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Cold Vacuum Drying Facility Civil - Structural System Design Description

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Abstract: This document describes the Cold Vacuum Drying (CVD) Facility civil - structural system. This system consists of the facility structure, including the administrative and process areas. The system's primary purpose is to provide for a facility to house the CVD process and personnel and to provide a tertiary level of containment. The document provides a description of the facility and demonstrates how the design meets the various requirements imposed by the safety analysis report and the design requirements document.

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COLD VACUUM DRYING FACILITY
CIVIL/STRUCTURAL SYSTEM
DESIGN DESCRIPTION

SYSTEM 06

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1.0 INTRODUCTION

The scope of this System Design Description (SDD) is the Civil and Structural (CIV) aspects of the Cold Vacuum Drying (CVD) Facility, including architectural considerations.

In general, the civil work scope includes all site work, soils investigation, underground piping, utilities, drainage and infrastructure.

Structural work scope includes all structures and associated supporting calculations and analysis to ensure compliance to the respective safety and design criteria. Structural elements, such as seismic analysis, soils interactions, concrete design, steel design connections, and load analysis are examples of structural scope items. The structural boundary generally extends to the structure itself, its foundation, interactions between structures, and the first integral attachment for systems supported by the structure.

Architectural work scope includes all standard finish items, such as coatings, doors, windows, landscaping, and trim, and, in general, those items related to human interface with the facility.

Figures 1-1, 1-2, and 1-3 depict the general configuration of the site and the structure.

1.1 System Identification

The CVD Facility Project provides the facility and processes required to drain the water and dry the spent nuclear fuel (SNF) filled multi-canister overpacks (MCOs) after they have been removed from the K-Basins. Removal of free water from the MCOs, using a cold vacuum drying process, will prevent MCO over-pressurization during the projected storage period at the Canister Storage Building (CSB).

The CVD Facility is located in the 100K Area of the Hanford Site near the K-West SNF storage basin (Figure 1-1). The CVD Facility consists of four main areas. The process bay area is a steel frame structure containing five process bays, four that share a second-level mezzanine, and one that is not equipped for processing. Contiguous with the process bay area building on the west side is the Process Support Area (transfer corridor/mechanical equipment area), a steel-frame, two-story metal building that encloses the transfer corridor, process bay support rooms, and the second floor mechanical equipment room. Immediately adjacent to the process bay area building on the south side is the administrative area, a single-story, pre-engineered metal building that encloses office and change room areas. Immediately adjacent to the process bay area building on the north side is a single-story, slightly below-grade, concrete and structural steel building that encloses the (PWC) process water tank room. Figures 1-2 and 1-3 are simplified diagrams of the floor plan of the facility.

The following abbreviated list of drawings provides key design information associated with this SDD (for a complete list, see Appendix B).

Figure 1-1. Civil Site Plan

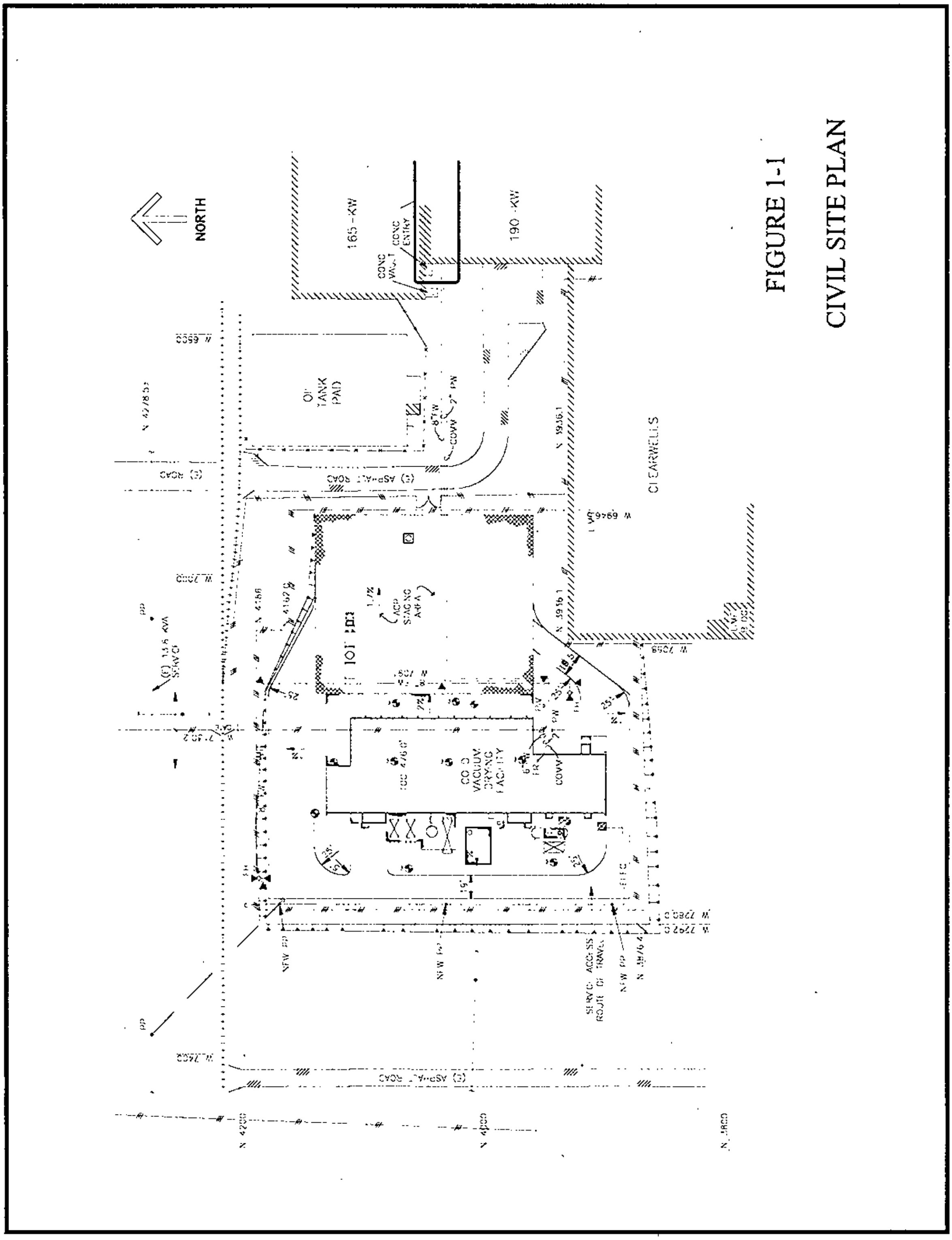

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Figure 1-2. First Floor Plan

