section 18.0, Natural Forces).

- Safety Class 2 structures in the Support Facility shall be designed by taking into consideration dead loads, live loads, roof live loads, soil pressure, external wind loads, and seismic loads, as applicable, in accordance with DOE Order 6430.1A, Section 0111-99.0.

- Safety Class 3 structures shall be designed for loads specified in DOE Order 6430.1A, Section 0111-2.

- Safety Class 2 structures, including exterior doors shall be designed for impact of wind-generated missiles. A site specific design basis missile shall be a 15 lb, 2- by 4-in. wooden post carried by a 50 mph wind 30-ft above ground, as defined in UCRL 15910.

- Safety Class 2 structures shall be designed to maintain their integrity during accident conditions postulated for those structures, as analyzed in the PSAR.

- Structures that provide radiation shielding shall have adequate thickness required for the protection of the workers (see Section 15.2.4, Shielding).

- Concrete members of the Safety Class 2 structures shall be designed in accordance with ACI 349 and DOE Order 6430.1A, Section 0111-99.0.1.

- Specifications for structural concrete for buildings shall be applied in accordance with ACI 301.

- Standard tolerances for concrete construction and materials given in ACI 117 shall be applied in the design.

- Steel members and connections for Safety Class 2 structures shall be designed, fabricated, and erected in accordance with AISC N 690.

- Structural steel welding requirements shall be as specified in AWS D1.1.

- Penetrations provided for piping, electric cables, and ventilation ducting shall be designed to meet the structural and shielding requirements to prevent radiation shine. All penetrations which could cause airborne contamination spreading shall be sealed.

- Minimum design loads given in ASCE 7 (formerly ANSI A58.1) shall be applied in the design. The applicable minimum design live loads are given in Table 8.1.
- The support facility and the equipment in the facility shall be designed to meet the requirements of DOE Order 6430.1A, Section 0111-99.0.7 to mitigate accident consequences.

Functional Requirements

- The same as those listed in Section 8.0, Buildings and Structures.
- Spills, overflow, or leakage from equipment located inside the Support Facility shall be retained within the facility for controlled disposal.

Operational and Maintenance Requirements

- The same as those listed in Section 8.0, Buildings and Structures.

8.2 Control Room

General
The control room shall be designed in accordance with the requirements of the FDC, Section 4.1.2. Operating and engineering control stations are located in the control room. The control room shall be provided with a raised computer floor, if required for ease of cable rerouting. The control room shall be located to provide safe and easy access to the operating galleries.

Safety Classification

The control room shall be designed to Safety Class 2 criteria.

Structural Requirements

- Design loads for natural phenomena shall be in accordance with Hanford Plant Standard, SDC 4.1, as modified by Table 18.1, taking into consideration the safety function of the individual structures. Design criteria given in UCRL 15910 shall be applied as required (see Section 18.0, Natural Forces).
- Control room structures shall be designed by taking into consideration dead loads, live loads, roof live loads, external wind loads, and seismic loads, in accordance with DOE Order 6430.1A, Section 0111-99.
- Control room structures shall be designed for impact of wind-generated missiles. A site-specific design basis missile shall be a 15 lb, 2- by 4-in. wooden post carried by a 50 mph wind 30-ft above ground, as defined in UCRL 15910.
- Control room structures shall be designed to maintain their integrity during accident conditions postulated for those structures, as analyzed in the PSAR.
- Concrete members of the control room structures shall be designed in accordance with ACI 349, and DOE Order 6430.1A, Section 0111-99.0.1.
- Specifications for structural concrete for buildings shall be applied in accordance with ACI 301.
- Standard tolerances for concrete construction and materials given in ACI 117 shall be applied in the design.
- Steel members and connections for control room structures shall be designed, fabricated, and erected in accordance with AISC S 335.
- Structural steel welding requirements shall be as specified in AWS D1.1.
- Minimum design loads given in ASCE 7 (formerly ANSI A58.1) shall be applied in the design. The applicable minimum design live loads are given in Table 8.1.

Functional Requirements

- Human factors engineering requirements set forth in Section 23 shall be applied in the design of the control room.
- The same as those listed in Section 8.0, Buildings and Structures.

Operational and Maintenance Requirements

- The same as those listed in Section 8.0, Buildings and Structures.

8.3 Diesel Generator Building

General
The diesel generator building shall be a reinforced concrete shear wall structure that houses a diesel generator (D/G), a fuel storage tank (day tank), and support equipment to supply backup power, as required by the FDC Section 4.1.3. The diesel generator building shall also contain batteries and battery chargers for starting the D/G. A long-term diesel fuel storage tank will be housed in a separate vault.

Safety Classification
The diesel generator building shall be designed to Safety Class 2 criteria.

Structural Requirements

- Requirements applicable to the diesel generator building are included in Section 8.1, Support Facility.

- Design shall provide a secondary containment for the fuel storage tank and the associated piping to prevent any oil leak to the environment, as required by WHC-CM-7-5, Section 3.0, "Hazardous Material Management."

- The applicable minimum design live loads are as follows:

D/G Building Design Live Loads

Roof	20 psf
Elevated Platforms	60 psf
Electrical Room	150 psf
D/G Room	250 psf
Concentrated loads	Per ASCE 7

Functional Requirements

- The same as those listed in Section 8.0, Buildings and Structures.

Operational and Maintenance Requirements

- Design shall prevent potential for diesel fire and fire that could be caused by diesel exhaust.

8.4 Gas Sample Building

General

The gas sample buildings are reinforced concrete shear wall structures located inside the Weather Enclosure and contain gas sampling equipment to monitor the vapor space in the primary storage tanks. They will also contain instrumentation to monitor and control operational functions of the primary storage tanks. Design of the Gas Sampling Buildings shall meet the requirements of the FDC, Section 4.1.4. Credit for Weather Enclosure design features shall be considered in the design of the gas sample building.

Safety Classification

The gas sample buildings shall be designed to Safety Class 2 criteria due to the safety class of the monitors and control equipment. Seismic issues of Safety Class 3 over 2 between the Weather Enclosure and the gas sample buildings shall be resolved during the design. Gas sampling is Safety Class 3, unless designated differently in subsequent PSAR or safety equipment lists.

Structural Requirements

- The gas sample buildings shall be designed to function as a secondary confinement for systems and components that hold or carry radioactive or hazardous materials, as required by DOE Order 6430.1A, Sections 1300-7 and 1323-5.

- Design loads for natural phenomena shall be in accordance with Hanford Plant Standard, SDC 4.1, as modified by Table 18.1, taking into consideration the safety function of the individual structures. Seismic and wind design criteria given in UCRL 15910 shall be applied as required (see Section 18.0, Natural Forces).

- The gas sample buildings shall be designed by taking into consideration dead loads, live loads, roof live loads, soil pressure, external wind loads, and seismic loads, as applicable, in accordance with DOE Order 6430.1A, Section 0111-99.

- The gas sample buildings, including exterior doors, shall be designed for impact of wind-generated missiles, unless the Weather Enclosure provides missile protection. A site-specific design basis missile shall be a 15 lb, 2- x 4-in. wooden post carried by a 50 mph wind 30-ft above ground, as defined in UCRL 15910.

- Structures that provide radiation shielding shall have adequate thickness required for the protection of the workers, in addition to the thicknesses required for structural integrity (see Section 15.2.4 for radiation shielding criteria).

- Concrete members of the Safety Class 2 structures shall be designed in accordance with ACI 349 and DOE Order 6430.1A, Section 0111-99.0.1.

- Specifications for structural concrete for buildings shall be applied in accordance with ACI 301.

- Standard tolerances for concrete construction and materials given in ACI 117 shall be applied in the design.

- Steel members and connections for the gas sample building shall be designed, fabricated, and erected in accordance with AISC N 690.

- Structural steel welding requirements shall be as specified in AWS D1.1.

- Penetrations provided for piping, electric cables, and ventilation ducting shall be designed to meet the structural and shielding requirements to prevent radiation shine. All penetrations which could cause airborne contamination spreading shall be sealed.

- Minimum design loads given in ASCE 7 (formerly ANSI A58.1) shall be applied in the design. The minimum floor live load shall be 150 psf and the minimum roof live load shall be 20 psf.

- The design shall consider the need for a separate gas sample building for each tank located in the vicinity of each tank in order to minimize long runs of sample lines.

Functional Requirements

- The same as those listed in Section 8.1, Support Facility, as applicable.

Operational and Maintenance Requirements

- The same as those listed in Section 8.1, Support Facility, as applicable.

8.5 Service Room

General
The service room is located in the Support Facility. The service room contains pressure regulators, strainers, flow meters, backflow preventers, heaters, radiation monitors, and associated valves for raw water and steam supplies. The service room shall be designed to meet the requirements of the FDC, Section 4.1.5.

Safety Classification
The service room shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists.

Structural Requirements

- Safety Class 3 structures shall be designed for loads specified in DOE Order 6430.1A, Section 0111-2.
- Standard tolerances for concrete construction and materials given in ACI 117 shall be applied in the design.
- Minimum design loads given in ASCE 7 (formerly ANSI A58.1) shall be applied in the design. The applicable minimum live design loads are given in Table 8.1.

Functional Requirements

- The same as those of listed in Section 8.1, Support Facility, as applicable.
- Indoor design temperatures shall be 85° F for the summer, and 65° F for the winter.

Operational and Maintenance Requirements

- The same as those of listed in Section 8.1, Support Facility, as applicable.

8.6 Air Compressor Room

General

Two separate air compressors are located in the air compressor room for supplying instrument air throughout the facility. Compressor cooling units are housed nearby. The air compressor room shall be designed to meet the requirements of the FDC, Section 4.1.6.

Safety Classification

The air compressor room and the air compressor/HVAC cooling equipment shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists.

Structural Requirements

- The same as for the Support Facility.

- Minimum design loads given in ASCE 7 (formerly ANSI A58.1) shall be applied in the design. The minimum floor design live loading shall be 150 psf (other minimum live loads are specified in Table 8.1). Vibratory equipment foundations shall be isolated from the building floor slabs per DOE Order 6430.1A, Section 0111-2.8.1.

Functional Requirements

- The same as those listed in Section 8.1, Support Facility, as applicable.

Operational and Maintenance Requirements

- The same as those listed in Section 8.1, Support Facility, as applicable.

8.7 Weather Enclosure

General

A permanent structure shall be installed over the underground waste storage tanks (both 200-East and 200-West areas) so that work can be performed in all weather conditions to meet the requirements of the FDC, Section 4.1.7. The structure shall also provide weather protection for the various equipment associated with waste storage tanks, and for the equipment required for remote inspection, sampling, and maintenance activities.

The gas sample buildings, primary storage tank ventilation system intake building, and Instrumentation Enclosure are located inside the Weather Enclosure.

Safety Classification

The Weather Enclosure shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists, and shall be analyzed to prevent collapse under Safety Class 1 seismic, winds, and ashfall loads.

Structural Requirements

- The Weather Enclosure is not required to perform the function of a confinement barrier as defined in DOE Order 6430.1A, Section 1300. ALARA principles and radiation protection requirements, however, shall apply in accordance with DOE Order 6430.1A, Section 1300-6.

- Design loads for natural phenomena shall be in accordance with Hanford Plant Standard, SDC 4.1, as modified by Table 18.1. Seismic and wind design criteria and guidelines given in UCRL 15910 shall be applied as required (see Section 18.0, Natural Forces).

- The Weather Enclosure shall be designed by taking into consideration dead loads, live loads, roof live loads, soil pressure, external wind loads, and seismic loads, as applicable and as modified above, in accordance with DOE Order 6430.1A, Section 0512-3.

- Design/build specifications for the Weather Enclosure shall be developed in accordance with DOE Order 6430.1A, Section 0512-3.

- Structural steel welding requirement specifications shall be developed in accordance with AWS D1.1.

- Minimum design loads given in ASCE 7 (formerly ANSI A58.1) shall be applied in the design. The applicable minimum live design loads are as follows:

    - Roof loads: 20 psf
    - Roof auxiliary (piping, lighting fixtures, heating units, and fire sprinklers, etc.) loads: 10 psf
    - Floor slab level load 125 psf
    - Concentrated loads: per ASCE 7

- The design shall provide at least one hollow-metal personnel door and two electrically operated, roll-up steel doors of sufficient size to accommodate the required maintenance vehicles. The design basis maintenance vehicle size (e.g. crane) shall be defined in the design specifications.

- The design shall allow for installation and removal of tank equipment of the largest size, while keeping the enclosure height to a minimum. The design basis equipment size shall be specified during the detail design.

- The need for a fire protection system will be evaluated in the Fire Hazards Analysis Report.

Functional Requirements

- The Weather Enclosure is not required to perform the function of a confinement system.

- Emergency access, egress, and maximum travel distances to the emergency exit doors shall be in accordance with NFPA 101.

Operational and Maintenance Requirements

- The Weather Enclosure should allow for year-round operational and maintenance work.

- The design shall provide a coated concrete floor which prevents spreading of dust and facilitates cleanup of contamination. The Weather Enclosure performs no other confinement function.

- The inside walls of the Weather Enclosure shall be capable of being decontaminated.

- The design shall provide for curbing at the perimeter to prevent fire water spills to the environment.

- Special cleaning equipment needs shall be considered during the design.

8.8 Primary Storage Tank and Annulus Ventilation Air Intake Structure

General
The air intake structures are located inside the Weather Enclosure and contain filters and instrumentation for supplying air for cooling inside the primary storage tanks and the annulus. The design of the air intake structure shall meet the requirements of the FDC, Section 3.4.1.

Safety Classification
The air intake structures shall be designed to Safety Class 2 criteria. Any issue of Safety Class 3 over 2 between the Weather Enclosure and the air intake structures shall be resolved during the design.

Structural Requirements

- Design loads for natural phenomena shall be in accordance with Hanford Plant Standard, SDC 4.1, as modified by Table 18.1, taking into consideration the safety function of the individual structures. Seismic and wind design criteria given in UCRL 15910 shall be applied as required.
- The air intake structures shall be designed by taking into consideration dead loads, live loads, roof live loads, soil pressure, external wind loads, and seismic loads, as applicable, in accordance with DOE Order 6430.1A, Section 0111-99.0.
- The air intake structures including exterior doors shall be designed for impact of wind-generated missiles, unless it is shown by design that the Weather Enclosure provides protection from missile impact. A site-specific design basis missile shall be a 15 lb, 2-in. x 4-in. wooden post carried by a 50 mph wind 30-ft above ground, as defined in UCRL 15910.
- Concrete members of the Safety Class 2 structures shall be designed in accordance with ACI 349 and DOE Order 6430.1A, Section 0111-99.0.1.
- Specifications for the structures shall be applied in accordance with ACI 301.
- Steel members and connections for the structures shall be designed, fabricated, and erected in accordance with AISC N 690.
- Structural steel welding requirements shall be as specified in AWS D1.1.
- Minimum design loads given in ASCE 7 (formerly ANSI A58.1) shall be applied in the design. The minimum live load shall be 150 psf and the minimum roof live load shall be 20 psf.

Functional Requirements

- The same as those listed in Section 8.1, Support Facility, as applicable.

Operational and Maintenance Requirements

- The same as those listed in Section 8.1, Support Facility, as applicable.

8.9 Stacks

General
A self-supported, stainless steel exhaust stack of sufficient height, shall be designed, installed, and connected to the ventilation exhaust system by stainless steel pipes in an underground concrete tunnel in accordance with the FDC, Sections 3.4.1 and 3.4.2. The underground tunnel and the stack are installed for release of treated and filtered air streams from contaminated or potentially contaminated systems and areas as required by the FDC, Section 4.2.1.

Safety Classification
The stack and underground tunnel shall be designed to Safety Class 2 criteria.

Structural Requirements

- The stack shall be self-supported, stainless steel structures with a concrete foundation.
- The stack shall be designed in accordance with rules of ASME/ANSI STS-1.
- The stack shall be of sufficient height and located away from other facilities to prevent the stack discharges from mixing with the ventilation intake air and exposing facility workers, in accordance with the criteria set forth in DOE Order 6430.1A, Section 1550-99.0.2.
- The underground concrete tunnel shall either be lined with stainless steel or coated with a special protective coating (SPC), in accordance with DOE Order 6430.1A, Section 0900-99.
- Maintenance access to the stack monitoring equipment shall be provided.
- Other design requirements for applicability of codes and standards listed in Section 8.1 shall apply.
- A separate stack for the annulus ventilation system and for the Support Facility ventilation system is not required.
- The minimum design live loads, as required by ASCE 7, shall include:
    - Elevated platforms loads: 60 psf
    - Concrete tunnel loads: 300 psf
    - Concentrated loads: per ASCE 7

Functional Requirements

- The stack shall remain functional under design basis accident (DBA) or DBE as defined in the PSAR and SDC 4.1, as modified by Table 18.1.
- The stack shall be monitored continuously to determine the quantities of radioactive or other hazardous materials released to the environment during and after DBA or DBE, in accordance with DOE Order 6430.1A, Section 1300-3.2 (bullet 4).

Operational and Maintenance Requirements

- Monitoring probes and any other equipment installed on the stack (i.e., beacon lights) shall be accessible for maintenance without creating unsafe conditions for the workers.

- Provisions shall be made to facilitate decontamination of the exhaust tunnel and the stack.

8.10 Stack Monitoring Facility

General
The stack monitoring facility is a reinforced concrete shear-wall structure that houses redundant radiation monitors with near iso-kinetic sampling for the stack, as specified in the FDC, Section 4.1.1.

Safety Classification
The facility contains Safety Class 2 and Safety Class 3 equipment. The PSAR or safety equipment lists will list the actual safety classifications.