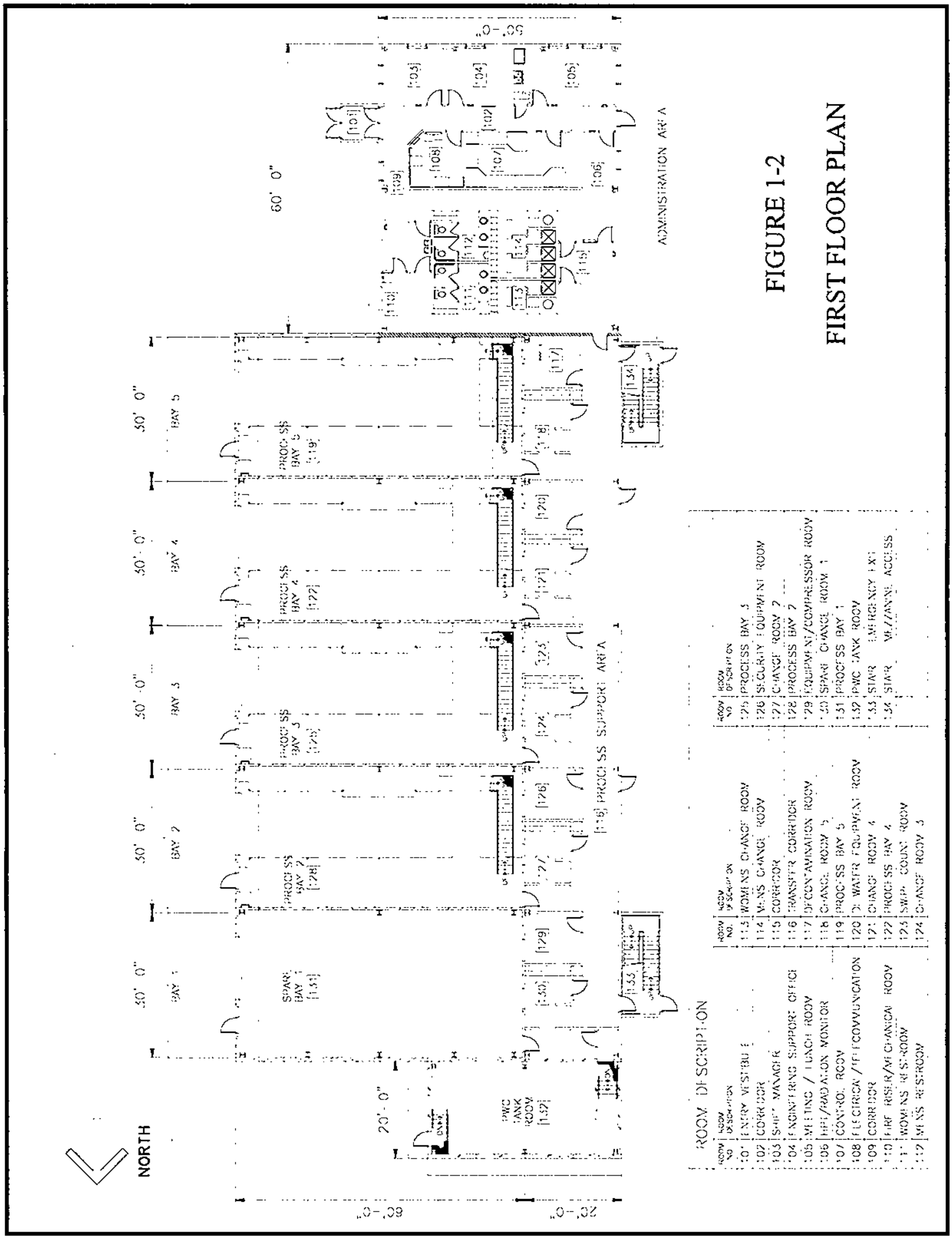
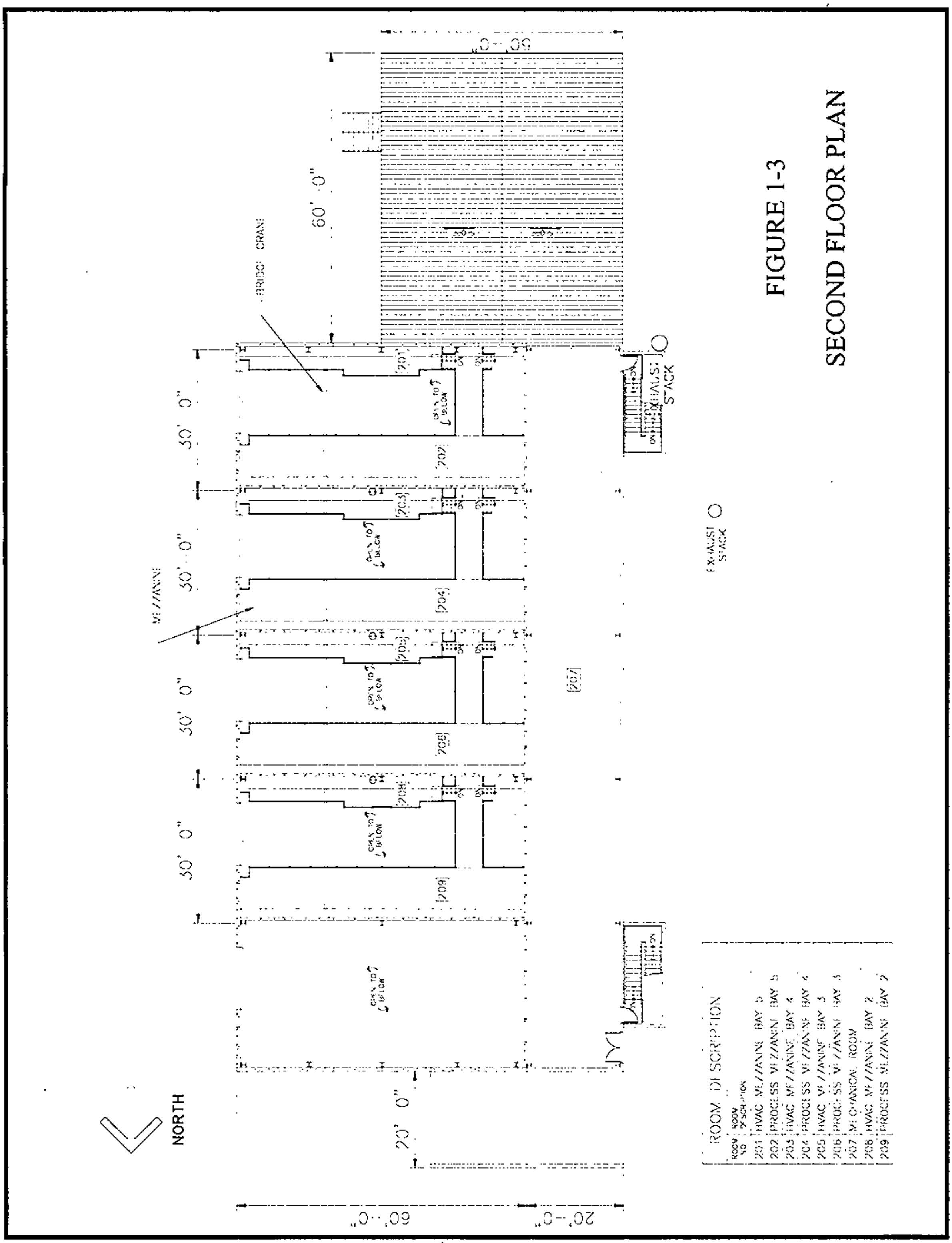


Figure 1-3. Second Floor Plan



WVF: CV-STR_SNF-3061_F1-3 ACAD FILE: ZTLC0009

H-1-82091, *Cold Vacuum Drying Facility Overall Site Plan*; H-1-82092, *Cold Vacuum Drying Facility Civil Site Plan, Legend;* H-1-82093, *Cold Vacuum Drying Facility Scanned Utilities Plan;* H-1-82101, *Cold Vacuum Drying Facility Architectural First Floor Plan;* H-1-82102, *Cold Vacuum Drying Facility Architectural Second Floor Plan;* H-1-82121, *Cold Vacuum Drying Facility Structural Foundation Plan;* and H-1-82121, *Cold Vacuum Drying Facility Structural Foundation Plan.*

This SDD, when used in conjunction with the other elements of the definitive design package, provides a complete picture of the civil, structural, and architectural information for the CVD Facility. Elements of this SDD include functions, requirements, and descriptions. Other documents comprising the definitive design include:

- Project design requirements (HNF-SD-SNF-DRD-002),
- Fire Hazard Analysis (HNF-SD-SNF-FHA-003),
- Master Equipment List (SNF- 4148),
- Data and calculation matrix tracking list (SNF-3001)
- Construction Specification (W-441-C1)
- Facility Functions and Requirements (WHC-SD-SNF-FRD-020)
- CVD Natural Phenomena Hazards (WHC-SD-SNF-DB-010).

1.2 Limitations of This SDD

This SDD has been prepared using the best available information taken from reviewed and approved design documents and drawings. Some in-process design changes affect the system described in this SDD. These changes are incorporated into this SDD to the extent possible and practical. As the design changes proceed to completion by incorporation into official design documentation and construction is completed, this SDD will be updated.

1.3 Ownership of This SDD

The CVD Design Authority assigned to the CIV system is responsible for the accuracy and technical content of this SDD. Any questions on the system or content of this document shall be resolved through the design authority.

1.4 Acronyms

ACI	American Concrete Institute
ALARA	As Low As Reasonably Achievable
ANSI	American National Standards
ASTM	American Society for Testing and Materials
CFR	Code of Federal Regulations
CIV	Civil and Structural
CVD	Cold Vacuum Drying
DBE	Design Basis Event
DRD	Design Review
DOE	U.S. Department of Energy
FSAR	Final Safety Analysis Report

MCO	Multi-Canister Overpack
MCS	Monitoring and Control System
NFPA	National Fire Protection Association
NGS	Non-Government Standards
NRC	U.S. Nuclear Regulatory Commission
OSHA	Occupational Safety & Health Administration
OSRs	Operational Safety Requirements
PWC	Process Water Conditioning
RL	U.S. Department of Energy, Richland Operations Office
SAR	Safety Analysis Report
SCHe	Safety-Class Helium
SCIC	Safety-Class Instrument and Control
SDD	System Design Description
SNF	Spent Nuclear Fuel
SSC	Structure, System and Component
TSRs	Technical Safety Requirements
TW	Tempered Water
UBC	Uniform Building Code

2.0 GENERAL OVERVIEW

2.1 System Functions

The CVD Facility structure provides protection from the design basis environmental conditions for the facility workers and allows for the process and utility systems contained within the CVD Facility to operate in accordance with safety analysis documentation prepared to insure the safety of workers and the public.

The building provides tertiary radiation confinement for the cask/MCO with the structure and the local exhaust system. The MCO and process hood provides confinement during normal operating and anticipated operational occurrences. The building functions as a tertiary confinement barrier during design basis accidents, including natural phenomena events.

These functions are given in WHC-SD-SNF-FRD-020, 1996, K Basin Spent Nuclear Fuel Cold Vacuum Facility Functions and Requirements, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

2.2 System Classification

The CVD Facility process areas are classified as a non-reactor nuclear facility, hazard category 2, and Performance Categories 2 and 3. The administrative area is classified as a non-nuclear facility, Performance Category 1.

2.3 Basic Operational Overview

The CVD Facility building is an above-grade structure, with the exception of the process water conditioning (PWC) room, 231 ft-8 in long by 88 ft-8 in wide. The CVD Facility structure has four significant sections, or subsystems, consisting of the process bay area, process water tank room, process support area, and administrative area.

The process bay area, 60-ft by 150-ft, contains four process bays and one unused bay that is not equipped for processing. These areas are constructed as a single-story, steel-frame building with 10-in. thick exterior walls made of pre-cast concrete panels. The bays are separated from the process support area and administrative area by pre-cast concrete walls.

The process support area, 20-ft by 150-ft, includes the transfer corridor, adjacent rooms, and a second-floor mechanical room. This area is constructed as a two-story steel frame building with an exterior skin of insulated metal siding.

A 20-ft by 40-ft process water tank room, located 2-ft below the rest of the facility, adjoins both the process bays and process support area.

The 50-ft by 60-ft administrative area is an adjacent, single-story, pre-engineered metal building with an exterior skin of insulated metal panels.

The process bay area and process water tank room have a built-up membrane roof on an insulated steel deck. The administrative area and mechanical/corridor equipment rooms have preformed insulated metal roofs.

The CVD Facility footprint includes approximately 12,800 ft^2 for the process bays, process water tank room, and the transfer corridor/mechanical equipment areas. The administrative area, including offices and change rooms, is 3,000 ft^2 in size. The facility is designed for occupancy of 15 persons.

3.0 REQUIREMENTS AND BASES

3.1 General Requirements

3.1.1 System Functional Requirements

Functional requirements include protection from environmental support to process functions, worker support/protection, and interaction with the site and adjacent facilities.

3.1.1.1 Design Requirements. See Section 3.3, Engineering Disciplinary Requirements.

3.1.1.2 Safety Requirements

3.1.1.2.1 Safety Class Requirements

1. **Requirement:** The CVD Facility Process Bay structure shall provide Performance Category 3 resistance to natural phenomena hazard events to protect the process equipment and to accomplish 3-over-1 seismic qualification to preclude damage or impairment of safety-class systems or components. Of specific concern for 3-over-1 protection is the process hood support stand and its flexible tubing connections to the process connectors attached to the MCO. The safety-class helium (SCHe) and safety class instrument and control (SCIC) systems also must be protected from damage. These systems and components provide preventive or mitigative functions for the accident conditions. Accomplishment of protection of safety-significant structure, system and component (SSCs) shall also be provided.

   Basis: Safety Analysis Report, HNF-3553, Rev.0, "Safety Function", Section B4.4.1.1. Equipment is to be protected from natural phenomena that could cause damage.

   How the system meets the requirement: The CVD Facility Process Bay structure provides Performance Category 3 resistance to natural phenomenon hazard events to protect the process equipment and to accomplish 3-over-1 seismic qualification to preclude damage or impairment of safety-class systems or components. Accomplishment of protection of safety-significant SSCs is also provided. The drawings and calculations identified in Appendix B provide detailed confirmation of this requirement.

2. **Requirement:** The CVD Facility structure shall provide seismically qualified mounting locations for safety-class items. The process hood support stand and SCHe support racks shall be anchored to the floor.

   Basis: Safety Analysis Report, HNF-3553, Rev.0, "Safety Function", Section B4.4.1.1, safety-class equipment must have the capability to withstand credible seismic events.

How the system meets the requirement: The CVD Facility structure provides seismically qualified mounting locations for safety-class items. The process hood support stand and SCHe support racks are anchored to the floor. The drawings and calculations identified in Appendix B provide detailed confirmation of meeting this requirement.

3. **Requirement:** The CVD Facility structure shall support and provide the process bay bridge cranes, which are considered important-to-safety, Category C.

   Basis: Safety Analysis Report, HNF-3553, Rev.0, "Safety Function", Section B4.4.1.1. Cranes should not fall and detrimentally affect safety-class equipment.

   How the system meets the requirement: The CVD Facility structure supports and provides the process bay bridge cranes, which are considered important-to-safety, Category C. The drawings and calculations identified in Appendix B provide detailed confirmation of this requirement.

3.1.1.2.2 Safety Significant Requirements

1. **Requirement:** The process bay area structures (process bays 2, 3, 4 and 5) and process water tank room structure shall provide confinement for gaseous releases inside the process bays or process water tank room.

   Basis: Safety Analysis Report, HNF-3553, Rev.0, "Safety-Class and Safety-Significant Structures, Systems and Components Summary List", Table B4-1. The structure provides protection to the public, personnel and the environment in the event of a radiological release.

   How the system meets the requirement: The process bay area structures (process bays 2, 3, 4 and 5) and process water tank room structure provide confinement for gaseous releases inside the process bays or process water tank room. The drawings and calculations identified in Appendix B provide detailed confirmation of this requirement.

2. **Requirement:** The process water tank room structure shall provide confinement for liquid spray and aerosols and for retention of liquid pools in the process water tank room.

   Basis: Safety Analysis Report, HNF-3553, Rev.0, "Safety-Class and Safety-Significant Structures, Systems and Components Summary List", Table B4-1. Control of the release of potentially contaminated fluids is necessary to protect the public/workers.

   How the system meets the requirement: The process water tank room structure provides confinement for liquid spray and aerosols and for retention of liquid pools in the process water tank room. The drawings and calculations identified in Appendix B provide detailed confirmation of meeting this requirement.

3. **Requirement:** The process bay area structure (process bays 2, 3, 4 and 5) and process water tank room structure shall provide confinement for gaseous releases inside the process bays as a result of an MCO external hydrogen explosion discharging into the process bay area or process water tank room.

   Basis: Safety Analysis Report, HNF-3553, Rev.0, "Safety-Class and Safety-Significant Structures, Systems and Components Summary List", Table B4-1. The structure provides confinement to limit the release of hazardous fluids due to an accident.

   How the system meets the requirement: The process bay area structure (process bays 2, 3, 4 and 5) and process water tank room structure provide confinement for gaseous releases inside the process bays as a result of an MCO external hydrogen explosion discharging into the process bay area or process water tank room. The drawings and calculations identified in Appendix B provide detailed confirmation of meeting this requirement.

4. **Requirement:** The process bay area structure (process bays 2, 3, 4 and 5) shall provide confinement for gaseous releases inside the process bays as a result of an MCO internal hydrogen explosion discharging into the process bay area.

   Basis: Safety Analysis Report, HNF-3553, Rev.0, "Safety-Class and Safety-Significant Structures, Systems and Components Summary List", Table B4-1. The structure provides confinement to limit the release of hazardous fluids due to an accident.

   How the system meets the requirement The process bay area structure (process bays 2, 3, 4 and 5) provides confinement for gaseous releases inside the process bays as a result of an MCO internal hydrogen explosion discharging into the process bay area. The drawings and calculations identified in Appendix B provide detailed confirmation of meeting this requirement.

5. **Requirement:** The process bay area structure (process bays 2, 3, 4 and 5) shall provide confinement for gaseous releases inside the process bays as a result of an MCO thermal runaway reaction causing the 150 lb/in^2 rupture disk to discharge into the process bay area.

   Basis: Safety Analysis Report, HNF-3553, Rev.0, "Safety-Class and Safety-Significant Structures, Systems and Components Summary List", Table B4-1. The structure provides confinement to limit the release of hazardous fluids due to an accident.

   How the system meets the requirement: The process bay area structure (process bays 2, 3, 4 and 5) provides confinement for gaseous releases inside the process bays as a result of an MCO thermal runaway reaction causing the 150 lb/in^2 rupture disk to discharge into the process bay area. The drawings and calculations identified in Appendix B provide detailed confirmation of meeting this requirement.

6. **Requirement:** The process bay area structure (process bays 2, 3, 4 and 5) shall provide confinement for gaseous releases inside the process bays as a result of MCO overpressurization causing the 150 lb/in^2 rupture disk to discharge into the process bay area.

   Basis: Safety Analysis Report, HNF-3553, Rev.0, "Safety-Class and Safety-Significant Structures, Systems and Components Summary List", Table B4-1. The structure provides confinement to limit the release of hazardous fluids due to an accident.

   How the system meets the requirement: The process bay area structure (process bays 2, 3, 4 and 5) provides confinement for gaseous releases inside the process bays as a result of MCO overpressurization causing the 150 lb/in^2 rupture disk to discharge into the process bay area. The drawings and calculations identified in Appendix B provide detailed confirmation of this requirement.

3.1.1.3 Other Safety Requirements. There are no other safety requirements for the civil and structural system.

3.1.1.4 Environmental Requirements. There are no unique environmental requirements not covered under the safety requirements for the civil and structural system.

3.1.1.5 Mission Critical Requirements. There are no mission critical requirements for the civil and structural system.

3.1.2 Subsystem and Major Components

The CIV system has four major subsystems:

- administration building (CIV-A)
- process bay (CIV-B)
- process water tank room (CIV-C)
- transfer corridor/mechanical room (CIV-D).

The detailed requirements for each of these subsystems are described in Section 2.3, "Engineering Discipline Requirements."