Structural Requirements

- Design loads for natural phenomena shall be in accordance with Hanford Plant Standard, SDC 4.1, as modified by Table 18.1, taking into consideration the safety function of the equipment. Design criteria given in UCRL 15910 shall be applied as required (see Section 18.0, Natural Forces).
- The structure shall be designed by taking into consideration dead loads, live loads, roof live loads, soil pressure, external wind loads, and seismic loads, as applicable, in accordance with DOE Order 6430.1A, Sections 0111-2, 0111-99.0.
- The structure, including exterior doors, shall be designed for impact of wind-generated missiles. A site-specific design-basis missile shall be a 15 lb, 2- by 4-in. wooden post carried by a 50 mph wind 30-ft above ground, as defined in UCRL 15910.
- Safety Class 2 structures shall be designed to maintain their integrity during accident conditions postulated for those structures, as analyzed in the PSAR.
- Structures that provide radiation shielding shall have adequate thickness required for the protection of workers (see Section 15.2.4, Shielding).
- Concrete members of this Safety Class 2 structure shall be designed in accordance with ACI 349 and DOE Order 6430.1A, Section 0111-99.0.1.
- Specifications for Structural Concrete Buildings shall be applied in accordance with ACI 301.
- Standard tolerances for concrete construction and materials given in ACI 117 shall be applied in the design.
- Steel members and connections of this Safety Class 2 structure shall be designed, fabricated, and erected in accordance with AISC N 690.
- Structural steel welding requirements shall be specified in AWS D1.1.
- Adequate shielding shall be provided to protect the workers from radiation from the samples.
- Minimum design loads given in ASCE 7 (formerly ANSI A58) shall be applied in the design. The minimum roof design live load is 20 psf.
- The facility and the equipment in the facility shall be designed to meet the requirements of DOE Order 6430.1A, Section 0111-99.0.7, to mitigate the consequences of accidents.

Functional Requirements

- The same as those listed in Section 8.0, Buildings and Structures.

Operational and Maintenance Requirements

- The same as those listed in Section 8.0, Buildings and Structures.

8.11 Administration Building

General
The Administration Building (200-East site only) located near the Support Facility. The Administration Building shall be as specified in the FDC, Section 4.2.2. The building will contain offices, a lunchroom, a nonprotective clothing changeroom, training rooms, and a communications room.

Safety Classification
The Administration Building performs only Safety Class 3 functions, unless designated differently in subsequent PSAR or safety equipment lists.

Structural Requirements

- Design loads for natural phenomena shall be in accordance with Hanford Plant Standard, SDC 4.1, as modified by Table 18.1. Design criteria given in UCRL 15910 shall be applied as required (see Section 18.0, Natural Forces).

- Safety Class 3 structures shall be designed for loads specified in DOE Order 6430.1A, Section 0111-2.

- Specifications for structural concrete for buildings shall be applied in accordance with ACI-301.

- Standard tolerances for concrete construction and materials given in ACI 117 shall be applied in the design.

- Structural steel welding requirements shall be as specified in AWS D1.1.

- Minimum design loads given in ASCE 7 (formerly ANSI A58.1) shall be applied in the design.

Functional Requirements

- The same as those listed in Section 8.0, Buildings and Structures, as applicable to Safety Class 3 structures.

- Indoor design temperatures shall be 78° F (max.) for the summer, and 72° (min.) for the winter.

Operational and Maintenance Requirements

- The same as those listed in Section 8.0, Buildings and Structures.

8.12 Section 8.0 References

FDC

- Section 3.4.1, Primary Storage Tank Ventilation System.
- Section 3.4.2, Annulus Ventilation System.
- Section 4.1, Architectural.
- Section 4.1.1, Support Facility.
- Section 4.1.2, Control Room.
- Section 4.1.3, Diesel Generator Building.
- Section 4.1.4, Sample Building.
- Section 4.1.5, Service Area.
- Section 4.1.6, Air Compressor Rooms.
- Section 4.1.7, Weather Enclosure.
- Section 4.2.1, Support Facility.
- Section 4.2.2, Other Buildings.

DOE Order 6430.1A (1989)

- Section 0110-99.0, Special Facilities.
- Section 0110-99.0.4, Building Layout.
- Section 0111-2, Loads.
- Section 0111-2.8.1, Vibratory Loadings.
- Section 0111-99.0, Special Facilities.
- Section 0111-99.0.1, Nonreactor Nuclear Facilities - General.
- Section 0111-99.0.7, Explosion, Internal Pressurization, Criticality, and Other DBA Causes.
- Section 0512-3, Pre-Engineered Metal Buildings.
- Section 0900-3, Hazardous Materials.
- Section 0900-99, Special Facilities.
- Section 1300-3.1, Safety Class Criteria, General.
- Section 1300-3.2, Safety Class Items.
- Section 1300-6, Radiation Protection.
- Section 1300-7, Confinement Systems.
- Section 1300-7.3, Access Ways.
- Section 1300-11, Decontamination and Decommissioning.
- Section 1323-5, Confinement Systems.
- Section 1323-5.2, High-Level Liquid Waste Confinement.
- Section 1323-5.3, Low-Level Liquid Waste Confinement.
- Section 1550-99.0.2, Confinement Ventilation Systems.

Hanford Plant Standards

- SDC 4.1, Rev. 12, Design Rules for Facilities.

Industry Codes and Standards

- ACI Section 117-90, Standard Specification for Tolerances for Concrete Construction and Materials.
- ACI Section 301-89, Specifications for Structural Concrete for Buildings.
- ACI 318-89 with 1992 Rev., Building Code Requirements for Reinforced Concrete.
- ACI 349-90, Manual of Concrete Practice, Code Requirements for Nuclear Safety Related Concrete Structures.
- AISC Manual of Steel Construction, Allowable Stress Design, 9th Edition.
- AISC Manual of Steel Construction, Load and Resistance Factor Design, 1st Edition.
- AISC/ANSI N690-89, Specifications for Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities.

- AISC S 335-89, Specification for Structural Steel Buildings.
- AWS D1.1-92, Structural Welding Code - Steel.
- ASCE 7-88 (formerly ANSI A58.1), Minimum Design Loads for Buildings and Other Structures.
- ASME/ANSI STS-1, Steel Stacks, 1982.
- NFPA 101, Life Safety Code, 1994.
- UCRL-15910, Design and Evaluation Guidelines for DOE Facilities - Subjected to Natural Phenomena Hazards, 1990.

<u>Washington Administrative Codes (WAC)</u>

- WAC Section 173-303-630, Use and Management of Containers, December 1993.
- WAC Section 173-303-640, Tank Systems, December 1993.

<u>Westinghouse Hanford Company</u>

- WHC-CM-1-3, MRP 5.46, Rev. 4, Appendix A, Design/Analysis Criteria for WHC Safety Class Systems, Components, and Structures.
- WHC-CM-7-5, Environmental Compliance, June 1993.
- WHC-SD-GN-DGS-30011, Radiological Design Guide, 1994.

<u>W-236A Project Reports</u>

- WHC-SD-W236A-PSAR-001, Preliminary Safety Analysis Report, Multi-Function Waste Tank Facility, March 1994.

TABLE 8.1
SUPPORT FACILITY DESIGN MINIMUM LIVE LOADS

Roof (except as noted) Operating Gallery Roof	20 psf 100 psf
2nd Floor	150 psf
1st Floor (except as noted) Pipe Trench Floor Cell Floor Change Room Floor	150 psf 250 psf 250 psf 100 psf
Miscellaneous: HVAC Service Tunnel HVAC Exhaust Tunnel Stairs and Exitways Elevated Platforms Cell Cover Blocks	 150 psf 150 psf 100 psf 60 psf 1000 psf **
Concentrated Loads per ASCE 7	

** This includes a cover block + 100% impact load.

9.0 Heating, Ventilation, and Air Conditioning (HVAC) Systems

General

Heating, ventilation, and air conditioning (HVAC) systems shall be designed for the Support Facility, Weather Enclosure, and other buildings located outside the Support Facility to meet the requirements of the FDC, Section 4.2. The other buildings include:

- Administration Building
- Diesel Generator (D/G) Building
- Gas Sampling Buildings
- Process Pits
- Stack Monitoring Building

The design shall take into consideration the energy efficiency requirements set forth in DOE Order 6430.1A, Section 0110-12, and Section 1525-2, as specified in Section 13.0 of this document and in Section 4.6 of the FDC.

The HVAC design requirements for each of the buildings, except the Administration Building, are specified in the following sections. The Administration Building will have office building HVAC per DOE Order 6430.1A, Section 1550-2.

The applicable FDC Sections are listed below:

- Section 3.2.2, Process Pits.
- Section 4.1.1, Support Facility.
- Section 4.1.4, Liquid Sample Building.
- Section 4.1.7, Weather Enclosure.
- Section 4.2, HVAC.
- Section 4.2.1, Support Facility.
- Section 4.2.2, Other Buildings.
- Section 4.6, Energy Conservation.

9.1 Support Facility HVAC

General
The ventilation system includes ductwork, fans, air-cleaning, tempering, or humidity control devices and associated monitoring, instrumentation and controls required to confine radioactive material within the ventilation system and to remove radioactive material from air streams released to the environment. An airflow pattern shall be established to ensure that airflow is from areas of least contamination to areas of greater contamination. The building shall be divided into four ventilation zones as shown in Table 9.1. The design of the Support Facility HVAC System shall meet the requirements of the FDC, Section 4.2.1.

Safety Classification
The Support Facility HVAC systems shall be designed to Safety Class 2 or 3 criteria, depending on the safety classification of the ventilated area.

Structural Requirements

- Air from potentially contaminated areas shall be filtered before release to the environment in accordance with the requirements of DOE Order 6430.1A, Section 1300-7.

- The building HVAC systems shall be designed in accordance with NFPA 90A and various ASHRAE standards specified in DOE Order 6430.1A, Section 1550. The design shall ensure that each requirement listed in Section 1550-99.0.2 of DOE Order 6430.1A is incorporated in the design. SDC 5.1 shall also be used in the design of HVAC the system.

- Safety Class 2 HVAC system components shall be provided with backup power to meet the criteria set forth in 6430.1A, Sections 1161-4 and Section 1550-99 and specified in WHC-CM-1-3, MRP 5.46.

- Failure of any single component in the Safety Class 2 system shall not compromise the function of the system to maintain the minimum required ventilation flow to meet the requirements of DOE Order 6430.1A, Section 1550-99. Single failure criteria are provided in WHC-CM-1-3, MRP 5.46.

- Supply air shall be properly conditioned and distributed at or near the ceiling to the potentially contaminated areas of the facility.

- WHC-SD-GN-DGS-30011 shall be used in the design of the facility.

- Air from ventilation zones 2 and 3 shall be removed near the floor through individual grilles or registers.

- The climatic conditions for each area of the Support Facility are specified in Table 9.2, to meet the requirements of DOE Order 6430.1A, Section 1550.

- The ventilation system shall be instrumented and alarmed to indicate and record its behavior. The instrumentation requirements shall be in accordance with ASME N509.

- The ventilation system shall be equipped for acceptance testing and periodic or continuous surveillance in accordance with requirements of ASME N510.

- Outdoor air intake units shall be weather protected. Intake units shall be arranged so as to minimize the effects of high winds, rain, snow, hoarfrost, and debris on the operation of the system. Heating coils shall be located upstream of filters to prevent damage caused by icing or moisture conditions.

- The supply air units shall be provided with at least 80% ASHRAE-rated prefilters to reduce build-up on the HEPA filters in the exhaust systems.

- Safety Class 2 air supply units shall be protected from missiles in accordance with SDC 4.1, (see Section 8.0, Buildings and Structures).

- Air supply inlets to ventilation zone 1 shall be provided with HEPA filters or bubble-tight isolation dampers.

- HEPA filter trains of the exhaust systems should be placed within a ventilation zone 3 area as a minimum.

- Ductwork shall be designed and constructed in accordance with ASME AG-1. Round or rectangular ductwork with rounded corners shall be used for ventilation zone 1, 2, and 3 exhaust systems.

- The capacity of the exhaust fans shall be sufficient to provide design flow rates when the differential pressure across one bank of HEPA filters in an air-cleaning system has increased by a minimum of 3.0 inches water column above initial clean filter conditions.

- The selected HEPA filter type shall meet the requirements of the applicable Hanford Plant Standards HPS-157-M through HPS-160-M, standard specifications for HEPA filters.

Functional Requirements

- The design of the building HVAC shall ensure that the desired airflow is maintained when personnel access doors or hatches are open. Airlocks or enclosed vestibules shall be used to minimize the impact on the ventilation system when opening doors or hatches.

- Airlocks shall be provided to prevent the spread of contamination within the facility, as required.

Operational and Maintenance Requirements

- The air filtration system shall have remotely operated test and measuring devices for monitoring operations, maintenance, and for periodic inspection and testing, as much as feasible.

- The exhaust prefilters and HEPA filters shall be installed to facilitate filter changes with minimum radiation exposure to personnel, as much as feasible.

9.2 Weather Enclosure Ventilation

General
The Weather Enclosure shall be provided with a ventilation system to meet the requirements of the FDC, Section 4.1.7.

Safety Classification
The Weather Enclosure ventilation shall be designed to Safety Class 3 criteria.

Structural/Mechanical Requirements

- Structural requirements for Weather Enclosure are given in Section 8.7, Weather Enclosure.
- Heating, cooling, and ventilating for the Weather Enclosure shall be provided by recirculating units consisting of a heating coil, an ASHRAE-rated filter bank, an evaporative cooling section, and a supply fan.
- Exhaust fans shall be provided to exhaust air from the Weather Enclosure during summer months. Exhaust fans shall be provided with louvers and motor-operated dampers.
- Indoor design temperatures for the Weather Enclosure shall be 90° F in the summer and 40° F in the winter.
- Ventilation rates for the Weather Enclosure shall dilute diesel and gasoline fumes from vehicles operating in the Weather Enclosure to acceptable values, or exhaust units and pertinent accessories shall be provided.

Functional Requirements

- The Weather Enclosure ventilation system shall provide a clean and controlled work environment.
- The design shall provide for lighting and receptacles for maintenance and inspection activities.

Operational and Maintenance Requirements

- The same as those in the Functional Requirements.

9.3 Diesel Generator Building Ventilation

General
A ventilation system shall be provided to prevent extreme temperature conditions in the diesel generator building to meet the requirements of the FDC, Section 4.2.2.

Safety Classification
Diesel generator building ventilation system shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists.

Structural Requirements

- Equipment and instrumentation in the diesel generator building, the fuel tank vault, and the battery room shall be protected from freezing conditions in the winter and high-temperature conditions in the summer.
- An air inlet duct shall be provided in the walls or roof of the D/G building.
- Another duct shall be provided in the roof of the D/G building for the diesel exhaust.
- Both ducts shall be protected from missiles. The design-basis missile is defined in SDC 4.1.
- The ventilation system for the battery room shall be in accordance with NFPA-70, Article 480.
- The ventilation system for the fuel tank vault shall be in accordance with ANSI N195.

Functional Requirements

- The diesel generator building ventilation system shall prevent extreme temperature conditions in the diesel generator building.

Operational and Maintenance Requirements

- The diesel generator building ventilation system shall be designed to maintain 65° F in the winter and 87° F in the summer.

9.4 Process Pit Exhaust

General
The process pits shall be provided with an exhaust system to meet the requirements of the FDC, Sections 3.2.2 and 4.1.7. (The chemical addition pit and the crossover pit are not process pits.)

Safety Classification
The process pit exhaust system shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists. The pit structure is Safety Class 1S.

Structural/Mechanical Requirements

- The exhaust stream shall be cleaned using HEPA filter trains before discharge to the environment. The HEPA filter housing shall be designed in accordance with the requirements of ASME N509 and tested in accordance with N510, with a bag-in/bag-out arrangement.

- The HEPA filters shall meet the requirements of Hanford Plant Standard HPS-159-M.

- Valves and dampers shall be designed in accordance with ASME N509, and tested in accordance with ASME N510.

- Exhaust fans shall be centrifugal type. The fan motors shall be in accordance with NEMA MG1.

- Instrumentation for measure pressure differential across individual HEPA filters shall be provided. Gauges and instruments shall be appropriately located and protected to prevent moisture accumulation (see Section 7.0, Instrumentation and Control).

Functional Requirements

- The process pit exhaust shall provide (-) 0.3 inch wc pressure in the pits with the cover blocks in place.

Operational and Maintenance Requirements

- The same as those in the Functional Requirements.

9.5 Gas Sample Building Ventilation

General
The gas sample building shall be provided with a recirculating HVAC system, as required by the FDC, Section 4.1.4.

Safety Classification
The gas sample building HVAC system shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists.

Structural/Mechanical Requirements

- Structural requirements for the gas sample buildings are given in Section 8.4, Gas Sample Building.
- Heating, cooling, and ventilating for the gas sample buildings shall be provided by recirculating units consisting of a heating coil, an ASHRAE-rated filter bank, cooling coil, and a supply fan.
- Indoor design temperatures for the gas sample building shall be 78° F summer, 72° F winter.

Functional Requirements

- The HVAC system shall be designed in accordance with NFPA 496.

Operational and Maintenance Requirements

- The same as those in the Functional Requirements.

9.6 Stack Monitoring Building Ventilation

General
The stack monitoring building shall be provided with a ventilation system to meet the requirements of the FDC, Section 4.1.1.

Safety Classification
The stack monitoring building ventilation shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists.