3.1.3 Boundaries and Interfaces

The CVD Facility is located at the 100K Area of the Hanford Site adjacent to the 105K West fuel storage facilities. Interfacing shall be accomplished per the following requirement:

1. **Requirement:** Several site upgrade projects, including utility expansions, are planned to be accomplished concurrent with construction of the CVDF. The CVDF design shall consider these related projects and ensure integration with the CVDF. The Operating Contractor shall provide a list of these upgrade projects. The current 100 K Area service water system shall be extended to provide an adequate water supply to the CVDF fire

suppression systems and fire protection loop. The current 100 K Area potable and service water system shall be extended to provide adequate service to the CVDF.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.2.1.2. It is cost effective to coordinate any utility work with both the existing utilities and other projects.

How the system meets the requirements: The site and structure interfaces with the current 100K area service water, potable water, electric, drainage, and fire protection systems, as well as the Hanford telephone system and Local Area Network system. All of these systems are being extended to provide tie-in points for the CVD Facility systems.

The interfaces within the structure are the chilled water/cooling water, de-ionized water, and compressed/instrument air systems for the cask drying systems.

The CVD Facility provides the structural framework and the environmental protection necessary for all systems internal to the CVD Facility, such as the vacuum purge system, tempered water (TW) system, SCIC system, and the monitoring and control system (MCS).

3.1.4 Codes, Standards, and Regulations

This section identifies the codes and standards that apply to this system.

10 Code of Federal Regulations (CFR) 835.1002d, "Occupational Radiation Protection"

This is a reference requirement by the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor. The intent of this directive is to help establish radiation protection standards, limits and program requirements for protecting individuals from ionizing radiation resulting from the conduct of U.S. Department of Energy (DOE) activities.

29 CFR 1910, "Occupational Safety and Health Standards"

This is required by the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor. The intent of this directive is to carry out OSHA requirements that have been found to be national consensus or established standards.

All routine industrial operations are covered under this requirement, from simple administrative function, such as maintaining worker exposure and medical surveillance records, to complex operations, such as handling hazardous materials. Minimum environmental controls required for a work area, provisions of proper personal protective equipment, fire protection, noise control, and medical and first aid during emergencies also are covered under this requirement. These regulations may be exempt if it is determined that they do not improve health and safety for specially designated employees. These regulations have no direct impact on the CVD Facility design, but the design may require certain characteristics that render it compliant with 29 CFR 1910. This regulation is maintained for reference.

<u>DOE Order 1300.2A, *Department of Energy Technical Standards Programs*</u>

This DOE order sets forth policies and responsibilities for the development and application of technical standards under DOE-controlled programs. This order stipulates that any applicable non-government standards (NGS) must be used and that their use must be properly documented. This order also states that all DOE facilities, programs, and projects will use NGSs in their design, construction, testing, modification, operation, decommissioning, decontamination, and remediation when such standards are adequate. If the existing federal standards are more conservative than NGSs, DOE requirements will be used. Uses of all standards in the design have to be properly documented. This DOE order is a general guide for using the technical standards. This document is maintained for reference.

<u>DOE Order 5480.7, *Fire Protection*</u>

This order relates to nuclear facility safety issues, such as fire protection of safety-class equipment, fire hazards analysis for the design basis fire to be included in the SAR, seismic criteria for the fire protection system, and life safety codes. It also sets forth provisions that address loss limitation for government-owned facilities.

<u>DOE Order 5480.28, *Natural Phenomena Hazards Mitigation*</u>

This order establishes requirements for response of facilities to natural phenomena, such as earthquakes and high winds.

<u>DOE Order 6430.1A, *General Design Criteria*</u>

This DOE order provides general design criteria for various engineering disciplines. The general design criteria are mandatory for all DOE-related work and provide the minimum acceptable design requirements for DOE facilities. Although DOE facilities are not mandated to follow state, county, and other requirements, it is recommended that they interface with the non-DOE authorities to accommodate their requirements as much as possible. The general design criteria contain 16 numerical divisions devoted to major building systems or design specialties. According to DOE instructions, the general design criteria must be used in the planning, design, and development of specifications for facilities, including the development of site-specific and equipment-specific designs.

<u>DOE Order 5820.2A, *Radioactive Waste Management.*</u>

This order requires a waste management plan, lists decontamination and decommissioning requirements, sets waste characterization standards, and establishes numerous other requirements that affect both the design and operation of the CVD Facility.

<u>DOE-STD-1020-94, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities.*</u>

This standard gives guidance regarding the selection of design criteria to be applied to the structural design of nuclear facilities. The facility is designed to seismic zone 2B for essential facilities. The site storm and floodwater drainage system is designed for a Performance Category 3 event.

DOE-STD-1021-93, *Natural Phenomena Hazards Performance Categorization Guidelines For Structures, Systems and Components.*

This standard gives guidance regarding the selection of design criteria to be applied to the structural design of nuclear facilities. The facility is designed to seismic zone 2B for essential facilities. The site storm and floodwater drainage system is designed for a Performance Category 3 event.

DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance With DOE Order 5480.23, Nuclear Safety Analysis Reports.*

This standard gives guidance regarding the selection of design criteria to be applied to the structural design of nuclear facilities. The facility is designed to seismic zone 2B for essential facilities. The site storm and floodwater drainage system is designed for a Performance Category 3 event.

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ANSI/NFPA 80, 1995, *Standard for Fire Doors and Fire Windows*, National Fire Protection Association, Quincy, Massachusetts.

ASTM A36/A36M, *Standard Specification for Carbon Structural Steel,* American Society for Testing and Materials, West Conshohocken Pennsylvania.

ASTM A53, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*, American Society for Testing and Materials, West Conshohocken Pennsylvania.

ASTM A185, *Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement,* American Society for Testing and Materials, West Conshohocken Pennsylvania.

ASTM A307, *Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength,* American Society for Testing and Materials, West Conshohocken Pennsylvania.

ASTM A325, *Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength,* American Society for Testing and Materials, West Conshohocken Pennsylvania.

ASTM A500, *Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes,* American Society for Testing and Materials, West Conshohocken Pennsylvania.

ASTM A563, *Standard Specification for Carbon and Alloy Steel Nuts,* American Society for Testing and Materials, West Conshohocken Pennsylvania.

ASTM A615/A615M, *Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement,* American Society for Testing and Materials, West Conshohocken Pennsylvania.

ASTM F436, *Standard Specification for Hardened Steel Washers* , American Society for Testing and Materials, West Conshohocken Pennsylvania.

AWS D1.1, *Structural Welding Code-Steel,* American Welding Society, Miami, Florida.

MNL-117, *Manual of Quality Control for Plants and Production of Architectural Precast Concrete Products*, Precast Concrete Institute, Chicago, Illinois.

NFPA 13, *Standard for the Installation of Sprinkler Systems*

NFPA 780, 1992, *Lightning Protection*, National Fire Protection Association, Quincy, Massachusetts.

UBC, 1994, *Uniform Building Code*, International Conference of Building Officials, Whittier, California.

UCRL-15673, *Human Factors Design Guidelines for Maintainability of Department of Energy Nuclear Facilities*, U.S. Nuclear Regulatory Commission, Washington, D,C.

Others as identified in the specifications and drawings, or as referenced within documents cited here.

3.1.5 Operability

The process bays and process water tank room are designed to remain intact if a design basis seismic, wind, or tornado event occurs. The administration area and transfer corridors are designed to fail away from the process bays and the process water tank room.

3.2 Special Requirements

3.2.1 Radiation and Other Hazards

The administrative building contains no source for the release of radiation and the possibility of radiation releases in the transfer corridor/mechanical room is small. However, the potential does exist for radiation release in the process bays and process water tank rooms during the MCO drying process. They are to be controlled areas per HNF-SD-SNF-002, Rev. 4, 1999, *Cold Vacuum Drying Facility Design Requirements*.

3.2.2 ALARA

1. **Requirement**: The radiological design of the CVD Facility shall incorporate ALARA design features.

   Basis: HNF-SD-SNF-DRD-002, Rev 4, 1999, Section 3.3.2. Shielding designs shall be consistent with ALARA practices to limit personnel and environmental exposures.

   How the system meets the requirements: ALARA shielding is provided in the process bays and process water tank rooms through steel framing and concrete panel walls. The drawings and calculations identified in Appendix B provide detailed confirmation of meeting this requirement.

3.2.3 Nuclear Criticality Safety

This section does not apply to this SDD.

3.2.4 Industrial Hazards

1. **Requirement:** The structure and components shall provide protection against industrial hazards for protection of the workers.

   Basis: HNF-SD-SNF-DRD-002, Section 6.3.3. This is consistent with Hanford standards and best construction practices.

   How the system meets the requirement: The facility is designed to 29 CFR 1910 requirements and the worker safety hazards protection features outlined in HNF-SD-SNF-DRD-002, Rev 4, *Cold Vacuum Drying Facility Design Requirements*.

3.2.5 Operating Environment and Natural Phenomena

1. **Requirement:** The design basis natural phenomena load requirements and conditions to be applied to the CVD Facility structural design are summarized in Table 3-1.

   Basis: These requirements are explained in detail in WHC-SD-SNF-DB-010, Rev. 1, *Cold Vacuum Drying System Natural Phenomena Hazards*, 1996, Westinghouse Hanford Company, Richland, Washington.

   How the system meets the requirement: These loadings and criteria have been incorporated into the design and verified by independent reviews. Appendix B lists the design calculations demonstrating that the CVD Facility meets these design requirements.