Structural/Mechanical Requirements

- Structural requirements for the stack monitoring building are given in Section 8.10, Stacking Monitoring Building.
- Heating, cooling, and ventilating for the stack monitoring building shall be provided by recirculating units consisting of a heating coil, an ASHRAE-rated filter bank, a cooling coil, and a supply fan.
- Indoor design temperatures for the stack monitoring building shall be 78° F summer, 72° F winter.

Functional Requirements

- The stack monitoring building ventilation system shall provide a clean and controlled work environment.

Operational and Maintenance Requirements

- The same as those in the Functional Requirements.

9.7 Section 9.0 References

References

FDC

- Section 3.2.2, Process Pits.
- Section 4.1.1, Support Facility.
- Section 4.1.4, Liquid Sample Building.
- Section 4.1.7, Weather Enclosure.
- Section 4.2, HVAC.
- Section 4.2.1, Support Facility (HVAC).
- Section 4.2.2, Other Buildings.
- Section 4.6, Energy Conservation.

DOE Order 6430.1A (1989)

- Section 0110-12, Energy Conservation.
- Section 1161-4, Ventilation.
- Section 1300-7, Confinement Systems.
- Section 1525-2, Minimization of Energy Loss.
- Section 1550, Heating, Ventilation and Air Conditioning Systems.
- Section 1550-2, HVAC Selection
- Section 1550-99, Special Facilities.
- Section 1550-99.0.2, Confinement Ventilation Systems.

Hanford Plant Standards

- SDC 4.1, Rev. 12, Design Load for Structures.
- SDC 5.1, Rev. 7, Heating, Ventilation, and Air Conditioning.
- HPS-157-M, Rev. 1, Standard Specification for Fire and Moisture-Resistant Nuclear Grade HEPA Filters.
- HPS-158-M, Rev. 1, Standard Specification for Hydrogen Flouride- and Caustic-Resistant Nuclear Grade HEPA Filters.
- HPS-159-M, Rev. 1, Standard Specification for Fire, Moisture, and Chemical Resistant Nuclear Grade HEPA Filters.
- HPS-160-M, Rev. 1, Standard Specification for Fire and Moisture Resistant, High Temperature and High Humidity Nuclear Grade HEPA Filters.

Westinghouse Hanford Company

- WHC-SD-GN-DGS-30011, Radiological Design Guide, 1994.
- WHC-CM-1-3, MRP 5.46, Rev. 4, Appendix A, Design/Analysis Criteria for WHC Safety Class Systems, Components, and Structures.

Industry Codes and Standards

- ASME AG-1, Code on Nuclear Air and Gas Treatment, 1991, with Addenda AG-1b, 1993.
- ASME N509, Nuclear Power Plant Air Cleaning Units and Components, 1989.
- ASME N510, Testing of Nuclear Air Treatment Systems, 1989.

- ANSI/NFPA 70-1993, National Electric Code.
- NEMA MG1, Motors and Generators, 1987.
- NFPA 90A, Standard for the Installation of Air Conditioning and Ventilation Systems, 1989.
- NFPA 496, Standard for Purged and Pressurized Enclosures for Electrical Equipment, 1993.
- ANSI N 195-1976 (ANS-59.51), Fuel Oil System for Standby Diesel Generators, 1976.

TABLE 9.1

SUPPORT FACILITY PRESSURE ZONES

Zone	Pressure with Respect to Atmosphere	Area
1	(-)0.75 in. wc	Process cells, pipe trenches, liquid sampling cells
2	(-)0.25 in. wc	Cell exhaust rooms, primary exhaust rooms, liquid sampling rooms, exhaust sampling rooms, annulus exhaust room
3	(-)0.15 in. wc	Building exhaust room, changeroom, contaminated solid-waste room, operating galleries, condenser cooling equipment room
4	(+)0.05 in. wc	Communications room, air-compressor room, building HVAC supply room, control room, electrical rooms, administrative areas (200-West area only)

TABLE 9.2

SUPPORT FACILITY INDOOR TEMPERATURES

Areas	Temperatures °F DB	
	Summer	Winter
Offices*, lobby*, lunchroom*, conference rooms*, operating galleries, liquid sampling room, training rooms*, ready room, manipulator maintenance room, RAM/HPT office, men/women restrooms, RAM office*, HPT office*	78°	72°
Electrical rooms (normal and backup), exhaust sampling rooms, work room	80°	65°
Clean and contaminated solid-waste room, condenser cooling equipment room, building exhaust room, primary exhaust room, annulus exhaust room, cell exhaust rooms, building HVAC supply room, cell supply-air filter room, pit ventilation exhaust room, air compressor room, chemical makeup room, storage room, service room	85°	65°
Process cells, pipe trench	100°	45°
Communications room, control room, programming room	72° ± 2° F; 45 ± 5% RH	72° ± 2° F; 45 ± 5% RH
Changeroom, decontamination room	78°	75°
Fire riser room	-	45°
Sample Cell	105°	60°
Unoccupied storage room, janitor closet, elevator machine room	Exhaust fan with thermostatically controlled thermostat when temperature is below 50° F and above 85° F. Makeup air shall come from general office areas or corridors.	
Corridors	Same as adjacent spaces	

* 200-West area Support Facility only

10.0 Utilities

General
This section delineates design requirements for utility systems provided in the MWTF, in accordance with the requirements of the FDC, Section 4.3, Utilities.

The applicable FDC Section are listed below:

- Section 3.4.10, Condensate Collection.
- Section 4.3, Utilities.
- Section 4.3.1, Compressed Air.
- Section 4.3.2, Raw Water.
- Section 4.3.3, Steam.
- Section 4.3.4, Sanitary Water.
- Section 4.3.5, Sanitary Sewer.

10.1 Compressed Air

General
A set of redundant, electric-driven air compressors shall be installed to supply process air and instrument air to meet the requirements of the FDC, Section 4.3.1.

Safety Classification
The compressed air system shall be designed to Safety Class 3 criteria.

Structural and Mechanical Requirements

- The air compressors shall be designed in accordance with DOE Order 6430.1A, Section 1595, Controls.
- All integral parts of each compressor unit shall be structurally supported by the mounting skid designed in accordance with AISC S 335.
- The units shall be liquid-cooled, rotary, electric-motor driven, with oil-free air compressors, filters, after-coolers and automatic regenerating dryers, and one common air receiving tank. All shall be mounted on skids ready for installation indoors on a concrete slab.
- The normal compressor shall be connected to the normal electric power supply. The standby compressor shall be available for service from the alternate normal power supply in the event of failure of the normal compressor. The electric construction shall meet NEMA ICS 6 enclosure requirements (see NEMA 250 for enclosure types).
- The compressors shall be provided with automatic switch-over capabilities.
- Two closed-circuit liquid coolers complete with automatic mixing valves, expansion tank, and pumps shall be provided for cooling the compressors and after-coolers.
- All vessels and piping shall be carbon steel. The receiver vessels shall be designed in accordance with ASME Section VIII, Division 1 and shall be code-stamped. All piping shall be fabricated and installed in conformance with ASME B31.3, Normal Service Category.
- Heat exchangers shall be designed, fabricated, and installed per TEMA standards and ASME Section VIII, Division 1 (code-stamped).
- Condensate from receiver tanks, filters, etc. shall be delivered to an appropriate container for collection and disposal.

Functional Requirements

- Each unit shall be capable of providing 150% of the required airflow for instrumentation and control systems and other facility services (see Section 7.0, Instrumentation and Control).

Operational and Maintenance Requirements

- The compressed air equipment shall be located in radiation or contamination free environment for easy access for maintenance.

10.2 Raw Water

General
Two independent outside lines shall be provided to supply raw water to the facility in accordance with FDC Section 4.3.2. These lines will provide a fire protection loop extending around the facility.

Safety Classification
All piping shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists.

Structural and Mechanical Requirements

- The design of the piping system shall comply with the general requirements of DOE Order 6430.1A, Sections 1530-9 and 1530-99.0.
- Thrust restraints on supports and bends within the piping system shall be in accordance with NFPA 24.
- The water distribution systems shall be of the looped grid type providing two-way flow with sectional valving arranged to provide alternate water flow paths to any point in the system.
- Adequately spaced 6-in. fire hydrants per AWWA C502, and sectional valving per AWWA C500, shall be provided and connected to the fire protection loop.
- 8-in. underground fire mains extending from the 12-in. fire-protection loop shall feed water to the sprinkler systems. The design of the underground fire water system shall be in accordance with NFPA 24.
- The water distribution system shall follow the guidelines established in DOE Order 6430.1A, Section 0266-4, and DOE RLID 5480.7, "Fire Protection."
- Services shall extend from horizontal service headers.
- A minimum 4-in. diameter line connected to the fire-protection loop shall be provided for process water for the Support Facility.
- The process waterline will be equipped with a flowmeter, radiation detector, and a pressure-reducing valve to prevent over pressurization of the line. Dedicated lines, each extending from the 4-in. header will supply make-up process water for chemical addition, flush building hydrants, and other process water requirements on the tank farm.
- The backflow preventers shall be installed in accordance with the AWWA Cross-Connection Control Manual.

Functional Requirements

- The raw water system shall be a reliable source for fire water and process water systems.

Operational and Maintenance Requirements

- Contamination of the raw water system shall be prevented by design.

10.3 Steam

General
A new 225-lb steamline shall be provided as required by the FDC, Section 4.3.3. The steamline will run above grade, supported intermittently on reinforced concrete supports. At low points of the steam distribution system, steam traps will be installed to collect and transfer condensate into a collection system, as required by the FDC, Section 3.4.10.

Safety Classification
Steam, condensate lines, and the steam condensate collection system shall be designed to Safety Class 3 criteria, unless the PSAR or safety equipment lists conflict.

Structural and Mechanical Requirements

- Steam and steam condensate lines shall be designed to the requirements of ASME B31.1. Piping flexibility analysis of the steam distribution system shall be made in accordance with ASME B31.1, per DOE Order 6430.1A, Section 1550-2.4.

- Steam connections from the steam headers for equipment shall be provided with a gate valve located in a horizontal run at the header and a globe valve adjacent to the equipment. This valving shall be in addition to any control valves.

- Services shall extend from horizontal service headers.

- The steam condensate collection tank shall be designed to the requirements of ASME Section VIII, Division 1.

Functional Requirements

- Adequate supply of steam shall be available for reliable operation of the systems that require steam.

- The steam condensate collection system shall be designed to handle a combined maximum flow rate of 50 gpm per the FDC, Table D.1.

- Steam condensate shall be collected and, after any best available technology (BAT) is applied in accordance with WHC-EP-0137 to meet the State of Washington discharge requirements under WAC-173-216, shall be disposed of through the 200-East Treated Effluent Facility (TEDF) (project W-049H) (reference WHC-SD-W049H-ICD-001).

Operational and Maintenance Requirements

- The valves that require manual operation shall not be located in enclosed spaces, to preclude personnel entrapment in the event of a steam leak.

- Valves on steamlines shall be provided with remote-operation features as much as feasible.

- Adequate pressure- and temperature-sensing devices shall be provided for indication of steamline conditions.

- Monitoring and sampling capabilities of the BAT system at the steam condensate collection point shall be in accordance with the requirements of the 200-East area TEDF (project W-049H). An appropriate LCU and/or DCS shall be used. Applicable parameters of the condensate to be discharged, such as pH, conductivity, total alpha and/or total beta, shall be monitored on a real-time basis for normal or upset conditions. Temperature of the discharge should also be considered for monitoring.

10.4 Sanitary Water

General
A minimum 6-in. diameter line shall be connected to an existing sanitary waterline to supply potable water to the facility as required by FDC Section 4.3.4.

Safety Classification
All piping shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists.

Structural and Mechanical Requirements

- The design of the piping system shall comply with the general requirements of DOE Order 6430.1A, Section 0260, and installed in accordance with NFPA 24.
- Thrust restraints on supports and bends within the piping system shall be in compliance with NFPA 24.
- Buried sanitary water distribution system shall be constructed of polyvinyl chloride (PVC) material AWWA C900, and be designed to deliver a peak flow of 2-1/2 times the daily demand, plus any special demands, at a minimum residual pressure of 30 psi. Sanitary water piping inside buildings shall be galvanized or black steel piping.
- The system design shall be per DOE Order 6430.1A, Section 0266-4.
- When sanitary waterlines must cross sewers or force mains, the waterlines shall cross 2-ft above the sewer or force main as established in DOE Order 6430.1A, Section 0270-1.3.
- The quality of potable water in the system shall be protected from degradation by installation of backflow prevention assemblies, as necessary, to preclude backflow of contaminants or pollutants into the system in compliance with DOE Order 6430.1A, Sections 0266 and 0266-2, and with WAC 246-290-490.
- Services shall extend from horizontal service headers.

Functional Requirements

- The sanitary water must be potable and free from disease-causing bacteria.

Operational and Maintenance Requirements

- The sanitary water system shall be designed for routine maintenance without disabling the contaminant backflow prevention features.

10.5 Other Utilities

General
If provided, other utility systems, including the sewage system required by FDC Section 435, shall be designed in accordance with applicable Federal, State, and County regulations.

Safety Classification
These systems shall be designed to Safety Class 3 criteria.

Structural and Mechanical Requirements

- Applicable WAC, WSDOH, and HPS codes and standards are listed in the References. Other applicable codes and standards not listed in the References shall also be examined for applicability during the design.

10.6 Section 10.0 References

FDC

- Section 4.3.1, Compressed Air.
- Section 4.3.2, Raw Water.
- Section 4.3.3, Steam.
- Section 4.3.4, Sanitary Water.
- Section 4.3.5, Sanitary Sewage.

DOE Order 6430.1A (1989)

- Section 0260, Piped Utility Materials.
- Section 0266, Water Distribution Systems.
- Section 0266-2, Regulatory Overview.
- Section 0266-4, System Design Consideration.
- Section 0270, Sanitary Wastewater Collection and Stormwater Management System.
- Section 0270-1.3, System Design Considerations.
- Section 1530-9, Water Storage and Distribution.
- Section 1530-99.0, Nonreactor Nuclear Facilities - General.
- Section 1550-2.4, Steam Distribution System.
- Section 1595, Controls.

Other DOE Orders

- DOE RLID 5480.7, Fire Protection, 1994.

Hanford Plant Standards

- Section AC-6, Roads and Sidewalks.

Industry Codes and Standards

- AISC S 335-89, Specification for Structural Steel Buildings, 1989.
- ASME B31.1, Power Piping, 1992.
- ASME B31.3, Chemical Plant and Petroleum Refinery Piping, 1993.
- ASME B&PV Code, Section VIII, Division 1, 1992, with 1993 Addenda.
- TEMA, Standards of Tubular Exchanger Manufacturers Association, Seventh Edition, 1988.
- AWWA C500-86, Gate Valves for Water and Sewerage System.
- AWWA C502-85, Dry Barrel Fire Hydrants.
- AWWA C900-89, Polyvinyl Chloride (PVC) Pressure Piping, 4" through 12" for Water Distribution.
- NEMA ICS 6, Industrial Control and Systems Enclosures, 1993.
- NEMA 250-1991, Enclosures for Electrical Equipment.
- NFPA 24, Installation of Private Fire Mains and the Appurtenances, 1992.
- AWWA Cross Connection Control Manual - Published by Cross-Connection Control Committee, Pacific Northwest Section, May 1990, 5th Edition.
- WSDOH, Guidelines for the Use of Pressure Distribution Systems, 1984.
- WSDOH and WSDOE, Design Guidelines for Larger Onsite Sewage Systems with Design Flows of Greater than 3,500 Gallons per Day, 1987.
- WSDOH, Criteria for Sewage Works Design, 1985.

Washington Administrative Code (WAC)

- WAC 173-216, State Waste Discharge Permit Program, December 1993.
- WAC 246-272, Onsite Sewage Systems, March 1994.

- WAC 246-290-490, Public Water Supplies, Cross Connection Control, December 1993.

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- WHC-SD-W236A-PSAR-001, Preliminary Safety Analysis Report, Multi-Function Waste Tank Facility, March 1994.
- WHC-EP-0137, Best Available Technology Economically Achievable Guidance Document for the Hanford Site Waste Management Systems Engineering, July 1988.
- WHC-SD-W049H-ICD-001, Rev. 0, Project W-049H, Interface Control Document, October 1992.

11.0 Lighting

General
This section delineates lighting requirements for normal and emergency lighting in accordance with FDC Section 4.4.

11.1 Normal Lighting

General
A normal lighting system shall be provided for interior and exterior lighting and to support operational and maintenance activities, in accordance with the FDC Sections 4.4 and 4.5.7.

Safety Classification
The normal lighting equipment shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists.

Electrical Requirements

- Lighting fixtures shall be constructed and supported in accordance with the requirements of ANSI/NFPA 70, NEC article 410, and SDC 7.5.
- Protective lighting shall be provided for security purposes, as required, in accordance with DOE Order 6430.1A, Section 0283-7.

Functional Requirements

- Lighting level shall conform to the requirements of the Illuminating Engineering Society (IES) Lighting Handbook, as required by DOE Order 6430.1A, Sections 1650 and 1655.
- Lighting branch circuits and feeders shall be designed in accordance with the requirements of ANSI/NFPA 70, articles 210 and 220.
- Discharge lighting, ballast type, shall have a power factor of 95% or better.
- Special lighting shall be provided in the control room based on a human factors analysis (see Section 23.0, Human Factors Engineering).

Operational and Maintenance Requirements

- The equipment must be accessible for normal maintenance and replacement of bulbs.

11.2 Emergency Lighting

General
The emergency lighting system shall provide sufficient light to permit safe egress from the buildings when normal power is not available, and for operation of the essential equipment and instrumentation, in accordance with the FDC Section 4.4.