Table 3-1. Cold Vacuum Drying System Natural Phenomena Design Loading Requirements

Hazard	Load	Application Documents
Seismic	0.26 g equal hazard response spectra[a]	DOE Order 5480.28[b] DOE Standard 1020-94[c]
Straight Wind	80 mi/h, fastest mile at 30 ft	ASCE-7-93[e] DOE Standard 1020-94 (including missiles)[c]
Tornado	Wind speeds: 200 mi/h total 160 mi/h rotational 40 mi/h translational	U.S. Nuclear Regulatory Commission (NRC) Standard Review Plan[e] • 3.3.2 Tornado Loading
Volcanic Ash	24 lb/ft^2 ground ash load	NRC Standard Review Plan[e] • 3.8.4 Other Seismic Category Structures
Flooding	Columbia River: 460 ft above mean sea level Site drainage basin: 7.4 in. for 6-hour probable maximum precipitation Site drainage: 9.2 in. for 6-hour probable maximum precipitation	ANSI/ANS-2.8-1992[f] NRC Standard Review Plan[e] • 2.4.2 Floods
Lightning	Lightning protection shall be considered for facility.	National Fire Protection Association (NFPA) 780[g]
Snow	20 lb/ft^2 ground load	ANSI/ASCE-7, Chapter 8[d]

[a] Geomatrix, 1996, Probabilistic Seismic Hazard Analysis DOE Hanford Site, Washington, WHC-SD-W236A-TI-002, Rev. 1A, prepared by Geomatrix Consultants, Inc. for Westinghouse Hanford Company, Richland, Washington.

[b] DOE Order 5480.28, Natural Phenomena Hazards Mitigation, U.S. Department of Energy, Washington, D.C.

[c] DOE Standard 1020-94, Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities, U.S. Department of Energy, Washington, D.C.

[d] ASCE, 1995, Minimum Design Loads for Building and Other Structures, ASCE-7-95, American Society of Civil Engineers, New York, New York.

[e] NRC, 1981, Standard Review Plan, NUREG-0800, U.S. Nuclear Regulatory Commission, Washington D.C.

[f] ANSI/ANS, 1992, Determining Design Basis Flooding at Power Reactor Sites, ANSI/ANS-2.8-1992, American Nuclear Society, La Grange Park, Illinois.

[g] NFPA, 1992, Lightning Protection, NFPA 780, National Fire Protection Association, Quincy, Massachusetts.

3.2.6 Human Interface Requirements

Adequate spacing for work and maintenance is provided per UCRL-15673, *Human Factors Design Guidelines for Maintainability of Department of Energy Nuclear Facilities*, U.S. Nuclear Regulatory Commission, Washington, D.C.

3.2.7 Specific Commitments

The design of the CVD Facility will incorporate the specific requirements relating to seismic criteria and design basis tornado information from WHC-SD-SNF-DB-002, *Spent Nuclear Fuel Project Path Forward Nuclear Safety Equivalency to Comparable NRC-Licensed Facilities*, 1996, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-SNF-DB-010, Rev. 1, *Cold Vacuum Drying System Natural Phenomena Hazards*, 1996, Westinghouse Hanford Company, Richland, Washington, provides the rationale to demonstrate that the design loads used for the CVD Facility meet or exceed Nuclear Regulatory Commission (NRC) facility requirements. In addition, the design of common utilities and services, and the physical interaction between facilities must not impair the capability of the K Basins to perform their assigned mission.

3.3 Engineering Disciplinary Requirements

This section describes the requirements and bases related to particular engineering disciplines. Appendix B lists the drawings and specific calculations and analyses for the design of the CVD Facility that demonstrate the compliance with the requirements outlined in this section.

3.3.1 Civil and Structural (including Architectural)

3.3.1.1 Civil Design Requirements

1. **Requirement:** The CVDF shall be located at the 100K Area of the Hanford Site and shall be sited adjacent to the 105 K East and 105 K West Fuel Storage Facilities. The location is inside the 800-m (0.5-mi) eagle-roost buffer zone but outside the 400-m (0.25-mi) line-of-site restrictive distance.

   Basis: HNF-SD-SNF-DRD-002, Rev. 4, Sections 6.2.1.1, 6.4.1. This location was determined to be optimal for operations in early project planning.

   How the system meets the requirements: The CVD Facility is located at the 100K Area of the Hanford Site, adjacent to the 105K East and 105K West fuel storage facilities, as determined in the evaluation recorded in WHC-SD-SNF-SE-001, *Cold Vacuum Drying Site Evaluation Report*, 1995, Westinghouse Hanford Company, Richland, Washington. The site location is near the 100K West Basin, near utility lines, and outside a nearby eagle roosting area. The site is inside the 0.5-mi eagle roost buffer zone but outside the 0.25-mi. line-of-sight restrictive distance.

2. **Requirement:** The site shall include construction of the necessary parking, maneuvering, transport roads, site drainage structures, security fencing, and sidewalks.

   The site shall be surveyed and mapped using the Hanford Site coordinate system. Design for paved roads shall conform to Washington State Department of Transportation M-41-10. The design shall be based on current and projected use.

All concrete design shall comply with American Concrete Institute (ACI) requirements, as defined in ACI-207, ACI-224, ACI-318, ACI-349and ACI-350, where applicable.

The site design shall include features to satisfy the storm water pollution prevention plan requirements of 40 CFR 122.44, "National Pollutant Discharge Elimination System." These features shall include those deemed appropriate to control erosion, runoff, and sedimentation during construction of the CVD Facility. The detailed design shall support filing of the notice of intent and writing the storm water prevention plan.

Underground conduit installations shall be in compliance with the NFPA 70, *National Electrical Code*, Article 300-5, ANSI/NFPA 70.

The CVD Facility site shall be selected so that it lies above 140 m (460-ft) elevation or site features shall be constructed to ensure that flooding cannot result in nuclear material being released from the CVDF.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.2.2 and standard engineering practices for site infrastructure design.

How the system meets the requirements: The site includes construction of the necessary parking, maneuvering, transport roads, site drainage structures, security fencing, and sidewalks.

The site is surveyed and mapped using the Hanford Site coordinate system. Design for paved roads conforms to Washington State Department of Transportation M-41-10. The design is based on current and projected use.

All concrete design complies with American Concrete Institute (ACI) requirements, ACI 121R-85, ACI 301-89, ACI 315R-93, ACI 318-92, ACI 311.4R-88, ACI 349-90 and ACI 349-91 as defined in Specification W-441-C1.

The site design includes features to satisfy the storm water pollution prevention plan requirements of 40 CFR 122.44, "National Pollutant Discharge Elimination System." These features include those deemed appropriate to control erosion, runoff, and sedimentation during construction of the CVD Facility. The detailed design supports filing of the notice of intent and writing the storm water prevention plan.

Underground conduit installations is in compliance with the NFPA 70, *National Electrical Code*, Article 300-5, ANSI/NFPA 70.

The CVD Facility site is selected so that it lies above 460-ft elevation. This elevation ensures that flooding cannot result in nuclear material being released from the CVD Facility.

The drawings and calculations identified in Appendix B provide detailed confirmation of meeting these requirements.

3. **Requirement:** The site drainage system shall be designed to handle the design basis rainfall runoff detailed in Section 3.3.6. An analysis shall be documented to demonstrate compliance with requirements. The design basis local runoff requirements given in WHC-SD-SNF-DB-010, *Cold Vacuum Drying System Natural Phenomena Hazards,* Section 5.2.1.

   Basis: HNF-SD-SNF-DRD-002, Rev. 4, Sections 6.2.3 and 6.2.5 and standard engineering design practices for site drainage.

   How the system meets the requirement: The site drainage system is designed to handle the design basis rainfall runoff specified in Table 3-1. The drawings and calculations identified in Appendix B provide detailed confirmation of meeting this requirement.

4. **Requirements**

Actual elevations and coordinates shall be shown on a site plan drawing and shall be determined from the ground control system currently in use.

The site shall be provided with a permanent benchmark and coordinate monument for future reference.

No landscaping is required other than grading and clearing the area around the facility.

The paved areas and the concrete parking lot shall be capable of supporting a tractor-trailer with an approximate weight of 47,600-kg (105,000 lbs.).

Room shall be available for parking spaces for four-passenger vehicles at the facility entrance. Location of the parking spaces shall be at the project's discretion.

Where excavations are backfilled during construction of utilities, the material used, the method of placement, and the level of compaction shall be specified to provide adequate support and to allow drainage.

The backfill around a pipe shall be of a material that does not damage the pipe.

Specifications for excavation work shall require that excavations comply with the Hanford Contractors Industrial Health and Safety Manual.

All outside circuits for power, telephone, Hanford Local Area Network, and electrical services shall be placed underground when practical.

A 110-VAC power supply shall be provided on the west side of the CVD Facility for the near-field air monitor.

A sanitary sewage drainage system shall be required for the CVD Facility. The system shall be self-contained and provide for pumping of its holding tank into a sewage pick-up tanker truck.

To facilitate surface drainage, all areas adjacent to the building shall have a 1 percent minimum slope away from the building if areas are paved and a 2 percent minimum slope if unpaved. Concrete slabs, door stoops, and truck ramps shall be sloped at least 2 percent where feasible.