Safety Classification
Emergency lighting shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists.

Structural Requirements

- Lighting fixtures, including batteries, shall be constructed and supported in accordance with the requirements of ANSI/NFPA 70, article 410.

Functional Requirements

- Emergency lighting fixtures shall be located in accordance with the requirements of NFPA 110.
- Feeder and branch circuits for emergency lighting shall be designed in accordance with the requirements of ANSI/NFPA 70, article 700.
- Emergency lighting shall be functional during emergency conditions to permit safe egress from the building and for operation from the control room and the operating gallery.
- Emergency lighting design shall meet the requirements of NFPA 101, Section 5-9, and DOE Order 6430.1A, Section 0283-7, as applicable.

Operational and Maintenance Requirements

- The lighting equipment must be accessible for replacement of bulbs and batteries.

11.3 Section 11.0 References

FDC

- Section 4.4, Lighting.

DOE Order 6430.1A (1989)

- Section 1650, Exterior Lighting.
- Section 1655, Interior Lighting.
- Section 0283-7, Lighting.

Industry Codes and Standards

- ANSI/NFPA 70 National Electrical Code (NEC), 1993.
- IES Lighting Handbook, Reference Volume 1984, Application Volume 1987.
- NFPA 101, Life Safety Code, 1994.
- NFPA 110, Standard for Emergency and Standby Power Systems, 1993.

Hanford Plant Standards

- SDC 7.5, Rev. 25, Interior Power and Lighting.

12.0 Electrical

General

Design and installation of electrical systems shall be in accordance with the FDC. Among other requirements specified in FDC Section 4.5, the requirement of implementing the Hanford circuit and raceway schedule, or equivalent, shall be incorporated in the design. No equipment or material containing mercury or polychlorinated biphenyls (PCB) shall be used in the design.

Electric connections between the permanent terminal boxes and the equipment in the process pits shall be with remote electrical connectors. Remote disconnects of standard industrial types may be used in the MWTF electrical systems, to meet the requirements of the FDC, Section 3.2.3.

The applicable FDC Sections are listed below:

- Section 3.2.3 Jumpers.
- Section 3.2.4 Corrosion Protection.
- Section 4.5 Electrical.
- Section 4.5.1 General.
- Section 4.5.2 Unit Substations.
- Section 4.5.3 Normal Power.
- Section 4.5.4 Back-up Power.
- Section 4.5.5 Receptacles.
- Section 4.5.6 Grounding.
- Section 4.5.6.3 Lightning Protection.
- Section 4.5.7 System Design Power Factor.

12.1 Normal Power

General
The normal power system including the distribution transformers and ancillary equipment shall be provided for all electrical power and lighting, in accordance with FDC Sections 4.5.1, 4.5.2, 4.5.3, 4.5.5, and 4.5.7.

Safety Classification
The normal power distribution system shall be designed to Safety Class 3 criteria.

Electrical Requirements

- Design criteria given in DOE Order 6430.1A, Division 16, ANSI C2, and ANSI/NFPA 70, shall apply to the normal power system.
- Electrical equipment shall conform to and be listed in UL Electrical Appliance and Utilization Equipment Directory and UL Electrical Construction Materials Directory; or other industry recognized standards shall be applied.
- Transformers shall conform to the requirements of ANSI/IEEE C57.92, ANSI C57.12.10 or NEMA ST 20.
- Oil-filled transformers, where used, shall meet FM 5-4/14-8.
- Electrical enclosures shall conform to NEMA ICS 6.
- Panelboards shall conform to NEMA PB 1.
- Medium-voltage cable shall conform to NEMA WC 8.
- Motor controllers shall conform to NEMA ICS 2.
- Safety switches shall conform to NEMA KS 1.
- A double-ended unit substation with two transformers, and associated switchgear shall be provided at each tank farm site.
- Primary voltage shall be 13.8 kV reduced to 480 volts for normal power supply to the MWTF.
- The normal power sources shall utilize digital metering technology, with watt-hour demand metered at 15 to 60 minute data collection intervals. Hanford Electrical Utilities and the facility operator shall be consulted regarding electrical metering requirements.
- The equipment shall be designed for a power factor of 95% or higher, wherever possible.
- The substation power circuit breakers shall be electrically operated.

Functional Requirements

- The electrical power system and its components shall be designed to function reliably in the environment in which they are located, including radiation fields.

Operation and Maintenance Requirements

- Electrical equipment will be in a location that will permit access for routine maintenance and testing.
- The switchgear power circuit breakers shall be capable of being racked-out and isolated from the substation buses for maintenance or replacement, while the rest of the switchgear remains energized.
- Each transformer shall be capable of being isolated for maintenance or replacement.
- The status of the substation power circuit breakers shall be monitored by the DCS and annunciated in the control room.

12.2 Backup Power

General

The backup system shall be provided to supply electrical power to equipment and lighting that must remain operational during an outage of normal power. A diesel generator and uninterruptible power supply (UPS) sources shall be installed to provide backup power to meet the requirements of FDC Section 4.5.4.

Safety Classification

The backup power system shall be designed to Safety Class 2 criteria.

Electrical Requirements

- Backup power system equipment shall be seismically qualified to the appropriate seismic load factor of Table 18.1 in accordance with WHC-CM-1-3, MRP 5.46, Appendix A.
- Backup power system shall be designed in accordance with DOE Order 6430.1A, Section 1660, including NFPA 110, Standard for Emergency and Standby Power Systems.
- Electrical equipment for the backup power system shall meet the same codes and standards that apply to normal power system equipment (see Section 12.1).
- The backup power system shall be designed to conform to the requirements of WHC-SD-GN-DGS-303.
- Systems and equipment that require backup power shall be identified during the design.
- UPSs shall be designed to supply UPS power to individual equipment, with redundant UPS power supplies.

Functional Requirements

- The backup power with adequate redundancy shall be available on the loss of normal power.
- Systems and equipment important to safety shall be designed with automatic switching features from normal power to the backup power.

Operational and Maintenance Requirements

- Backup system electrical equipment will be in a location that will permit access for maintenance and testing.
- A load bank shall be provided for testing the generator.

12.3 Grounding

General
Three grounding systems shall be provided: the building grounding system, instrumentation grounding system, and lightning protection grounding system, in accordance with the FDC Section 4.5.6.

Safety Classification
The grounding systems shall be designed to Safety Class 3 criteria.

Electrical Requirements

- The grounding systems will conform to the requirements of ANSI/NFPA 70, NEC Article 250, and SDC 7.5.
- Acceptable resistance levels for the grounding systems specified in Section 4.5.6 of the FDC shall be used in the design.
- The grounding systems will be interconnected as required by ANSI/NFPA 70, and NFPA 780.
- Criteria given in DOE Order 6430.1A, Section 1639 shall be applied.

Operational and Maintenance Requirements

- The grounding system components are passive and do not require routine maintenance.
- The grounding system shall be connected to the cathodic protection system.

12.4 Lightning Protection

General
Lightning protection shall be provided in accordance with the FDC, Sections 4.5.6 and 4.5.6.3. The lightning protection system shall consist of air terminals or dissipators mounted on the stacks and roofs of the Weather Enclosure and Support Facility, and a grounding system to conduct lightning to the ground.

Safety Classification
The lightning protection system shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists.

Electrical Requirements

- The lightning protection system will be designed and installed in accordance with the requirements of ANSI/NFPA 70 and NFPA 780.

Operational and Maintenance Requirements

- The lightning protection system components are passive and require little routine maintenance.

12.5 Cathodic Protection System

General
A cathodic protection system shall be provided to mitigate corrosion effects on all metallic underground structures that are in contact with the earth in accordance with the FDC, Section 3.2.4. However, other methods of corrosion protection shall be evaluated during the design.

Safety Classification
The cathodic protection system shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists.

Electrical Requirements

- A cathodic protection system shall be installed for underground piping that is in contact with the soil.
- Concrete pads for rectifiers used in the system shall be constructed in conformance with the requirements of Hanford Plant Standards Design Criteria SDC 4.1, as modified by Table 18.1 (see Section 18.0, Natural Forces).
- The cathodic protection system shall conform to the following requirements: NACE Standard RP0169; WAC 173-303, Section 173-303-640; DOE Order 6430.1A, Section 0262; ANSI/NFPA 70.
- Methods given in the DACCO Report for cathodic protection system design shall be evaluated for applicability.
- Rectifier enclosures shall conform to NEMA ICS 6 and shall be Type 4.
- Rectifier disconnect switches shall conform to NEMA KS 1.
- Conductors shall conform to NEMA WC5/ICEA S-61-402.
- When flange connections are made for dissimilar piping, insulating flanges shall be used.
- The cathodic protection system shall be connected to the grounding system.

Functional Requirements

- The need for cathodic protection or other types of corrosion protection methods for the primary storage tank, secondary liner, and risers shall be evaluated during the design based on the recommendations given in the DACCO report prepared for DOE.
- The corrosion protection system shall be compatible, if possible, with the existing cathodic protection systems of the surrounding facilities.
- The corrosion protection shall be approved by a NACE certified corrosion engineer.

Operational and Maintenance Requirements

- The rectifiers appear to be the only component that will require maintenance. The rectifiers shall be located on concrete pads and shall be accessible from all sides. Periodic voltage tests at the test stations will be performed to ensure proper voltage on the protected pipes.
- If a system cannot be designed to be effective for the life of the facility, the design shall provide for replacement of the system or its components, while taking ALARA requirements into consideration.

12.6 Section 12.0 References

FDC

- Section 3.2.3, Jumpers.
- Section 3.2.4, Corrosion Protection.
- Section 4.5, Electrical.
- Section 4.5.1, General.
- Section 4.5.2, Unit Substations.
- Section 4.5.3, Normal Power.
- Section 4.5.4, Backup Power.
- Section 4.5.5, Receptacles.
- Section 4.5.6, Grounding.
- Section 4.5.7, System Design Power Factors.

DOE Order 6430.1A (1989)

- Section 0262, Corrosion Control.
- Division 16, Electrical.
- Section 1639, Grounding.
- Section 1660, Special Systems.

Hanford Plant Standards

- SDC 4.1, Rev. 12, Design Loads for Facilities.
- SDC 7.5, Rev. 25, Interior Power and Lighting.

Industry Codes and Standards

- ANSI C2, National Electrical Safety Code, 1993.
- ANSI/NFPA 70, National Electrical Code, 1993.
- ANSI C57.12.10, Requirements for Transformers 230 kV and Below; 833/958 through 8333/10417 kVA, Single Phase, and 750/862 through 60,000/80,000/100,000 kVA, Three Phase, 1987.
- ANSI/IEEE C57.92, Guide for Loading Mineral Oil-Immersed Power Transformers Up to and Including 100 MVA with 55 C or 65 C Winding Rise, 1992.
- Factory Mutual Loss Prevention Data Sheet 5-4/14-8, "Transformers," September 1986.
- DACCO Sci, Inc. Report, Corrosion Evaluation and Protection Programs of External Surfaces for High-Level Waste (HLW) Underground Storage Tanks and Piping at the Hanford and Savannah River Sites, 1993.
- NEMA ST20, Dry-Type Transformers for General Applications, 1988.
- NEMA ICS 2, Control Devices, Controllers and Assemblies, 1988.
- NEMA WC 8, Ethylene-Propylene-Rubber-Insulated Wire and Cable for Transmission and Distribution of Electric Energy, 1988.
- NEMA PB 1, Panelboards, 1990.
- NEMA KS 1, Enclosed Switches, 1983.
- NEMA ICS 6, Industrial Controls and Systems Enclosures, 1993.
- NEMA WC 5/ICEA S-61-402, Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy, 1992.
- NFPA 110, Standard for Emergency and Standby Power Systems, 1993.
- NFPA 780, Lightning Protection Code, 1992.
- NACE Standard RP0169, Control of External Corrosion on Underground or Submerged Metallic Piping Systems (R 1992).
- UL Electrical Appliance and Utilization Equipment Directory, 1994.
- UL Electrical Construction Materials Directory, 1994.

Washington Administrative Codes (WAC)

- WAC Section 173-303-640, Tank Systems, December 1993.

Westinghouse Hanford Company

- WHC-SD-GN-DGS-303, Rev. 0, Backup Electrical Power System Definition and Design Criteria, 1990.
- WHC-CM-1-3, MRP 5.46, Appendix A, Design/Analysis Criteria for WHC Safety Class Systems, Components, and Structures, Rev. 4.

13.0 Energy Conservation

General
Criteria of energy conservation shall be applied in the design as required by FDC, Sections 4.5.7 and 4.6. Use of renewable energy sources shall be considered in the design.

Safety Classification
N/A

Structural Requirements

- Criteria set forth in the DOE Order 6430.1A, Section 0110-12 and DOE Order 4330.2D shall be applied in the design.
- Energy efficiency standards delineated in ASHRAE Standard 90A shall be applied as a minimum.
- Building envelope thermal transmittance values ("U" values) specified in ASHRAE 90A shall be used in the design.
- Building envelope air leakage through walls, windows, and doors shall comply with the criteria given in ASHRAE Standard 90A.
- Use of renewable energy sources shall be coordinated with DOE Energy Management Coordinator, as specified in DOE Order 6430.1A, Section 0110-12.5.
- Energy consumption and the building Life Cycle Cost Analysis (LCCA) shall be performed as specified in DOE Order 6430.1A, Section 0110-12.7.
- Power supply and distribution systems, including UPS, shall have a power factor of at least 95%, where possible.
- Energy utilization equipment shall be designed with a power factor of at least 90%, where possible.
- Criteria given in DOE Order 6430.1A, Section 1550-1 shall be applied for the sizing and design of the building HVAC systems to minimize energy use without compromising employee health and safety and quality of the work environment.
- The building HVAC system controls and zoning shall be in accordance with DOE Order 6430.1A, Section 1595 to maximize energy conservation.
- A heat recovery system shall be considered in the design of the facility in accordance with DOE Order 6430.1A, Section 1550-1.6.
- Criteria given in IEEE 739 shall be used in the design of electric equipment, electric distribution system, and lighting equipment, etc., as applicable.
- Energy conservation reports shall be prepared separately for the 200-East and 200-West area facilities. The reports shall be reviewed by independent outside experts.
- Building energy management activities shall be performed by the DCS.

Functional Requirements

- Application of energy conservation criteria should not result in an unsafe condition or interference with intended operation of the equipment.

Operational and Maintenance Requirements

- Equipment with energy conservation features shall be designed to be easily operable and repairable.

References

FDC

- Section 4.5.7, System Design Power Factors.
- Section 4.6, Energy Conservation.

DOE Order 6430.1A (1989)

- Section 0110-12, Energy Conservation.
- Section 1550-1, General Sizing and Design Criteria.
- Section 1550-1.6, Energy Recovery System - Waste Heat Recovery Systems.
- Section 1595, Controls.

Other DOE Orders

- DOE Order 4330.2D, In-House Energy Management, 1992.

Industry Codes and Standards

- IEEE 739, Recommended Practice for Energy Conservation and Cost Effective Planning in Industrial Facilities, 1984.
- ASHRAE Standard 90A, Energy Conservation in New Building Design, 1980 (with 1987 Addendum).

14.0 Operation and Maintenance

General
This section describes operations and maintenance requirements in accordance with the FDC, Sections 4.7 and 5.8.

The applicable FDC Sections are listed below:

- Section 4.7, Maintenance.
- Section 5.8, Operating Personnel and Services.

14.1 Operation

General

Operational requirements that could impact the design are described in individual sections of this report. More specific requirements for operation will be incorporated while performing human factors engineering evaluations, as required by DOE Order 6430.1A, Section 1300-12..

14.2 Maintenance

General
The facility shall be designed to allow access for maintenance work and heavy equipment changeout for cranes, trucks, high-lifts, and sweepers etc., in accordance with the FDC, Section 4.7. Filter change systems concepts shall facilitate confinement during filter changes. Filter enclosures shall be designed with unobstructed access to bag-out openings for minimal personnel exposure, safe handling, and confinement of hazardous materials during filter changes. Building ventilation systems shall have strategically located test ports and balancing devices.

Maintenance Requirements

- Future removal of the condenser and HEMEs for access and maintenance shall be done by removal of cover blocks. The cover blocks on the cells shall be capable of being removed and stacked without moving the crane.

- All equipment shall be located in a manner to permit sufficient airflow for heat dissipation and cooling. All equipment shall have sufficient clearances for maintenance and shall meet code requirements, such as the National Electrical Code. Outdoor equipment and electrical equipment in the cells shall be provided with NEMA Type 4 enclosures, in accordance with NEMA ICS 6. The DCS local control units shall be provided with NEMA Type 12 cabinets.

- Maintenance planning which indicates space requirements, special routing, tools, and handling equipment shall be considered in the design.

- Commercially available, reliable, and interchangeable parts shall be used as much as practical to meet design requirements and specifications.

- When similar functions are being performed, a single type and size of device should be selected for all locations to the maximum extent practical to simplify maintenance and minimize inventory requirements.

- Complex components or those having a high probability of failure shall be located outside of normally contaminated areas whenever possible.

- Instrumentation and monitoring equipment systems shall be designed to facilitate troubleshooting and replacement.

- The complexity of the repair and maintenance activities shall be proportionate with the skill level of maintenance personnel who work primarily to detailed written procedures, ALARA requirements, economic considerations.

- All replaceable parts/equipment shall have failure-predictive curve with replacement recommendations and maintenance requirements.

14.3 Personnel

General
A staff of 40 to 60 operating personnel will be required to perform the operations and provide data collection services at each tank farm, as specified in FDC Section 5.8. Implementing the "Operating Team Concept" at the tank farms, the preliminary staffing is anticipated to be as follows:

• Facility Manager	1
• DOE Operations Representative	1
• DOE Operations Secretary	1
• Operations Clerk	1
• Operations Manager	1
• Operators (including shift supervisors)	10-15
• Cognizant Engineer	1
• Plant Engineer/Facility Representative	2
• Person in Charge (PIC)	2
• Job Control Personnel	4-6
• Maintenance Personnel	6-8
• Power Operators	2
• HPT Supervisor	1
• Health Physics Technician (HPT)	2-4
• Janitorial	1

In addition, the facility will require personnel support from other organizations, such as cranes and rigging, plant engineering, process engineering, and miscellaneous auditing groups.

Although the staff requirements may vary between the 200-East and the 200-West area facilities, the facility design should be based on an adequate number of workers to perform the required tasks.

14.4 Material and Equipment

General
The facility design shall establish equipment, spare parts and material requirements for maintenance and operation of the facility in accordance with the FDC Sections 4.7.2 and 4.7.3.

14.5 Section 14.0 References

FDC

- Section 4.7, Maintenance.
- Section 4.7.2, Equipment.
- Section 4.7.3, Materials.
- Section 5.8, Operating Personnel and Services.

DOE Order 6430.1A (1989)

- Section 1300-12, Human Factors Engineering.

Industry Codes and Standards

- NEMA ICS 6, Industrial Controls and Systems Enclosures, 1993.

15.0 Safety

General

This section delineates design requirements for the protection of the public and the workers from undue exposure to radiation and nonradioactive hazardous materials in normal and abnormal operational conditions of the facility, as required by the FDC, Section 5.1. Industrial safety requirements are also set forth in this section.

Safety analyses shall be performed and reported in the Safety Analysis Reports (SARs) to identify Safety Class structures, systems, and components to prevent or mitigate consequences of accidents. The SARs will be prepared in accordance with DOE Order 5480.23.

15.1 Criticality Safety

General
Based on the concentration of fissile materials in the waste that is stored in the tanks, the design shall minimize the accumulation of fissile materials, including transuranics, in any component of the facility systems to preclude the potential for a criticality event to occur, as specified in Section 5.1.1 of the FDC. The design shall provide means to prevent potential for criticality based on the recommendations in the Criticality Analysis Report prepared during the design. Credit may be taken for administrative controls, if control can be identified by the design for incorporation into the facility operating procedures.

There are no current plans to install a criticality monitoring system in the facility, as no criticality monitoring system is expected to be required. If the Criticality Analysis Report indicates the need for a monitoring system, this section will be revised.

Safety Classification
N/A

Structural Requirements

- Criticality controls specified in DOE Order 6430.1A, Sections 1300-4 and 1323-3, and DOE-RL Order 5480.5 shall be applied in the design as indicated by the Criticality Analysis Report.

- Equipment, drains, sumps, and storage vessels that have potential for accumulating fissile materials shall be designed with a geometry or mass/density limit that is incapable of sustaining a nuclear chain reaction, in accordance with Industry Standard ANSI/ANS 8.1, and WHC Manual WHC-CM-4-29.

- Water accumulation from fire protection sprinkler systems shall be considered in criticality analysis, as required by DOE Order 6430.1A, Section 1530-99.

- If a favorable geometry is not achievable, administrative controls shall be defined in the design as required by DOE-RL Order 5480.5, paragraph 9. (b).

- Criteria set forth in DOE-RL Order 5480.5, paragraphs 11 and 12, shall be applied in preparing the Criticality Analysis Report and in the design.

Functional Requirements

- Equipment, drains, sumps, and storage vessels designed for criticality control or prevention shall not be modified with and without analyzing the modified design for criticality potential.

- Administrative criticality controls shall not be changed without analyzing the criticality potential.

Operational and Maintenance Requirements

- The same as those in the Functional Requirements.

15.2 Radiation Protection

General
Facility design shall provide means of protection for the public and workers from undue exposure to radiation or to minimize contamination from radioactive sources during normal and abnormal operation conditions. ALARA principles shall be applied in the design, as specified in FDC, Section 5.1.2.

Safety Classification
Equipment provided for radiation protection shall be designed to Safety Class 2 criteria.

Structural Requirements

- Criteria specified in DOE Order 6430.1A, Sections 1300-1.3, 1300-1.4, and, specifically, 1300-6, shall be applied in the design.
- Safety Class structures, systems, and components, and other safety features shall be installed to prevent or minimize untreated releases of radioactive materials to the environment as required by DOE Order 6430.1A, Sections 1300-1.4, 1300-3, and 1323-4.2.
- Confinement systems shall be provided as required by DOE Order 6430.1A, Sections 1300-7 and 1323-5, and DOE Order 5820.2A.
- Design requirements for release of radioactive materials and chemicals are specified in Section 16.0 of this document, to meet the requirements of DOE Order 5400.5, and 40 CFR 61, Subpart H.
- Radiological aspects of the design shall be in accordance with WHC-SD-GN-DGS-30011.
- Human factors engineering shall be in accordance with the criteria set forth in DOE Order 6430-1A, Section 1300-12, and in Appendix A of WHC-SD-GN-DGS-30011 (see Section 23.0, Human Factors Engineering).
- Radiation monitors, continuous air-monitoring equipment, and contamination control features shall be installed in accordance with RL Order RLIP 5480.11, DOE Order 5480.11, and WHC-SD-GN-DGS-30011. All other radiological requirements specified in HSRCM-1 shall be incorporated in the design.
- All radiation monitoring and alarm systems shall be connected to the facility DCS system (see Section 7.0).
- Radiation monitoring and alarm systems shall be connected to the Site Emergency System via the control room for appropriate actions for protection of the public and the onsite workers.
- A cost-benefit analysis shall be performed to set ALARA goals for the design, in accordance with the International Commission on Radiological Protection (ICRP) Report 37, Section 1.0, Subsection 5.0 of WHC-SD-GN-DGS-30011, and Appendix A of WHC-CM-4-11 to meet the requirements of FDC, Section 5.1.2.2.
- Contamination control zoning requirements are set forth in Section 9.1 of this document.
- Shielding requirements are set forth in Section 15.2.4 of this document.
- Decontamination requirements are set forth in Section 21.0 of this document.

- Design shall preclude any release of liquid or solid radioactive materials to the environment.

- A reliability, availability, and maintainability (RAM) analysis shall be performed to provide guidance to the design to achieve ALARA objectives.

Functional Requirements

- Certain selected radiation monitoring equipment systems shall remain functional at all times, including abnormal or emergency conditions.

- Certain selected radiation control and mitigating systems shall remain functional under all normal and abnormal conditions, both for the protection of the public and for the site workers.

Operational and Maintenance Requirements

- Access points to zoned areas shall be equipped with personnel radiation monitors, such as portal monitors and friskers.

- Provisions shall be made for storage and use of full-face respiratory devices and air-supply connections in areas of high contamination.

- Personnel decontamination capabilities shall be provided and located in the change rooms.

- Shielding shall be provided for work areas, as specified in Section 15.2.4.

- One-way doors, with crash bars, shall be provided for emergency exits from closed rooms and areas.

15.2.1 Occupational Worker Protection

General
Radiation dose to workers is governed by DOE Order 5480.11 and DOE RLIP 5480.11. Many of the requirements in those Orders relate to health physics procedures, and are not directly applicable to the design. Such requirements are not included in the SDRD document. Section 9, paragraph (j), of DOE Order 5480.11 delineates design objectives. External radiation, on the average, is limited to 0.05 mrem/hour, and internal radiation exposure from inhalation should be avoided during normal conditions to achieve ALARA goals, as delineated in WHC-CM-4-11. The limit on combined committed dose from all sources is 5 rem/year.

However, WHC administrative limits on exposure to workers, as specified in WHC-SD-GN-DGS-30011 and WHC-CM-1-6, shall be evaluated for applicability to the facility design.

In addition, the concentration of individual radionuclides in air at the point of release (i.e., stack) or at the workplace shall not exceed the derived air concentration (DAC) guidelines listed in Table 1 and Table 3 in Attachment 1 of DOE Order 5480.11 (DOE Order 6430.1A, Section 1300-9).

The design requirements given in Section 15.2 of this document shall meet this safety objective.

Safety Classification
The same as in Section 15.2, Radiation Protection.

Structural Requirements
N/A

Functional Requirements
N/A

Operational and Maintenance Requirements

- The same as in General.

15.2.2 Public Protection

General
Radiation dose to the public is governed by DOE Order 5400.5. The limit for combined dose from all sources for routine operations is 100 mrem/year. EPA regulation 40 CFR 61, subpart H, specifies a limit of 10 mrem/year for airborne releases. The radionuclide concentrations tabulated in Chapter III of DOE Order 5400.5, in terms of derived concentration guidelines (DCGs), corresponds to 100 mrem/year. In order to meet the EPA requirements, the concentration of individual radionuclides in the air at the site boundary shall not exceed 10% of the DCGs specified in DOE Order 5400.5.

Safety Classification
The same as in Section 15.2, Radiation Protection.

Structural Requirements

- These limits shall be complied with in the design requirements specified in Section 15.2.

Functional Requirements

- The same as those in Section 15.2, Radiation Protection.

Operational and Maintenance Requirements

- The same as those in Section 15.2, Radiation Protection.

15.2.3 Contamination Control

General
Design shall conform to the requirements of FDC Section 5.1.3 for the control of contamination to protect facility workers from an unanticipated radiation dose, and to avoid unnecessary delays in operation and maintenance activities.

Safety Classification
Design features installed for contamination control shall be designed to Safety Class 2 criteria.

Structural Requirements

- Remote control and maintenance shall be the underlying philosophy of the facility design.
- Monitoring, warning, and alarm systems required by DOE Order 6430.1A, Section 1300-7 shall be installed by the design.
- Confinement barriers and an air filtration system shall be provided as required by DOE Order 6430.1A, Section 1300-7 (see Sections 7.0 and 9.0 in the SDRD).
- Requirements set forth in DOE Order 5820.2A, Chapter I, for storage and transfer of waste, monitoring systems, and leak detection systems, shall be incorporated in the design.
- Requirements specified in Section 15.2 of this document shall be applied.
- Personnel monitoring, decontamination equipment, and gender-segregated change rooms, shall be provided.
- Shielding structures that have potential for contamination, shall be lined with stainless liner or covered with special coating. The special coating shall meet the requirements of DOE Order 6430.1A, Section 0900-99.0.

Functional Requirements

- The same as those in Section 15.2, Radiation Protection.

Operational and Maintenance Requirements

- The same as those in Section 15.2, Radiation Protection.

15.2.4 Shielding

General
Shielding shall be provided to protect facility workers from radiation during facility operation and maintenance meeting the requirements of FDC, Section 5.1.4.

Safety Classification
The same as the safety classification of the structural element that performs the function of the shielding.

Structural Requirements

- Shielding design shall meet the requirements of DOE Order 6430.1A, Section 1300-6.2 to minimize personnel exposure to radiation within ALARA guidelines. The maximum annual level of 500 mrem established by HSRCM-1 article 128 shall be used.
- Guidelines given in ANSI/ANS 6.4 shall be used to design concrete radiation shielding, and the material selection shall be in accordance with ANSI/ANS 6.4.2.
- ACI 349 shall be used for shielding structures that provide critical confinements, such as process cells.
- Straight-line penetration of shielding walls shall be avoided to prevent radiation streaming.
- The radiation field shall not exceed 0.05 mrem/hr in any uncontrolled access area and 0.2 mrem/hr in controlled access areas during routine operation, as specified in WHC-SD-GN-DGS-30011. This requirement complies with the criteria set forth in DOE Order 5480.11 and RL Order RLIP 5480.11.
- Physical layout of the equipment and piping will be in accordance with WHC-SD-GN-DGS-30011. Specifically, process lines carrying radioactive fluids shall not be routed through uncontrolled areas.

Functional Requirements

- Shielding structures that provide critical confinements or are part of Safety Class 1 or 2 structures, shall remain functional during abnormal conditions.

Operational and Maintenance Requirements

- Operating galleries and maintenance areas shall be protected by shielding structures.
- The shielding design shall meet the ALARA and decontamination requirements delineated in DOE Order 6430.1A, Sections 0110-99, 0900-99, and 1550-99.
- The primary storage tank risers that are not enclosed in the pits shall be provided with adequate shielding through the use of shield plugs or other appropriate devices to minimize radiation exposure to personnel in accordance with the ALARA guidelines.

15.3 Industrial Safety

General
Industrial safety shall be considered in the design, as required by FDC, Section 5.1.5.

Safety Classification
N/A

Structural Requirements

- The facility shall be designed in accordance with the industrial safety requirements of Occupational Safety and Health Administration, Code of Federal regulations (CFR), 29 CFR 1910, DOE Order 6430.1A and DOE Order 5480.1B, "Environmental Safety and Health Program for the DOE Operations," and the additional safety-related Orders listed in the reference section.

- If possible, materials containing hazardous substances, as defined in WAC-173-303, shall not be used, or their use minimized, in the construction of the facility.

- NFPA 241, "Safeguarding Building Construction and Demolition," and NFPA 101, "Life Safety Code," shall be applied to this project along with other applicable NFPA codes.

- Criteria given in Section 1300-12.4 of DOE Order 6430.1A, shall apply.

- The design shall meet the requirements of WHC Manual WHC-CM-4-3, "Industrial Safety Standards" and WHC Manual WHC-CM-7-5, "Industrial Safety Manual."

Functional Requirements

- The requirements set forth in WHC Manual WHC-CM-4-3 shall be complied with in the design.

Operational and Maintenance Requirements

- The requirements set forth in WHC Manual WHC-CM-4-3 shall be complied with in the design.

- Toxic vapor monitoring shall be performed using portable equipment to meet OSHA monitoring requirements.

15.4 Fire Protection and Alarms

General
A fire protection system shall be provided in accordance with the requirements of FDC Section 5.1.6.

Safety Classification
Fire protection system shall be designed to Safety Class 3 criteria.

Structural Requirements

- Fire protection system shall be designed in accordance with DOE Order 6430.1A (Section 1530), DOE Order 5480.7A, DOE RLID 5480.7, WHC-CM-4-41, and SDC 4.1.
- Fire alarm system shall be designed so it can be activated by any of the signal initiating devices, such as fire detectors, manual switches, or sprinkler water flow switch.
- The alarm signal shall be annunciated in the local Fire Alarm Control Panel (FACP).
- The FACP shall transmit a coded signal to the 200 Area Fire Station via the Radio Fire Alarm Reporter (RFAR).
- The fire protection systems shall comply with the requirements of applicable NFPA codes and standards.
- The facility shall be divided into fire zones. Alarms for each zone shall be individually recognized and responded to by the local FACP. The troubled zones shall be collectively transmitted to the 200 Area Fire Station via RFAR.
- The automatic sprinkler system shall be designed in accordance with NFPA 13 and be provided throughout the facility. Underground feed mains to the sprinkler system shall comply with NFPA 24.
- Fire alarm zones shall be assigned by considering geographic locations within the facility.
- As far as practical, there shall be a one-to-one relationship between FACP RFAR zone number assignments. The zones shall be coordinated with the Hanford Fire Department.
- The fire alarm panels shall be provided with alarm zone disconnect bypass switches to initiate a trouble condition.
- Smoke detectors shall be photoelectric type. Ionization detectors may be used for unique applications.
- Backup batteries used in the fire alarm system shall be sized for a 60-hour capacity per NFPA 72, Chapter 5.
- An alarm check valve shall be provided on wet-pipe sprinkler systems that have more than 20 heads.
- Two independent, reliable, fire protection water sources shall be provided. The requirement of DOE Order 6430.1A, Section 1530.99 that specifies that one of the two water sources be DBE qualified is not applicable to MWTF facility per RL Letter No. 94-PMDB-132.

- The fire alarm system shall comply with the requirements of NFPA 70, 72, and 1221.
- Redundant fire detection/alarm systems shall be designed and provided in accordance with the SDC 7.8.
- Hand-held fire protection equipment shall be provided in addition to the sprinkler system, in accordance with requirements of NFPA 10.
- Remote function of shutdown or activation of a system or equipment required for fire protection shall be processed by FACP.
- Ignitable and reactive waste storage containers and their storage areas shall be designed to meet the requirements of WAC 173-303-630.
- Flammable and combustible liquid storage shall be designed to meet the requirements of NFPA 30.
- Fire equipment shall be UL-listed or Factory Mutual-approved whenever such components are available.
- A preliminary Fire Hazards Analysis (FHA) report shall be prepared during Title I design in accordance with the DOE Order 6430.1A, Section 0110-6.2. The FHA shall be performed under the direction of a qualified fire protection engineer.
- A final FHA report shall be prepared during Title II design and included in the FSAR package.
- The design shall use noncombustible construction materials to the greatest extent possible.

Functional Requirements

- The fire protection system should be designed with a high degree of reliability.
- A minimum of two fire hydrants within 300-ft. of each building shall be provided.

Operational and Maintenance Requirements

- System equipment and components shall be easily accessible for testing and maintenance.
- Design shall provide for containment of fire water run-off for contaminated areas.

15.5 Traffic Safety

General

The MWTF layout shall take into consideration traffic into, around, and out of the facility, particularly during an emergency situation to meet the requirements of FDC Section 5.1.7.

Design criteria given in Section 15.3, "Industrial Safety," shall be applied in the facility layout for traffic safety.