Splash pads shall be provided below roof drains and gutters.

Exterior concrete slabs (e.g., sidewalks, door stoops) shall be given a broom surface finish, or equivalent, to minimize the safety hazard of slipping during freezing weather conditions.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.2.4 and standard engineering design practices.

How the system meets the requirements: The drawings and calculations identified in Appendix B provide detailed confirmation of implementation of these requirements.

3.3.1.2 Structural Design Requirements

1. **Requirement:** The CVD Facility shall consist of the following collocated structural systems:

   - The CVDF process building, consisting of the following areas:
     - Process Bays.
     - Transfer corridor and mechanical room.
     - Process Water tank room.
   - The CVDF administration area.
   - Process equipment systems within the CVDF.

   Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.1.

   How the system meets the requirements: The CVD Facility consists of the following collocated structural systems:

   - Process building, consisting of the following areas:
     - process bays.
     - transfer corridor and mechanical room.

  - process water tank room.

- Administration area.

The drawings and calculations identified in Appendix B provide detailed confirmation of this requirement.

2. **Requirement:** The process bays shall house the cask trailer and all of the process systems, except the PWC system. The process water tank room shall house the PWC system. The transfer corridor shall provide access areas and support areas to the process bays and house support and/or utility systems and equipment. The mechanical room shall house and/or support facility systems, equipment, and HVAC systems.

   Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.2, Project Operations Planning.

   How the system meets the requirements: The process bays house the cask trailer and all the vacuum drying process systems, except the PWC system. The process water tank room houses the PWC system. The transfer corridor provides access areas and support areas to the process bays and houses support and/or utility systems and equipment. The mechanical room houses and/or supports facility systems, equipment, and HVAC systems. The administration area houses offices, lavatories, change rooms, and other administrative support systems.

3. **Requirement** The CVD Facility is to be a temporary structure. The scheduled duration for processing all the K-Basins SNF is 3 years. The design life of the facility shall be five years to allow for unplanned processing duration extension.

   Basis: HNF-SD-SNF-DRD-002, Rev. 4, Sections 6.3.4.1.1 and 6.4.2.

   How the system meets the requirement: The CVD Facility is a temporary structure. The design life of the facility is five years to allow for any unplanned processing duration extension.

4. **Requirement:** The CVD Facility structural design shall be selected to facilitate demolition of the facility and recycling of the structural materials when the CVD Facility's temporary mission is completed.

   Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.4.1.2.

   How the system meets the requirement: The CVD Facility structural design was selected to facilitate demolition of the facility and recycling of the structural materials when the CVD Facility's temporary mission is completed. All-steel construction is selected for this purpose except where lower-cost radiation shielding may be achieved using concrete panels attached to the steel frame.

5. **Requirement:** The structural systems shall be constructed from one or more of the following materials unless design dictates the use of other materials or strengths:

- Reinforced concrete
  - Compressive strength (f_c) = 3000 lb/in^2 minimum
  - Reinforcing steel - ASTM A615 (fy = 60,000 lb/in^2)
  - Welded wire fabric - ASTM A185
- Carbon steel
  - Structural steel - ASTM A36/A36M (Fy = 36 lb/in^2)
  - Structural tubing - ASTM A500 Grade B (Fy = 46 lb/in^2)
  - Steel pipe - ASTM A53 Type E or S Grade B (Fy = 35 lb/in2)
  - Welding material - AWS D1.1, E70XX electrode
- Bolts, nuts, and washers
  - Common bolts - ASTM A307
  - High-strength bolts - ASTM A325 (bolted connections)
  - Nuts - ASTM A563
  - Hardened washers - ASTM F436.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.1.4.3 and standard structural engineering design practices.

How the system meets the requirements: The structural systems are constructed from one or more of the following materials unless design dictates the use of other materials or strengths:

- Reinforced concrete
  - Concrete slabs compressive strength (f_c) = 4,000 lb/in^2 minimum, all other concrete (f_c) =3000 lb/in^2 min
  - Reinforcing steel - ASTM A615 (fy = 60,000 lb/in^2)
  - Welded wire fabric - ASTM A185
- Carbon steel
  - Structural steel - ASTM A36/A36M (Fy = 36 lb/in^2)
  - Structural tubing - ASTM A500 Grade B (Fy = 46 lb/in^2)
  - Steel pipe - ASTM A53 Type E or S Grade B (Fy = 35 lb/in2)
  - Welding material - AWS D1.1, E70XX electrode
  - Steel crating bearing bars – ASTM A569
- Bolts, nuts, and washers
  - Common bolts - ASTM A307

- High-strength bolts - ASTM A325 (bolted connections)
- Nuts - ASTM A563
- Hardened washers - ASTM F436.

Refer to the American Society for Testing and Materials (ASTM) specifications for specific material requirements. For miscellaneous materials, such as the metal deck, grating, floor plate, and crane rails, refer to the respective project construction specification sections or detailed drawings.

The drawings and calculations identified in Appendix B provide detailed confirmation of this requirement.

6. **Requirement:** Dead loads include the gravity load of structures, permanent equipment, piping, static liquid, soil, long-term stored materials, permanent partitions, and any other permanent static load. Dead-load criteria for the CVD Facility are given in GC-LOAD-01, *Standard Architectural-Civil Design Criteria, Design Loads for Facilities*. ICF Kaiser Hanford, Richland, Washington.

- Live loads are the loads superimposed on structures or components by the use and occupancy of the facility. Live loads, in general, include the weight of movable objects, such as personnel, temporarily stored materials, movable partitions, maintenance equipment, forklifts, hoists, and cranes. Live-load criteria for the CVD Facility are given in GC-LOAD-01, *Standard Architectural-Civil Design Criteria, Design Loads for Facilities*, ICF Kaiser Hanford, Richland, Washington.

- Snow-load criteria, as specified in WHC-SD-SNF-DB-010, shall be the criteria given in ANSI/ASCE-7, Chapter 8 (98 kg/m^2 [20 lb/ft^2]).

- Self-straining forces and effects arise from restraint of expansion or contraction caused by temperature change, shrinkage, creep, or differential settlement. These forces shall be considered in the facility design. All structures and items exposed to the exterior environment shall be designed for a maximum daily temperature of 50°C (115 F) and a minimum daily temperature of –30°C (-20 F). The effects of thermal gradients due to the difference between the internal and external temperatures in massive concrete members or structures shall be taken into account in accordance with Appendix A of ACI-349. The minimum linear coefficient of shrinkage shall be assumed to be 0.0002 in./in in accordance with DOE Order 6430.1A.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.4.2.1 and standard structural engineering design practices.

How the system meets the requirements: Dead loads include the gravity load of structures, permanent equipment, piping, static liquid, soil, long-term stored materials, permanent partitions, and any other permanent static load. Dead-load criteria for the CVD Facility are given in GC-LOAD-01, *Standard Architectural-Civil Design Criteria, Design Loads for Facilities*. ICF Kaiser Hanford, Richland, Washington and in Table 3-1.

Additional loads not found in the table are summarized here:

Collateral dead load: 10 lbs/ft^2 roof and second floor

- Live loads are the loads superimposed on structures or components by the use and occupancy of the facility. Live loads, in general, include the weight of movable objects, such as personnel, temporarily stored materials, movable partitions, maintenance equipment, forklifts, hoists, and cranes. Live-load criteria for the CVD Facility are given in GC-LOAD-01, *Standard Architectural-Civil Design Criteria, Design Loads for Facilities*, ICF Kaiser Hanford, Richland, Washington and in Table 3-1.

  A summary of the live load design requirements not found in the table are:

  Roof live load - 20 lbs/ft^2
  Bridge crane lifted load - 4000 lbs.
  Second floor live loads:
  Process area - 75 lbs/ft^2 uniform or 2,000 lbs. concentrated on a 2'-6" by 2'-6" area.
  Maintenance area – 150 lbs/ft^2 uniform or 2,000 lbs. concentrated on a 2'-6" by 2'-6" area
  Mechanical access area – 40 lbs/ft^2 uniform or 300 lbs. concentrated on a 1'-4" by 1'-4" area.
  Main floor live load:
  Process area – HS-20 truck loading
  Other areas – 150 lbs/ft^2

  Snow-load design requirements used are the criteria given in ANSI/ASCE-7, Chapter 8 (98 kg/m^2 [20 lb/ft^2]) and in Table 3-1.

- Self-straining forces and effects arise from restraint of expansion or contraction caused by temperature change, shrinkage, creep, or differential settlement and are considered in the facility design. All structures and items exposed to the exterior environment are designed for a maximum daily temperature of 115 F and a minimum daily temperature of -20 F. The effects of thermal gradients caused by the difference between the internal and external temperatures in massive concrete members or structures have been taken into account in accordance with Appendix A of ACI-349. The minimum linear coefficient of shrinkage is assumed to be 0.0002 in./in in accordance with DOE Order 6430.1A.

  The drawings and calculations identified in Appendix B provide detailed confirmation of this requirement.

7. **Requirement:** The governing documents in determining load combinations for PC-3 structures are as follows:

Dead load, live load, and accident load combinations
1. ACI 349-90 for reinforced concrete.
2. ANSI/AISC N690 for structural steel.