15.6 Section 15.0 References

FDC

- Section 5.1.1, Criticality.
- Section 5.1.2, Radiation Protection.
- Section 5.1.3, Contamination Control.
- Section 5.1.4, Shielding.
- Section 5.1.5, Industrial.
- Section 5.1.6, Fire Protection.
- Section 5.1.7, Traffic Safety.

DOE Order 6430.1A (1989)

- Section 0110-6.2, Fire Protection Design Analysis.
- Section 0110-99, Special Facilities.
- Section 0900-99, Special Facilities.
- Section 1300-1.3, Objectives.
- Section 1300-1.4, Guidance on Limiting Exposure of the Public.
- Section 1300-3, Safety Class Criteria.
- Section 1300-4, Nuclear Criticality Safety.
- Section 1300-6, Radiation Protection.
- Section 1300-6.2, Shielding Design.
- Section 1300-7, Confinement Systems.
- Section 1300-9, Effluent Control and Monitoring.
- Section 1300-12, Human Factors Engineering.
- Section 1300-12.4, General Human Factors Implementation Criteria and Considerations.
- Section 1323-3, Nuclear Criticality Safety.
- Section 1323-4.2, Collection Systems.
- Section 1323-5, Confinement Systems.
- Section 1530, Fire Protection.
- Section 1530-99, Nonreactor Facilities - General.
- Section 1550-99, Special Facilities.

Other DOE Orders

- DOE Order 5400.5, Radiation Protection of the Public and the Environment, 1990.
- DOE Order 5480.1B, Environmental Safety and Health Program for the DOE Operations, 1986.
- DOE-RL Order 5480.5, Safety of Nuclear Facilities, 1984.
- DOE Order 5480.7A, Fire Protection, 1993.
- DOE RLID 5480.7, Fire Protection, 1994.
- DOE Order 5480.11, Radiation Protection for Occupation Workers, 1988.
- DOE RLIP 5480.11, Radiation Protection for Occupation Workers, 1991.
- DOE Order 5820.2A, Radioactive Waste Management, 1988.
- DOE-RL Order 5480.1A, Environment, Safety, and Health Program for Department of Energy Operations for Richland Operations, 1988.
- DOE Order 5480.4, Environmental Protection, Safety, and Health Protection Standards, 1984.
- DOE RLIP 5480.4C, Environmental Protection, Safety, and Health Protection Standards, 1992.
- DOE Order 5480.23, Nuclear Safety Analysis Reports, 1992.
- DOE Order 6430.1A, General Design Criteria, 1989.

Hanford Plant Standards

- HSRCM-1, Hanford Site Radiological Control Manual, Rev. 2, 1994.
- ICRP 37, Cost Benefit Analysis in the Optimization of Radiation Protection, 1983.
- SDC 4.1, Rev. 12, Design Loads For Facilities, 1989.
- SDC 7.8, Rev. 14, Fire Alarm Systems, 1993.

Westinghouse Hanford Company

- WHC-CM-4-3, Industrial Safety Standards, June 1993.
- WHC-SD-GN-DGS-30011, Radiological Design Guide.
- WHC-CM-4-11, ALARA Program Manual, April 1992.
- WHC-CM-4-29, Rev. 3, Nuclear Criticality Safety.
- WHC-CM-4-41, Fire Protection Safety Manual, 1993.
- WHC-CM-7-5, Industrial Safety Manual, 1993.

Industry Codes and Standards

- ACI 349-90, Code Requirements for Nuclear Safety Related Concrete Structures.
- ANSI/ANS 6.4, Guidelines on the Nuclear Analysis and Design of Concrete Radiation Shielding for Nuclear Power Plants, 1985.
- ANSI/ANS 6.4.2, Specification for Radiation Shielding Materials, 1985.
- ANSI/ANS 8.1, Nuclear Criticality Safety in Operations with Fissionable Material Outside Reactors, 1983 (R 1988).
- NFPA 10, Standard for Portable Fire Extinguishers, 1990.
- NFPA 13, Installation of Sprinkler Systems, 1994.
- NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances, 1992.
- NFPA 30, Flammable and Combustible Liquids Code, 1993.
- NFPA 70, National Electric Code (NEC), 1993.
- NFPA 72, National Fire Alarm Code, 1993.
- NFPA 101, Life Safety Code, 1994.
- NFPA 1221, Public Fire Service Communication Systems, 1991.
- NFPA 241, Safeguarding Building Construction and Demolition, 1989.

Code of Federal Regulations

- 29 CFR 1910, OSHA Occupational, Safety, and Health Standards, 1992.
- 40 CFR 61, Subpart H, National Emission Standards for Emissions of Radionuclides Other than Radon from DOE Facilities, 1992.

Washington Administrative Codes (WAC)

- WAC 173-303, Dangerous Waste Regulations, December 1993.
- WAC 173-303-630, Use and Management of Containers, December 1993.

W-236A Project Documents

- DOE Letter No. 94-PMDB-133, October 18, 1994.

16.0 Environmental Protection

General
Release of radioactive and hazardous materials to the environment shall be controlled by design as required by FDC, Section 5.2. Limits specified in applicable orders and regulations shall be applied during the design of the facility systems and equipment. See W-236A-T1-ESR1 for the addressing of applicable regulations. (The term "confinement" used herein is synonymous with the word "containment" which is generally used in the State, EPA, and other federal regulations).

Safety Classification
N/A

Structural Requirements

- The primary and the secondary waste-confinement systems shall be designed in accordance with DOE Order 6430.1A, Sections 0110-7, 0275-99.0.2, 1300-7.2, 1323-5, 1550-99.0.1, and 1550-99.0.2.

Primary Storage Tank System (see Section 3.0, Primary Confinement Structure)

- The primary storage tank shall have sufficient structural strength, compatibility with the wastes, and corrosion protection to ensure that it will not collapse, rupture, or fail. The primary storage tanks shall meet the requirements of WAC 173-303.

- The primary storage tank shall be maintained at a negative pressure and means shall be provided to prevent failure of tank from excessive negative pressure.

- Capabilities shall be provided for periodic inspection of the primary storage tank outer wall from the annulus and the inner wall of the primary storage tank in the vapor space (see Section 25.3, Inspections).

- Spill and overflow prevention controls, such as level-sensing devices, shall be provided.

Secondary Confinement System (see Section 4.0, Secondary Confinement Structure)

- The secondary confinement system shall be designed, installed, and operated to prevent any migration of wastes out of the system to the soil, groundwater, or surface water at any time during the use of the system.

- The secondary confinement system shall be capable of containing liquids leaked into the secondary confinement system from the primary system, and shall be equipped with leak-detection and removal capabilities.

- The secondary confinement system shall have sufficient strength and thickness to prevent failure due to pressure gradients, physical contact with the waste, climatic conditions, and the stress of daily operations.

- The secondary confinement system shall be sized to retain the maximum liquid waste inventory that may be released by spill, overflow, or leak from the primary storage tank.

- The secondary confinement system shall be sloped into a sump, a pit, or a low point for leak detection and removal.

- Provisions shall be made to transfer fluids from the annulus to another tank facility, in the event of a leak from the primary to the annulus.

- Material selected for secondary confinement system shall be compatible with the waste stored in the primary storage tank so that the integrity of the secondary confinement system is maintained until the waste is transferred to another storage facility.

- Secondary confinement system shall be designed to prevent run-on or infiltration of precipitation into secondary confinement.

- Process cells and pits shall be constructed with chemical-resistant water-stops in place at all construction joints below maximum liquid levels and provided with an impermeable coating or lining compatible with the waste to prevent migration into the concrete (see Section 15.2.3, Contamination Control).

- Capabilities shall be provided for periodic inspection of the primary storage tank outer wall and the secondary liner from the annulus.

Secondary Waste Container Storage Area

- A storage area shall be provided for staging and temporary storage of dangerous waste and mixed waste containers. This area is for secondary waste generated during maintenance activities and routine facility operation.

- The area shall have a confinement system capable of collecting and holding spills and leaks.

- The spill confinement area shall be sized to hold the volume of the largest container or 10% of the maximum number of containers, whichever is greater.

- The area shall have a roof with adequate overhang to minimize intrusive stormwater.

- The floor shall be sloped or otherwise designed to drain and remove liquids.

Ventilation System (see Section 6.0, Tank Ventilation System)

- Either HEPA filtration or fail-safe backflow prevention for process area ventilation system air intake shall be provided.

- The design of the off-gas system shall be commensurate with the characteristics of the radioactive and nonradioactive hazardous materials in the off-gas and the risk associated with their releases.

- The design shall preclude the accumulation of potentially flammable quantities of hydrogen generated by radiolysis or chemical reactions within process equipment.

- The stack locations shall preclude subsequent uptake into the facility.

- Portions of the off-gas systems and components required to limit the release of radioactive and nonradioactive hazardous materials shall be provided with redundancy.

- The design shall limit the concentration of gases or vapors inside the tanks or anywhere else in the primary storage tank ventilation systems, to less than 25% of their lower flammable limit.

- The design and selection of the air treatment systems shall be based on best available radionuclide control technology (BARCT) and best available control technology for toxics (T-BACT) to minimize the release of hazardous materials to the environment. Performance of the selected equipment shall be evaluated during definitive design to achieve the required objectives.

- HVAC dampers shall be located so that cross-contamination will not occur in the event of a localized release.

Functional Requirements

- The facility shall be designed to comply with all Federal, State, local, and EPA standards as listed in the reference section.

<u>Air Emission Limits</u>

- Exhaust air filtering and treatment systems shall be provided for all contaminated or potentially contaminated airstreams to control the release of radioactive and nonradioactive hazardous particulates and gases to the atmosphere in accordance with WHC-CM-7-5 to meet the requirements of DOE Order 5400.5, Chapter II, paragraph 1.b. This includes the treatment of the primary storage tank ventilation exhaust, annulus air exhaust, and ventilation exhaust from cells.

- Visible emissions shall not exceed 20% opacity for more than 3 minutes in any one hour at the stack as required by WAC 173-400.

- T-BACT shall be used for selection of control equipment for toxics as required by WAC 173-460.

- BARCT shall be used for selection of control equipment for radionuclides as required by WAC 173-480 and WAC 246-247.

- Emissions of toxic air pollutants (TAPs) shall not exceed the acceptable source impact level (ASIL) at the site boundary as listed in WAC 173-460.

- Radionuclide emissions shall not exceed the concentrations listed in WAC 246-221 for restricted (DOE RLIP 5480.11) or unrestricted access areas (DOE Order 5400.5).

- The leak detection system shall be capable of detecting dangerous waste or accumulated liquid in the secondary confinement system within 24 hours or as soon as practicable if existing technologies or site conditions do not permit detection within 24 hours.

- The HVAC system air shall be negative with respect to the atmosphere, and shall cascade from zones of least potential for radioactive contamination to greatest potential for radioactive contamination.

Operational and Maintenance Requirements

- Low-level liquid process wastes shall be collected and monitored (i.e. decontamination showers, flushing of sample lines, HEMF filter backwash, etc.).

- Leaked waste shall be removed within 24 hours or as soon as practicable if existing technologies or site conditions do not permit removal within 24 hours.

- Monitoring and control systems shall be provided to identify noncompliant streams and to divert such streams to a redundant filter and treatment system.

- Annual does from releases shall be considered in combination from expected releases from other facilities at Hanford per DOE Order 6430.1A, Section 1300-1.4.3.

Permitting Requirements

- The MWTF design shall support the RCRA, and Air and Water permitting requirements specified in WHC memos 88220-93-001 and 88300-92-137.

References

FDC

- Section 5.2, Environmental Protection.

DOE Order 6430.1A (1989)

- Section 0110-7, Environmental Protection and Pollution Control.
- Section 0275-99.0.2, Nonreactor Nuclear Facilities - Process Wastes.
- Section 1300-1.4.3, Routine Releases.
- Section 1300-7.2, Confinement Systems - General.
- Section 1323-5, Radioactive Liquid Waste Facilities - Confinement Systems.
- Section 1550-99.0.1, General Ventilation and Off-Gas Criteria.
- Section 1550-99.0.2, Confinement Ventilation Systems.

Other DOE Orders

- DOE Order 5400.1, General Environmental Protection Regulations, 1990.
- DOE Order 5400.5, Radiation Protection of the Public and the Environment, 1990.
- DOE RLIP 5480.11, Radiation Protection for Occupational Workers, 1991.
- DOE Order 5820.2A, Radioactive Waste Management, 1988.

DOE Publication

- DOE/EH-0173T, Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance, January 1991.

Westinghouse Hanford Company

- WHC-CM-7-5, Environmental Compliance Manual, June 1993.

Code of Federal Regulations 1992

- 40 CFR 60, Standards of Performance for New Stationary Sources.
- 40 CFR 61, National Emission Standards for Hazardous Air Pollutants.
- 40 CFR 112, Oil Pollution Prevention.
- 40 CFR 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.
- 40 CFR 265, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.

Washington Administrative Code

- WAC 173-303, Dangerous Waste Regulations, December 1993.
- WAC 173-400, General Regulations for Air Pollution Sources, December 1993.
- WAC 173-460, Controls for New Sources of Toxic Air Pollutants, December 1992.
- WAC 173-480, Ambient Air Quality Standards and Emission Limits for Radionuclides, December 1992.

- WAC 246-221, Radiation Protection Standards, December 1993.
- WAC 246-247, Radioactive Airborne Emission Standards, December 1992.

County Regulations

- G.R. 80-7, Benton-Franklin-Walla Walla Counties Air Pollution Control Authority, 1980.

W-236A Project Documents

- W-236A-T1-ESR1, Rev. 1, Environmental Status Report, Project W-236A, Multi-Function Waste Tank Facility, 1994.
- Internal Memo 88220-93-001, Multi-Function Waste Tank Facility - RCRA Permitting Plan, January 7, 1993.
- Internal Memo 88300-92-137, Multi-Function Waste Tank Facility - Air and Water Permitting Plan, December 14, 1992.

17.0 Safeguards and Security

General
A safeguards and security system shall be provided as required by FDC, Section 5.3 for physical protection of the MWTF. The system shall be linked to the Hanford Site security system and emergency preparedness facilities.

The MWTF is an unclassified facility, therefore, the main focus of the security system shall be to prevent unauthorized entries to the buildings and areas within the MWTF.

Safety Classification
The security system shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists, with the exception of the provisions for the backup power for the security alarm system (see Section 12.2).

Physical Requirements

- General requirements for physical protection delineated in DOE Order 6430.1A, Section 0110-13 shall be applied in the design.
- MWTF shall be considered a property protection area as defined in DOE Order 6430.1A, Section 0110-13.
- The requirements set forth in DOE Order 6430.1A, Section 1300-10 are generally not applicable to the MWTF.
- The security system shall be designed in accordance with the requirements of DOE RLID 5632.1B.
- A temporary construction fence shall be provided for the facility site during construction. The fence may encompass the construction worker parking lot, the equipment laydown area, and the excavation spoils area.
- A security alarm control center, as required by DOE Order 6430.1A, Section 0110-99.8.7, shall be provided as applicable to the MWTF.
- A closed-circuit television system shall be provided in the control room or the security alarm control center for perimeter security surveillance.
- A minimum number of entrances shall be provided to control unauthorized access to security areas, without compromising the fire protection and safety requirements set forth in NFPA 101 (see Section 15.4).
- The emergency exit doors provided for worker protection shall be controlled and monitored for unauthorized entries and exits during normal conditions.
- Means shall be provided for personnel accountability during emergency conditions.
- Doors for the security areas shall be controlled and monitored for workers and vehicle entrances and exits.

Functional Requirements

- The security system shall remain functional at all times.
- The security violation alarm system shall be provided to annunciate in the control room and the security alarm control center.

Operational and Maintenance Requirements

- The security system shall be provided with backup power to enhance reliability and availability of the system.

References

FDC

- Section 5.3, Safeguards and Security.

DOE Order 6430.1A (1989)

- Section 0110-13, Physical Protection.
- Section 0110-99.8.7, Security Alarm Control Center.
- Section 1300-10, Physical Protection, Material Safeguards, and Storage of Special Nuclear Material.

Other DOE Orders

- DOE RLID 5632.1B , Asset Protection Requirements, 1994.

Industry Codes and Standards

- NFPA 101, Life Safety Code, 1994.

18.0 Natural Forces

General
The design of the facility structures, systems, and components that are important to safety shall take into consideration the loads generated by seismic events and other natural phenomena, as required by the FDC, Section 5.4. The seismic accelerations and load factors given in Table 18.1 shall be used for all structures, systems, and components. The design criteria in SDC 4.1 shall be applied for analyzing the structural integrity of the above-ground structures, systems, and components, except for the criteria for seismic loads. The criteria given in WHC-SD-GN-DGS-30008 shall be used for underground structures, systems, and components. except for the seismic loads.

Safety Classification
N/A

Seismic Analysis Requirements

- Flood loading is not applicable as the site elevation exceeds the probable maximum flood level per SDC 4.1. The elevation also exceeds the maximum flood water elevations for upstream dam failure scenarios.

- The design of below-grade structures need not consider wind loads, except during construction, if applicable. The design of above-ground structures shall include wind loads in accordance with SDC 4.1.

- Snow loads and missile-impact loads shall be in accordance with SDC 4.1.

- All above-ground Safety Class 1 structures, systems, and components, if any, shall have ashfall loading in addition to snow loading per SDC 4.1.

- Seismic analyses shall be performed using the guidelines for underground tanks and piping given in BNL 52361 and UCRL 15910 to meet the requirements of various sections of DOE Order 6430.1A, as listed in References using seismic loads given in Table 18.1.

- The underground waste storage tanks shall be designed using response level 3 damping per TSEP Guidelines. Appropriate damping values are given in Table 3.2 of the TSEP Guidelines.