Seismic and wind loads combinations
1. DOE-STD-1020-94 for both reinforced concrete and structural steel.
2. ACI 349-9990 for reinforced concrete
3. ANSI/AISC N690 for structural steel.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.4.2.3.1.

How the system meets the requirements: The CVD Facility building is designed to adequately resist the effects of various load combinations. Load combinations for Performance Category 3 structures are determined in accordance with the following governing documents:

Dead load, live load, and accident load combinations:
1. ACI-349-90 for reinforced concrete
2. ANSI/AISC N690 for structural steel

Seismic and wind load combinations:

1. DOE-STD-1020-94 for both reinforced concrete and structural steel
2. ACI-349-90 for reinforced concrete
3. ANSI/AISC N690 for structural steel.

The drawings and calculations identified in Appendix B provide detailed confirmation of implementing this requirement.

8. **Requirement:** The following load combinations shall be used to determine the demand on reinforced concrete members of the CVD Facility building:

1. $D_e = 1.4D + 1.7L + 1.7H$
2. $D_e = D + L + H \quad T \quad E$
3. $D_e = 0.9\,[D + L + H + T + W_t]$
4. $D_e = D + L + H \quad E$
5. $D_e = D + 1.3W$
6. $D_e = 1.05D + 1.3L + 1.3H + 1.05T$
7. $D_e = 1.4D + 1.7L + 1.7H + 1.7W$
8. $D_e = 1.05D + 1.3L + 1.3H + 1.3W$

where

D_e = demand
D = dead load, including collateral dead load where it produces the more critical condition
L = live load, including applicable crane impact loads, and snow load
T = normal operational thermal load
W = wind load
W_t = wind load caused by tornado
E = earthquake load
H = earth pressure load.

Where any load reduces the effects of other loads, the load factor for that load shall be taken as zero unless that load can be demonstrated to always be present; and in such a case, the load factor was taken as 0.9.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.4.2.3.2 and standard structural engineering design practices.

How the system meets the requirements: The following load combinations were used to determine the demand on reinforced concrete members of the CVD Facility building:

1. $D_e = 1.4D + 1.7L + 1.7H$
2. $D_e = D + L + H \quad T \quad E$
3. $D_e = 0.9\,[D + L + H + T + W_t]$
4. $D_e = D + L + H \quad E$
5. $D_e = D + 1.3W$
6. $D_e = 1.05D + 1.3L + 1.3H + 1.05T$
7. $D_e = 1.4D + 1.7L + 1.7H + 1.7W$
8. $D_e = 1.05D + 1.3L + 1.3H + 1.3W$

where

D_e = demand
D = dead load, including collateral dead load where it produces the more critical condition
L = live load, including applicable crane impact loads, and snow load
T = normal operational thermal load

W = wind load
W_t = wind load caused by tornado
E = earthquake load
H = earth pressure load.

Where any load reduces the effects of other loads, the load factor for that load was taken as zero unless that load can be demonstrated to always be present; in such a case, the load factor was taken as 0.9.

The drawings and calculations identified in Appendix B provide detailed confirmation of this requirement.

9. **Structural Steel Design Load Combination Requirements:** The following load combinations shall be used to determine the demand on structural steel members of the CVD Facility building.

	Load Combination	Stress Limit Coefficient[d]
1.	$D_e = D + L + L_T + T$	1.0[a]
2.	$D_e = D + L + L_T + T \quad E$	1.6[b]
3.	$D_e = D + L + L_T + T \quad W$	1.5[c]
4.	$D_e = D + L + L_T$	1.6[b]
5.	$D_e = D + L + L_T \quad E$	1.7[b]
6.	$D_e = D + L + W$	1.33
7.	$D_e = D + L + 0.5\ L_s + W$	1.33
8.	$D_e = D + L + L_s + 0.5\ W$	1.33
9.	$D_e = 0.85\ D + W$	1.33
10.	$D_e = D + L + L_T + W_t$	1.6

where all symbols have the same meanings as above except

H = soil pressure, which is combined with live load in these combinations

L = live loads, including applicable crane impact loads, but excluding snow or roof live loads

L_T = roof live load or snow load.

All load combinations shall be checked for the no-live-load condition.

- For primary plus secondary stress, the allowable limits are increased by a factor of 1.5.

- The stress limit coefficient in shear shall not exceed 1.4 in members and bolts.

- Secondary stresses used to limit primary stresses shall be treated as primary stresses. In no instance shall the allowable stress exceed 0.70 F_u (in axial tension 0.7 F_u times the ratio Z/S for tension plus bending: F_u is the specified minimum tensile strength of the material; Z is the plastic section modulus; and S is the elastic section modulus).

- Stress limit coefficients are applied to primary stress limits given in ANSI/AISC N690, Sections Q1.5.1, Q1.5.2, Q1.5.3, Q1.5.4, Q1.5.5, Q1.6, Q1.1.0, and Q1.11.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.4.2.3.3 and standard structural engineering design practices.

How the system meets the requirements: The following load combinations were used to determine the demand on structural steel members of the CVD Facility building.

	Load Combination	Stress Limit Coefficient[d]
1.	$D_e = D + L + L_T + T$	1.0[a]
2.	$D_e = D + L + L_T + T \quad E$	1.6[b]
3.	$D_e = D + L + L_T + T \quad W$	1.5[c]
4.	$D_e = D + L + L_T$	1.6[b]
5.	$D_e = D + L + L_T \quad E$	1.7[b]
6.	$D_e = D + L + W$	1.33
7.	$D_e = D + L + 0.5\,L_s + W$	1.33
8.	$D_e = D + L + L_s + 0.5\,W$	1.33
9.	$D_e = 0.85\,D + W$	1.33
10.	$D_e = D + L + L_T + W_t$	1.6

where all symbols have the same meanings as in Paragraph 3.3.1.2.5 except

H = soil pressure, which is combined with live load in these combinations

L = live loads, including applicable crane impact loads, but excluding snow or roof live loads

L_T = roof live load or snow load.

All load combinations have been checked for the no-live-load condition.

- For primary plus secondary stress, the allowable limits are increased by a factor of 1.5.

- The stress limit coefficient in shear does not exceed 1.4 in members and bolts.

- Secondary stresses used to limit primary stresses are treated as primary stresses. In no instance does the allowable stress exceed 0.70 F_u (in axial tension 0.7 F_u times the ratio Z/S for tension plus bending: F_u is the specified minimum tensile strength of the material; Z is the plastic section modulus; and S is the elastic section modulus).

- Stress limit coefficients are applied to primary stress limits given in ANSI/AISC N690, Sections Q1.5.1, Q1.5.2, Q1.5.3, Q1.5.4, Q1.5.5, Q1.6, Q1.1.0, and Q1.11.

The drawings and calculations identified in Appendix B provide detailed confirmation of this requirement.

10. **Requirements:** The foundation shall be designed to support the structure and to keep the differential settlements within acceptable limits. Frost depth is a maximum of 30 in. below grade. Allowable basic soil-bearing pressure shall be 24,400 kg/m^2 (5,000 lb/ft^2) based on the Shannon and Wilson Report (H-1435-01).

    Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.4.3 and standard engineering design practices for foundations.

    How the system meets the requirement: The foundation is designed to support the structure and to keep the differential settlements within acceptable limits. Frost depth is a maximum of 30 in. below grade. Allowable basic soil-bearing pressure is 5,000 lb/ft^2 and the allowable bearing pressure on sandy soil is 1500 lbs/ft^2, based on the Shannon and Wilson Report (H-1435-01).

11. **Requirements:** Backfill, such as around building foundations and under slabs, shall be compacted to a minimum of 95 percent of the maximum dry density in accordance with methods defined in ASTM D 1557 or to 75 percent of the maximum of the relative density in accordance with methods defined in ASTM D 4253. Soil shall be compacted in layers not exceeding 8 in. thick. Load-bearing fill and backfill shall contain aggregate no larger than 3 in.

    Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.4.4 and standard engineering design practices for soil compaction.

    How the system meets the requirements: Backfill, such as around building foundations and under slabs, is compacted to a minimum of 95 percent of the maximum dry density in accordance with methods defined in ASTM D 1557 or to 75 percent of the maximum of the relative density in accordance with methods defined in ASTM D 4253. Soil is compacted in layers not exceeding 8 in. thick. Load-bearing fill and backfill do not contain aggregate larger than 3 in.

12. **Requirements:** Metal roof decks shall be constructed, for fire protection purposes, as Class I with these restrictions.

- Insulation shall be of fiberboard, fiberglass, or foam glass materials.
- The vapor barrier material shall be noncombustible.
- Factory Mutual Data Sheet 1-28S and the Factory Mutual Approval Guide shall be used for acceptable materials selection and construction practices. (This last requirement applies only to the administration area and PWC tank rooms).

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.4.5 and standard engineering design practices for roof decks.

How the system meets the requirements: For fire protection purposes, roof decks are constructed as Class I with the following restrictions.

- Insulation is fiberboard, fiberglass, or foam glass materials.
- The vapor barrier material is noncombustible.