- Probable consequences of the DBE shall be considered per DOE Order 6430.1A.

- A seismic analysis shall be performed for above-ground items per SDC 4.1, (modified by Table 18.1), and the UCRL 15910, if the item is not in the zone of influence of Safety Class 1 structures.

- Structures that are in the zone of influence of Safety Class 1 structures shall be designed to resist Safety Class 1 seismic criteria without collapse or failure, using the seismic loads given in Table 18.1.

References

FDC

- Section 5.4, Natural Forces.

DOE Order 6430.1A (1989)

- Section 0111-2.7, Earthquake Loads.
- Section 0111-99.0.2, Tornado and Extreme Wind.
- Section 0111-99.0.4, Earthquakes.
- Section 1300-1.4.2, Accident Releases.
- Section 0200-99.0.6, Seismology.
- Section 1550-99.0.1, General Ventilation and Off-Gas Criteria.
- Section 1660-99.0.1, Safety Class Electrical Systems.

Hanford Plant Standards

- SDC 4.1, Rev. 12, Design Loads for Facilities.

Westinghouse Hanford Company

- WHC-SD-GN-DGS-30008, Design Loads for New Underground Double-Shell Tanks and Associated Underground Process Piping, 1993.

Industry Codes and Standards

- UCRL-15910, Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena Hazards, 1990.
- BNL 52361, Seismic Design Evaluation Guidelines for the DOE High-Level Waste Storage Tanks and Appurtenances, prepared by the Tank Seismic Experts Panel for the U.S. Department of Energy, 1993.

TABLE 18.1
SEISMIC LOADS

	Acceleration	Load Factor
Safety Class 1	0.29 g	1.2
Safety Class 2	0.13 g	1.5
Safety Class 3	0.13 g	1.0

The seismic demand shall be multiplied by the load factor as an additional factor of safety, to find the earthquake contribution to the overall demand. Alternately, the seismic acceleration may be multiplied by the load factor and that value used as the input peak ground acceleration (PGA) in the seismic analyses.

19.0 Design Format

General
Drawings shall be prepared in accordance with the FDC, Section 5.5.

Safety Classification
N/A

Structural Requirements
N/A

Functional Requirements

- Drawings shall be prepared in a format established in Hanford Plant Standard SDC 1.3.
- All drawings shall be originated on computer aided design and drafting (CADD).
- The general drawing arrangement shall conform to ANSI Y 14.1, except for the location of the parts or material list and revision block.
- Parts or material lists shall be utilized on fabrication and assembly drawings when appropriate.
- The standard size drawing shall be 28 x 40 in.
- The CADD drawing material shall be 17 lb minimum vellum.
- Revisions to drawings shall include a revision block located to the right of the title block.
- Areas of code or safety class boundaries in systems, components, or structures shall be identified on the drawings.

Operational and Maintenance Requirements
N/A

References

<u>FDC</u>

- Section 5.5, Design Format.

<u>Hanford Plant Standards</u>

- SDC 1.3, Rev. 6, Preparation and Control of Engineering and Fabrication Drawings, 1990.

<u>Industry Codes and Standards</u>

- ANSI Y 14.1, Drawing Sheet Size and Format, 1980 (R 1987).

20.0 Quality Assurance

General
All project activities shall be governed by the Multi-Function Waste Tank Facility Quality Assurance Program Plan (QAPP), WHC-SD-W236A-QAPP-001, to meet the requirements of the FDC, Section 5.6.

Safety Classification
N/A

Quality Requirements

- The Operating Contractor and the A/E Contractor shall develop their quality assurance programs in accordance with DOE Order 5700.6C.

- A project document identified as the Quality Assurance Program Plan (QAPP) shall be generated by the Operating Contractor as required by DOE RLIP 4700.1A. The QAPP shall ensure that the application of quality requirements is commensurate with the overall function and end use of the facility.

- An A/E contractor document identified as the Quality Assurance Plan (QAP) shall be generated to implement the requirements of the QAPP and DOE Orders.

- In general, ASME NQA-1 basic requirements and applicable Supplemental requirements shall be applied to Safety Class 1 structures/systems/components which are defined in WHC-CM-1-3, MRP 5.46 and identified in the PSAR, WHC-SD-W236-PSAR-001.

- Design verification shall be performed per the W-236A Design Verification Plan, W236A-T2-AP12.

- Independent peer review shall be performed on applicable seismic design in accordance with DOE Order 6430.1A, Sections 0111-2.7.1 and 0111-99.0.4.

- Safety Class 1 materials, equipment, and services shall be procured from qualified suppliers meeting ASME NQA-1 basic and supplemental requirements.

- For Safety Class 2 structures/systems/components, a graded approach shall be applied as specified in MRP 5.46.

- For Safety Class 3 structure/systems/components, conventional industrial standards shall be applied as defined in MRP 5.46. Materials and services may be procured using national codes and standards.

- The minimum QA requirements for Contractors shall be established within the design documents. Contractors shall have a quality assurance program which addresses the quality assurance requirements applicable to their assigned tasks and for work performed by others in support of those tasks.

References

DOE Orders

- DOE RLIP 4700.1A, Project Management System, 1991.
- DOE Order 5700.6C, Quality Assurance, 1991.
- DOE Order 6430.1A, General Design Criteria, 1989, Sections 0111-2.7.1 and 0111-99.0.4.

Westinghouse Hanford Company

- WHC-CM-1-3, MRP 5.46, Rev. 4, Safety Classification of Systems, Components, and Structures.

Industry Codes and Standards

- ASME NQA-1, Quality Assurance Program Requirements for Nuclear Facilities, 1989 with a, b, and c addendas.

W-236A Project Documents

- WHC-SD-W236A-QAPP-001, Quality Assurance Program Plan, 1994, Rev. 1.
- WHC-SD-W236A-PSAR-001, Preliminary Safety Analysis Report, March 1994.
- W236A-T2-AP12, Design Verification Plan, August 1994.

21.0 Decontamination and Decommissioning

General
The facility design shall provide for decontamination of contaminated equipment and work areas to minimize exposure of facility personnel to radioactive and non-radioactive hazardous materials. Provisions shall be made for remote operation and maintenance. Provisions shall be made for decommissioning of the facility at the end of its operational life. The design shall conform to the requirements of the FDC, Section 5.7.

Safety Classification
N/A

Structural Requirements
N/A

Functional Requirements
N/A

Operational and Maintenance Requirements

- The design shall meet the requirements of DOE Order 6430.1A, Sections 1300-6 and 1300-11.
- The design shall meet the requirements of WAC 173-303, Section 640, paragraph (8).
- The design shall conform to the requirements in accordance with WHC manual WHC-SD-GN-DGS-30011.
- Remote-control and operations features, shielded operating galleries, and manipulators shall be provided in the design to achieve ALARA goals.
- Radiological lines shall not be routed through uncontrolled areas.
- Equipment that contains radioactive material shall be located behind shielding walls or in concrete cells.
- Personnel decontamination facilities shall be provided.
- Separate change facilities for female and male personnel shall be provided.
- Human factors engineering considerations shall be applied to the design as specified in DOE 6430.1A, Section 1300-12. This is a FDC requirement for the design.
- Design shall provide ventilated hot cells with manipulators.
- Design shall provide ventilated hoods and glove boxes.
- Use of skid-mounted equipment shall be incorporated in the design for remote installation and removal of equipment.
- Design shall provide for remote installation and removal of jumpers for pipe connections.
- Remote decontamination (chemical, wastes, washdown) devices shall be provided.
- Design shall provide adequate spacing for removal of packaging and passage way for contaminated equipment.

- Cells, shielding walls, or other structures that have potential for contamination shall be lined with stainless steel or covered with appropriate coatings.
- Provisions shall be made for remote decontamination of vessel, piping, and other equipment.
- Provisions shall be made for remote cutting of pipe connections.
- Provisions shall be made for remote removal and bagging of equipment.
- Provisions shall be made for loadout facilities for contaminated equipment. (i.e., removal of the transfer pumps from the waste storage tank).
- Design shall minimize piping, ducting, vessels, and wall surfaces that have potential for contamination.
- Cracks, crevices, and joints shall be caulked and sealed.
- Design shall provide for isolation of contaminated areas from uncontaminated areas to minimize quantities of contaminated waste.
- Design shall avoid traps, bends, and low points that accumulate contaminants in pipe lines.
- Primary storage tank ventilation system ducting and other piping shall be provided with washdown and draining equipment, as required for decontamination and decommissioning.
- Piping shall be washable and drainable.
- A Decontamination & Decommissioning Report shall be prepared during the course of the design.

References

<u>FDC</u>

- Section 5.7, Decontamination and Decommissioning.

<u>DOE Order 6430.1A (1989)</u>

- Section 1300-6, Radiation Protection.
- Section 1300-11, Decontamination and Decommissioning.
- Section 1300-12, Human Factors Engineering.

<u>Washington Administrative Codes (December 1993)</u>

- WAC 173-303-640, paragraph (8), Closure- and Post-Closure Care.

<u>Westinghouse Hanford Company</u>

- WHC-SD-GN-DGS-30011, Radiological Design Guide, Rev. 0, 1994.

22.0 Communications System

General
A communications system shall be provided in accordance with the requirements of the FDC, Section 5.9. The MWTF communications system shall be integrated into the existing site-wide communications and emergency annunciation network.

Safety Classification

- The communication system shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists.

Structural Requirements

- The communication system shall meet the requirements of DOE Order 6430.1A, Sections 0110-99.8 and 0200-99.8.
- A centrally located communication room shall be provided to locate the communication equipment in a dust-free environment.
- The communications room shall be provided with an automatic wet-pipe sprinkler system for fire protection in accordance with the criteria specified in DOE/EP 0108.
- Telephones shall be installed at each entrance of the facility.
- The communications system cable and wiring shall be designed to the standards specified in FIPS PUB 174.
- The cable and wiring conduits shall be sized for 100% expansion.
- A closed-circuit television system shall be provided for surveillance of the facilities perimeter and any other selected areas.
- An audio speaker system with intraplant paging capability for all telephones in the facility shall be provided.
- The communications system components shall be UL listed and/or Factory Mutual approved whenever such components are available, in accordance with DOE Order 6430.1A, Section 1605.
- Area with high-ambient noise levels shall be provided with visual signaling devices, in addition to the audio announcement devices.

Functional Requirements

- The communications system shall have adequate coverage for all areas of the facility to ensure that all personnel are immediately notified in case of an emergency.
- The audio speaker system shall be designed for adequate speech intelligibility per ANSI S3.5. The background sound levels shall not exceed the criteria set forth in 29 CFR 1910.95.
- No specific security controls are required for the facility communications system.

Operational and Maintenance Requirements

- The emergency announcement system shall remain operational at all times.
- A dedicated emergency announcement system connected to the site-wide communication system may be provided, if required.
- The communication room and equipment layout shall be designed for ease of maintenance.
- The communications devices in the high-hazard areas shall be easily replaceable to minimize maintenance time.
- The use of hand-held walkie-talkies may be excluded if they interfere with the function of the facilities' electronic control systems.

References

<u>FDC</u>

- Section 5.9, Communications and Telecommunication Systems.

<u>DOE Order 6430.1A (1989)</u>

- Section 0110-99.8, Telecommunications, Alarms, and ADP Centers and Radio Repeater Stations.
- Section 0200-99.8, Telecommunications, Alarms, and ADP Centers and Radio Repeater Stations.
- Section 1605, Basic Electrical Materials and Methods.

<u>Other DOE Orders</u>

- DOE/EP-0108, Standard for Fire Protection of DOE Electronic Computer/Data Processing Systems, 1984.

<u>Industry Codes and Standards</u>

- FIPS PUB 174, Federal Building Telecommunications Wiring Standard, August 1992.
- ANSI S3.5, Methods for Calculation of the Articulation Index, January 1969.

<u>Code of Federal Regulations</u>

- 29 CFR 1910.95, Occupational Noise Exposure, 1992.

23.0 Human Factors Engineering

General
Human factors engineering criteria and requirements shall be incorporated into the equipment, systems, and facility design to enhance operation, maintenance, reliability, environment, and personnel health and safety in accordance with the requirements of the FDC, Section 3.1. The requirements on human performance published in DOE Orders, industry standards, and WHC design guides shall be applied in the design.

Safety Classifications
N/A

Structural Requirements
N/A

Functional Requirements
N/A

Operational and Maintenance Requirements

- The design shall meet the general requirements of DOE Order 6430.1A, Section 1300-12, to improve human performance through enhancements in the work environment and human-machine interfaces.

- The design shall conform to specific requirements described in WHC-SD-GN-DGS-30011 Appendix A, on human factors.

- Equipment used by personnel, such as control panels, counters, enclosures, equipment, seating, work tables, etc., shall be designed for human dimensions considerations to accommodate body size and movement (MIL-STD-1472D, Section 5.6, NUREG 0700, Section 6.1, and Human Factors Design Handbook).

- Environmental conditions, such as temperature, humidity, and climate control systems, shall be designed to maintain acceptable inhabitable conditions (NUREG 0700, Section 6.1 and UCRL 15673, Section 3.2.4.5).

- Adequate lighting levels shall be designed to ensure optimum human comfort and performance. Glare and shadowing shall be avoided (DOE Order 6430.1A, Section 1655 and NUREG 0700, Section 6.1).

- Emergency lighting shall be provided (NFPA 101 and NUREG 0700, Section 6.1.5.4).

- Acoustic design shall reduce noise levels to ensure that verbal communications are not impaired, signals are readily detectable, and distraction and irritation are minimal (NUREG 0700, Section 6 and UCRL 15673, Section 3.2.4.2).

- Vibration of structural and equipment shall be minimized to avoid impairment of work efficiency (UCRL 15673 Section 3.2.4.3).

- Controls, displays, labeling, and component ergonomics shall promote efficient use and operator awareness (MIL-STD-1472D, Section 5.2 and NUREG 0700, Sections 6.1, 6.3, 6.4, 6.7, 6.8, and 6.9, and IEEE-1023).

- Protective equipment, such as protective clothing, breathing equipment, radiation badges, etc., shall be provided to protect personnel from exposure to a hazardous environment during routine operation and maintenance activities (NUREG 0700, Section 6.1.4 and EPRI-NP-2360).
- Warning, communication, and annunciator systems shall be designed to alert personnel in an effective and timely manner to handle abnormal and emergency conditions. Visual and auditory methods should be used (MIL-STD-1472D, Section 5.4 and NUREG 0700 Section 6.2 and 6.3).
- Proposed DOE Standard, Human Factors Engineering Design Criteria, on human factors engineering shall be evaluated for implementation into the design of the MWTF, when issued.
- A Human Factors Engineering report shall be prepared during the course of the design.

References

FDC

- Section 3.1, Instrumentation and Control.

DOE Order 6430.1A (1989)

- Section 1300-12, Human Factors Engineering.
- Section 1655, Interior Lighting.

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- WHC-SD-GN-DGS-30011, Radiological Design Guide, 1994.

Industry Codes and Standards

- DOE Standard, Human Factors Engineering Design Criteria, Volume 1, 1993 (proposed).
- EPRI-NP-2360, Human Factors Methods for Assessing and Enhancing Power Plant Maintainability, 1982.
- IEEE-1023, IEEE Guide for the Application of Human Factors to Systems, Equipment, and Facilities of Nuclear Power Generating Stations, 1988.
- MIL-STD-1472D, Military Standard, Human Engineering Criteria for Military Systems, Equipment and Facilities, 1989.
- NUREG 0700, Guidelines for Control Room Design Reviews, 1981.
- UCRL 15673, Human Factors Design Guidelines for Maintainability of DOE Nuclear Facilities, 1985.
- NFPA 101, Life Safety Code, 1994.
- Human Factors Design Handbook, H. S. Zahn, McGraw-Hill Co., 1982.

24.0 Waste Characterization and Processing

General

This section describes the design requirements for any chemical processing performed in the MWTF. This includes sampling and monitoring of waste streams, contents of the primary storage tank, leak detection, and leakage removal capabilities and systems.

The chemical composition of waste to be stored in the MWTF is given in Appendix A of the FDC. The radionuclide concentrations are given in Appendix B of the FDC.

The applicable FDC Sections are listed below:

- Section 3.1, Instrumentation and Control.
- Section 3.3, General Chemical Process.
- Section 3.4.6, Liquid Sampling System.
- Section 3.4.7, Waste Liquid Balance.
- Section 3.4.8, Leak Detection.
- Section 3.4.9, Annulus Leakage Removal.
- Section 4.1.4, Liquid Sample Building.

24.1 Chemical Processing

General

Chemical processing is not performed in this facility. The design shall allow for additions of chemicals, water, and other liquids to the primary storage tank in accordance with the FDC, Section 3.3.

24.2 Sampling and Monitoring

General
Sampling capabilities shall be provided for the primary storage tank wastes, the primary storage tank ventilation system, the stack exhaust, and work areas where hazardous vapors or particles are present in accordance with the FDC, Sections 3.1, 3.4.6, and 4.1.4. Sampling systems shall provide for remote handling of the waste samples. Additional sampling requirements for leak detection are discussed in Section 24.4, Leak Detection.

Safety Classification
Sampling and monitoring systems shall be designed to Safety Class 2 criteria, with the exception of those systems specifically identified as Safety Class 3 items in the PSAR, WHC-SD-W236A-PSAR-001 or safety equipment lists.

Structural Requirements

- The same as those listed in Functional Requirements.

Functional Requirements

<u>Primary Storage Tank Waste Sampling</u>

- A system shall be provided to routinely sample the liquid contents of the primary storage tanks, and provisions shall be made to ship the samples to a designated laboratory.
- The liquid sampling system shall include temperature sensing devices, redundant liquid-level measuring devices, sludge-level measuring devices, and probes to alarm high-liquid levels.
- The liquid sampling system shall include locations for sampling the liquid waste at a minimum of three elevations in each tank.
- Liquid sample return lines shall slope to the return point, while sample supply lines shall slope to the supply point.
- The liquid sampling system shall be located in a room in the Support Facility building. The room shall contain ventilated gloveboxes or cells equipped with manipulators for collecting liquid samples for measurements. Adequate shielding shall be provided around the cells or gloveboxes to protect workers.
- Hydrogen, ammonia, and total organic (hydrocarbon) analyzers shall be installed to measure concentration of ignitable and hazardous gases in the vapor space at three locations in the primary storage tank. The devices shall be able to detect and measure continuously the presence of hydrogen, ammonia and organic gases which might be generated in the waste stored in the tank (see Section 7.2, Tank Monitoring).

<u>Ventilation System Sampling</u>

- Adequate instrumentation shall be provided to monitor and assess performance of the air-treatment components of the primary storage tank and building ventilation systems.
- Near-isokinetic samplers and toxic gas analyzers shall be used to monitor the ventilation exhaust systems. The sampling system shall be designed to meet ANS N13.1.
- Monitoring systems shall be installed on each primary storage tank ventilation train, the process cell and pit ventilation train, and the annulus ventilation train to meet the requirements of DOE Order 6430.1A, Sections 1323-6.3.1 and 1550-99.0.2.

Exhaust Sampling

- Continuous air monitors and record air samplers shall be installed on the exhaust stacks to detect and measure radioactive and toxic material releases to the atmosphere, to meet the requirements of DOE Order 6430.1A, Section 0110-99.0.8.
- All exhaust systems shall have monitors that provide an alarm if the concentration of certain specified hazardous materials in the exhaust exceeds specified limits.
- The stacks shall be provided with a redundant monitoring system for radionuclide particulates.
- An alarm system shall be provided for low flow or loss of sample airflow to the monitors. This alarm system shall be independent of the radiation alarm system.
- Stack particulate air sampling shall be continuous and representative of the airflow in the exhaust and be provided by a near-isokinetic air sampling system.
- Stack sampling techniques shall comply with the requirements of 40 CFR 60, Appendix A, and 40 CFR 61, Subpart H.

Sampling of Personnel Work Areas

- Continuous air monitors (CAMs) and an alarm system, or fixed-head samplers, shall be provided in work areas where potential for hazardous airborne particles or vapors exist, to meet the requirements of DOE Order 6430.1A, Section 1300-6.5.

Operational and Maintenance Requirements

- Sampling and monitoring shall ensure adequate and accurate measurements under normal operations, anticipated operational occurrences, and accident conditions, to meet the requirements of DOE Order 6430.1A, Section 1300-9.
- Safety Class 2 components of the sampling and monitoring system shall be selected to perform their intended function in the environment they are located, and shall be provided with adequate redundancy.
- Contamination control and adequate radiation shielding shall be provided for all sampling operations.
- Sampling and decontamination operations shall be remotely operated, and include the capability to remotely return the sample to its primary storage tank or other suitable location, and to remotely clear and flush sample lines with water, air, and/or decontamination solutions.
- Equipment shall be accessible for maintenance and testing without creating undue hazard to the workers.

24.3 Waste Liquid Balance

General

The design shall include instrumentation for estimating the net loss of water from the primary storage tank and the amount of water to be added to maintain the physical characteristics of the waste in the tank within the specified limits, as required by the FDC, Section 3.4.7.

Safety Classification

Waste liquid balance instrumentation shall be designed to Safety Class 3 criteria, unless designated differently in subsequent PSAR or safety equipment lists.

Structural Requirements

- *All sources of water into tanks shall be metered and totalled.*

Functional Requirements

- The system should be available for continuous measurements.
- The ventilation systems need not be monitored on a continuous basis if determined during definitive design to be a minor source/sink.

Operational and Maintenance Requirements

- The equipment shall be selected for ease of maintenance and testing to assure a level of measurement accuracy.

24.4 Leak Detection

General
A leak detection system shall be installed to detect the failure of waste confinement systems in accordance with the FDC, Section 3.4.8. Instrumentation for leak detection shall be provided in accordance with the FDC, Section 3.1.

Safety Classification
The leak detection system shall be designed to Safety Class 2 criteria.

Physical Requirements

- Liquid detectors in the annulus space and air radiation monitors in the annulus ventilation exhaust shall be installed to detect leaks from the primary storage tank.

- Liquid leak detectors, liquid-level measuring devices, and/or radiation monitors shall be installed in the cells, pump pits, annulus pump pits, flush building, and the main valve pit.

- A selected, individually programmable instrumentation and interlock system shall be provided to effect safe shutdown or to maintain safe operation of the facility upon the detection of a leak.

- A leakage monitoring system shall be provided to detect leakage in the space between the primary process piping and encasement, in accordance with DOE Order 6430.1A, Sections 1300-7.4 and 1323-5.2.

- Safety Class 2 electrically operated leak-detection system components shall be provided with backup power in accordance with DOE Order 5820.2A, Chapter I, paragraph 3.b.(3).

- Alternate methods of leak detection specified in DOE Order 5820.2A, paragraph 3.b.(3) shall be used in the design to ensure detection of a leak.

Functional Requirements

- The leak detection system shall be capable of detecting the presence of waste or accumulated liquid in the secondary containment within 24 hours or as soon as practicable if existing technologies or site conditions do not permit detection within 24 hours, as required by WAC 173-303-640, paragraph (4).

- The leak detection system shall be designed with adequate redundancy to provide a high level of reliability (except for annulus ventilation).

Operational and Maintenance Requirements

- The components of the detection system should be located for easy access without creating undue hazard to personnel.

24.5 Annulus Leakage Removal

General
The design shall provide means for transferring, to a suitable storage location, any material leaked into the annulus from the primary storage tank in accordance with the FDC, Section 3.4.9.

Safety Classification
The annulus leakage removal system (pump) shall be designed to Safety Class 2 criteria.

Physical Requirements

- An annulus pump shall be provided to transfer waste leaked into the annulus from the primary storage tank as required by DOE Order 6430.1A, Section 1323.5.1, and WAC 173-303-640, paragraph 4.
- Design shall provide for contingency actions to be taken upon the detection of a leak, in accordance with DOE Order 5820.2A, Chapter I, paragraph 3.b.(4).

Functional Requirements

- Leaked waste shall be removed within 24 hours or as soon as practicable if existing technologies or site conditions do not permit removal within 24 hours.

Operational and Maintenance Requirements

- Methods shall be provided to facilitate contingency actions undertaken by workers, including leakage removal, without causing undue hazard to the workers.

24.6 Section 24.0 References

FDC

- Section 3.1, Instrumentation and Control.
- Section 3.3, General Chemical Process.
- Section 3.4.6, Liquid Sampling System.
- Section 3.4.7, Waste Liquid Balance.
- Section 3.4.8, Leak Detection.
- Section 3.4.9, Leakage Removal.
- Section 4.1.4, Liquid Sample Building.

DOE Order 6430.1A (1989)

- Section 0110-99.0.8, Personnel and Public Safety.
- Section 1300-6.5, Monitoring, Warning and Alarm System.
- Section 1300-7.4, Transfer Pipes and Encasements.
- Section 1300-9, Effluent Control and Monitoring.
- Section 1323-5.1, Confinement Systems - General.
- Section 1323-5.2, High-Level Liquid Waste Confinement.
- Section 1323-6.3.1, Radioactive Liquid Waste Facilities-Airborne Effluents.
- Section 1550-99.0.2, Confinement Ventilation Systems.

Other DOE Orders

- DOE Order 5820.2A, Radioactive Waste Management, Chapter I, Monitoring, Surveillance, and Leak Detection, 1988.

Westinghouse Hanford Company

- WHC-SD-W236A-PSAR-001, Preliminary Safety Analysis Report, March 1994.

Industry Codes and Standards

- ANSI N13.1, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities, 1969 (R 1993).

Code of Federal Regulation

- 40 CFR 60, Standards of Performance for New Stationary Sources.
- 40 CFR 61, National Emission Standards for Hazardous Air Pollutants (NESHAP).

Washington Administrative Codes (WAC)

- WAC 173-303-640, paragraph (4), Tank Systems, Containment and Detection of Releases, December 1993.

25.0 Materials, Welding, and Inspection

General
This section defines the requirements for selection of materials, welding, and inspections during construction. In-service inspections that effect the design and should be identified in the design are specified in this section. Requirements set forth in industry standards, such as ASME codes, EPA, DOE Orders, and Washington State regulations (WAC) regarding these items are addressed.

The applicable FDC Sections are listed below:

- Section 2.2, Waste Storage and Containment.
- Section 2.2.1, Primary Storage Tank.
- Section 2.2.2, Secondary Confinement Structure.
- Section 3.2, Piping.
- Section 3.2.1, Process Piping.
- Section 3.2.4, Corrosion Protection.
- Section 3.4.3, Tank Corrosion Monitoring.

25.1 Materials

General
Material selection is required for compatibility of the nature of the waste to be stored, transported, and handled by the facility equipment and for structural integrity, as required by the FDC, Sections 2.2.1, 2.2.2, and 3.4.3.

Safety Classification
N/A

Structural Requirements

- Material selection shall meet the general requirements of DOE Order 6430.1A, Section 1323-5.2 (bullet 4).
- Material selected for the primary storage tank shall conform to the rules set forth in ASME B&PV, Section III, Division 1, Subsection NC, Article NC-2000, and shall be based on the results of studies and testing to evaluate corrosion effects. The selected material is carbon steel, grade 70, chromium content 0.2 to 0.3%, normalized per ASME SA-516, as selected in WHC-SD-W236A-ES-003.
- Material selection for the secondary liner shall conform to the rules of ASME Section III, Division 2, Subsection CC, Article CC-2000. The material is carbon steel, grade 70, normalized per ASME SA-516, as selected in WHC-SD-W236A-ES-003.
- Material requirement for primary and annulus ventilation ducting shall be as specified in Section 6.0, Tank Ventilation System.
- Material selection for all other systems and components shall be in accordance with the applicable design code.
- Provisions for control of handling of the carbon steel primary storage tank sections during cold weather shall be invoked in the applicable design specifications to limit brittle metal failure possibilities.

Functional Requirements

- Material selected shall be compatible with waste to be stored, transferred, or handled by the process equipment.
- The design shall meet the requirements of State regulation WAC 173-303-640, paragraph (3).

Operational and Maintenance Requirements

- The same as those listed in Section 25.3, Inspections.

25.2 Welding

General
Welding requirements shall be consistent with the materials selected for construction and with the industry codes used for design and construction of the tanks and process piping to maintain structural integrity of the tanks and the piping required by the FDC, Sections 2.2 and 3.4.3.

Safety Classification
The same as the component to be welded.

Structural Requirements

- Welding process controls and selection of filler material used for welding shall be the responsibility of the construction contractor (subject to directions in the applicable design and/or construction specifications), and shall be in accordance with the rules of the ASME B&PV Code, Section III, Division 1, Subsection NC, Article NC-2000 for the primary storage tank, and the ASME B&PV Code, Section III, Division 2, Subsection CC, Article CC-2000 for the secondary liner, in conjunction with the rules of ASME Section IX.

- Welding processes shall meet the general requirements of DOE Order 6430.1A, Section 1323-5.2 (bullet 4).

- Welding processes for other Safety Class 2 and Safety Class 3 items will be governed by the appropriate design code.

- The welding process for structural steel shall be in accordance with AWS D1.1.

Functional Requirements

- The welded tanks or piping shall perform the function of confinement and meet the requirements of DOE Order 6430.1A, Section 1323-5.2, and State regulation WAC 173-303-640.

Operational and Maintenance Requirements

- The same as in Section 25.3, Inspections.

25.3 Inspections

General
Inspections and examinations during construction and periodically during operation shall be done in accordance with the Federal and State regulations and industry standards to meet the overall requirements of the FDC, Sections 2.2.1, 2.2.2, 3.2 and 3.4.3.

Safety Classification
The level of inspections shall be commensurate with the safety classification of the item being inspected, and shall be in accordance with the QAPP and the design specifications.

Inspections Requirements

- The construction contractor's QA program shall be consistent with the requirements specified in Section 20.0, Quality Assurance, of this document.

- Inspections of the primary storage tank, secondary confinement structure, and ancillary equipment are subject to the reviews and assessments performed by an independent, qualified registered professional engineer, as required by State regulation WAC 173-303-640, paragraphs (3) and (4).

- Inspections and examinations of the primary storage tank and secondary liner during construction shall be in accordance with the design specifications and the construction contractor's approved QA program.

- The construction contractor's examination program shall comply with the rules of the ASME B&PV Code, Section III, Division 1, Subsection NC, Article NC-5000 for the primary storage tank; and with the rules of the ASME B&PV Code, Section III, Division 2, Subsection CC, Article CC-5000 for the secondary liner.

- Inspections and examinations shall include visual inspections, radiographic and dye penetrant examinations, and any other examination specified in the applicable industry code for the class of component being built.

- The construction of the primary storage tanks are also subject to an independent overview by an Authorized Nuclear Inspection Inspector, as required by the ASME code.

Functional Requirements

- The waste handling, storage and transfer systems shall perform as required by DOE Order 6430.1A, Section 1323-5, and by State regulation WAC 173-303-640.

Operational and Maintenance Requirements

- Design shall allow for periodic in-service inspections, as required in the FDC, Section 2.2.2, and DOE Order 6430.1A, Section 1323-5.2, last paragraph.

- Design shall have provisions for in-service inspection and remedial requirements set forth in State regulation WAC 173-303-640, paragraph (6).

25.4 Testing

General
The process testing of waste handling, storage, and transfer systems shall be performed to ensure structural integrity and to comply with the Federal and State regulations and the standards used in the design and construction of the system components as required by the FDC, Sections 2.2.1, 2.2.2, 3.2.1, and 3.2.4.

Safety Classification
Level of testing shall be commensurate with the Safety Class of the system, components, or structures being tested and will be specified in the design documents.

Testing Requirements

- Hydrostatic testing of the primary storage tank shall be done in accordance with the ASME B&PV Code, Section III, Division 1, Subsection NC, Article NC-6000 as part of the construction activity. No such testing is required for the secondary liner.

- The examination of welds that are not accessible at the bottom of the primary storage tank will not be possible during hydrostatic testing. A request for code change has been submitted to the ASME by ICF KH Letter KEH-236A-159 in this regard.

- All testing required for code-stamping of the primary storage tank shall be performed by the construction contractor.

- Testing shall be performed on the primary storage tank system to meet the requirement of State regulation WAC 173-303-640, paragraph (3) (e), before the tank system is put in service.

- The process transfer lines shall be pressure-tested as required by ASME B31.3. The applicable chapter of B31.3 will depend on the class of piping. Chapter VIII, Part 10 shall apply to Class "M" piping.

- All ventilation systems containing HEPA filters shall be tested to the requirements of ASME N510.

- All concrete components/structures designed to ACI 349 shall have the concrete tested to the requirements of ACI 349, as a minimum.

- Safety Class 3 systems/components shall be tested to the requirements indicated in the design specifications.

- Safety Class 2 jumpers shall be tested to an appropriate Safety Class 2 fabrication standard.

Functional Requirements

- The waste handling, storage, and transfer systems shall perform the intended function for the life of the facility.

Operational and Maintenance Requirements

- Provisions shall be made in the design for in-service surveillance testing of process piping and the waste storage systems, as required by DOE Order 6430.1A, Section 1323-5.2, WAC 173-303-640, paragraph (3)(b) and WHC-SD-WM-EV-054.

25.5 Section 25.0 References

FDC

- Section 2.2, Waste Storage and Containment.
- Section 2.2.1, Primary Storage Tank.
- Section 2.2.2, Secondary Confinement Structure.
- Section 3.2, Piping.
- Section 3.2.1, Process Piping.
- Section 3.2.4, Corrosion Protection.
- Section 3.4.3, Tank Corrosion Monitoring.

DOE Order 6430.1A (1989)

- Section 1323-5.2, High-Level Liquid Waste Confinement.
- Section 1323-5, Confinement Systems.

Westinghouse Hanford Company

- WHC-SD-WM-EV-054, Rev. 0, Double-Shell Waste In-tank Corrosion Monitoring Program, 1991.

Industry Codes and Standards

- ACI 349-90, ACI Manual of Concrete Practice, Code Requirements for Nuclear Safety-Related Concrete Structures.
- ASME Section IX, Welding and Brazing Qualifications, 1992 with 1993 addenda.
- ASME B31.3, Chemical Plant and Petroleum Refinery Piping, 1993.
- ASME N510, Testing of Nuclear Air Treatment Systems, 1989.
- ASME B&PV Code Section III, Division 1, Subsection NC, 1992.
- ASME B&PV Code Section III, Division 2, Subsection CC, 1992.
- AWS D1.1, Structural Welding Code-Steel, 1992.

Washington Administrative Codes (WAC)

- WAC 173-303-640, Tank Systems, December 1993.

W-236A Project Documents

- WHC-SD-W236A-ES-003, MWTF Tank Carbon Steel Evaluation Report, June 1994.
- KEH-W236A-159, Letter from ICF KH to ASME, Request for Revision to Code Rules, January 14, 1993.
- WHC-SD-W236A-QAPP-001, Rev. 1, MWTF Quality Assurance Program Plan, 1994.

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