For the administration area and PWC tank rooms, Factory Mutual Data Sheet 1-28S and the Factory Mutual Approval Guide were used for acceptable materials selection and construction practices.

13. **Requirements:** The seismic design and analyses are given independent assessments. For PC-3 SSCs, it shall be provided by a party completely uninvolved in the project. For PC-2, it shall be provided by an engineering check performed by a qualified professional, not necessarily removed from the project. The criteria include input definition, response determination approach, performance requirements, and seismic design considerations. These criteria are based primarily on the guidelines provided by DOE-STD-1020-94 *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities,* TM 5-809-10-1, and the Uniform Building Code (UBC) 1994.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.5.3. This is consistent with best engineering practices.

How the system meets the requirements: The seismic design and analyses have been given independent assessments. For Performance Category-3 SSCs, a party independent of the project provided the assessment. For Performance Category-2, a qualified professional, not necessarily removed from the project, provided an engineering check. The criteria include input definition, response determination approach, performance requirements, and seismic design considerations. These criteria are based primarily on the guidelines provided by DOE-STD-1020-94 *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities,* TM 5-809-10-1, and the Uniform Building Code (UBC) 1994.

14. **Requirements:** Performance categories determined in accordance with DOE-STD-1020-94 are defined for the safety SSCs in Section 6.3.4.1 of the DRD. PC-3 DBE loads are defined in Section 6.3.4.2.3 of the DRD. There is no operating basis earthquake associated with the CVD Facility.

- Performance category 2 earthquake loads shall be those given in UBC (1994) for seismic zone 2B for essential facilities (DOE-STD-1020-94).
- The CVD Facility shall be designed for passive safety. Achievement or maintenance of the safe shutdown condition shall not require action by energized components. No small-magnitude, near-field earthquake analyses need be performed.
- The administration building shall be structurally decoupled from the process bay structure and designed to fail away from the bay during a PC-3 event.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.5.3.1

How the system meets the requirements: Performance categories are to be determined in accordance with DOE-STD-1020-94. No operating basis earthquake is associated with the CVD Facility.

- Performance category 2 earthquake loads are those given in UBC (1994) for seismic zone 2B for essential facilities (DOE-STD-1020-94).
- The CVD Facility is designed for passive safety. Achievement or maintenance of the safe shutdown condition does not require action by energized components. No small-magnitude, near-field earthquake analyses were performed.

The administration building is structurally decoupled from the process bay structure and is designed to fail away from the bay during a Performance Category 3 event.

15. **Requirements:** For purposes of elastic dynamic analysis taking into account spectral damping values, the damping coefficients given in DOE-STD-1020-94, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*, Table 2.3, shall be used. The Seismic analysis shall justify the damping coefficient used.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.5.3.2.

How the system meets the requirements: For purposes of elastic dynamic analysis, taking into account spectral damping values, the damping coefficients given in DOE-STD-1020-94, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*, Table 2.3, were used. The response level 3 damping values are used as directed by DOE-STD-1020-94, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities,* Section C4.4.1.

16. **Requirements:** Inelastic absorption factor values, F_u, are to be taken from DOE-STD-1020-94 *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities* Table 2-4. The maximum spectral acceleration shall be used for fundamental frequencies greater than the frequency at which the peak spectral acceleration occurs when $F_u > 1.0$.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.5.3.3.

How the system meets the requirements: Inelastic absorption factor values, F_u, were taken from DOE-STD-1020-94 *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities* Table 2-4. The maximum spectral acceleration used for fundamental frequencies was greater than the frequency at which the peak spectral acceleration occurs when $F_u > 1.0$.

17. **Requirement:** Three ground acceleration components shall be considered (two horizontal and one vertical). Combination of direction components shall comply with ANSI/ASCE 4.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.5.3.4.

How the system meets the requirements: Three ground acceleration components were considered (two horizontal and one vertical). Combination of direction components complies with ANSI/ASCE 4.

18. **Requirements**:

- Performance Category 3 SSCs shall be subjected to a dynamic analysis. Dynamic analysis of the CVD Facility building structure shall be an elastic response spectrum analysis using a commercially available finite element code. The extent and detail of structural models shall be done consistent with obtaining realistic structural response of items to be analyzed within an engineering degree of accuracy.

- Modeling of items shall be conducted to the detail required to ensure obtaining the actual response and shall be consistent with the method of analysis being used. For dynamic analysis, the model shall be, as a minimum, a lumped-mass system interconnected by elastic elements.

- The models must adequately represent the physical characteristics of SSCs and their corresponding responses to seismic excitations.
- All physically connected SSCs shall be represented as a combined single mathematical model unless such connected SSCs are permitted to be uncoupled by the following considerations. All physically connected SSCs are coupled to some degree and should be modeled accordingly. However, for purposes of simplicity and economy, in many cases it is desirable and sufficiently accurate to

separate models of structural systems into two or more individual parts. Models of structural systems may be uncoupled according to the following general guidelines.

There are two distinct types of coupling conditions.

- Where SSCs are coupled together but supported independently, the coupled point may be considered as an additional support point.
- Where the SSCs are physically coupled and physically support one or another through the coupling point, one may be considered as being the primary support.

All other coupling conditions are combinations of these two types of sampling conditions.

The modal analysis shall include all significant modes of the structure with frequencies below the cutoff frequency. In addition, the analyst is required to demonstrate that the analysis accounts for the inertial effects of modes above the cutoff frequency. Analytic techniques shall account for the effect of horizontal torsional moments due to actual and accidental eccentricities between centers of mass and rigidity at each level.

For the condition where a substructure, subsystem, or subcomponent is supported by more than one supporting SSC, there shall be differing response spectra at various support points. These support point spectra shall be superimposed on each other, and the design spectrum for the substructure, subsystem, or subcomponent taken as the upper bound envelope of the support point spectra considered.

Performance Category 2 structures shall be structurally designed and analyzed in accordance with the static equivalent procedure given in the UBC (1994) for seismic zone 2B, Essential Facilities.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.5.3.5 and standard engineering design practices for structural analysis.

How the system meets the requirements: Performance Category 3 SSCs were subjected to a dynamic analysis. Dynamic analysis of the CVD Facility building structure utilized an elastic response spectrum analysis using a commercially available finite element code. The extent and detail of structural models was done consistent with obtaining realistic structural response of items to be analyzed within an engineering degree of accuracy.

Modeling of items was conducted to the detail required to ensure obtaining the actual response and was done consistent with the method of analysis being used. For dynamic analysis, the model was a lumped-mass system interconnected by elastic elements.

The models adequately represent the physical characteristics of SSCs and their corresponding responses to seismic excitations.

All physically connected SSCs were represented as a combined single mathematical model unless such connected SSCs are permitted to be uncoupled by the following considerations. All physically connected SSCs are coupled to some degree and were modeled accordingly. However, for purposes of simplicity and economy, in many cases it is desirable and sufficiently accurate to separate models of structural systems into two or more individual parts. Models of structural systems were uncoupled according to the following general guidelines.

There are two distinct types of coupling conditions.

- Where SSCs are coupled together but supported independently, the coupled point may be considered as an additional support point.

- Where the SSCs are physically coupled and physically support one or another through the coupling point, one may be considered as being the primary support.

All other coupling conditions are combinations of these two types of sampling conditions.

The modal analysis included all significant modes of the structure with frequencies below the cutoff frequency. In addition, the analyst was required to demonstrate that the analysis accounts for the inertial effects of modes above the cutoff frequency.

Analytic techniques accounted for the effect of horizontal torsional moments due to actual and accidental eccentricities between centers of mass and rigidity at each level.

For the condition where a substructure, subsystem, or subcomponent is supported by more than one supporting SSC, differing response spectra was used at various support points. These support point spectra were superimposed on each other, and the design spectrum for the substructure, subsystem, or subcomponent was taken as the upper bound envelope of the support point spectra considered.

Performance Category 2 structures were structurally designed and analyzed in accordance with the static equivalent procedure given in the UBC (1994) for seismic zone 2B, Essential Facilities.

19. **Requirements**

- A fixed-base seismic analysis shall be performed because the building foundation is shallow. Soil structure interaction (SSI) shall be accounted for by peak broadening in the high-frequency range. This is consistent with the criteria given in DOE—STD-1020-94, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*, which states that it is permissible to ignore the beneficial effects of SSI and assume that the DBE ground motion applies to the foundation level of the structure provided that any frequency shifting due to SSI is considered.

- An SSI analysis shall be performed based on site soil properties extracted from WHC-SD-W236A-TI-002, *Probabilistic Seismic Hazard Analysis, DOE Hanford Site, Washington,* Rev. 0 This will ensure the fixed-base analysis is bounding. A fixed-base analysis neglects the benefits of foundation scattering and radiation damping. The effects of rocking modes are excluded in this approach but are small for short buildings such as the CVD Facility.

- Verification that the peak broadening approach for accounting adequately for SSI is appropriate shall be achieved by extending soil properties data given in WHC-SD-W236A-TI-002, *Probabilistic Seismic Hazard Analysis, DOE Hanford Site, Washington,* Rev. 0.

  An allowable soil-bearing pressure of 24,400 kg/m^2 (5000 lb/ft^2) (Shannon and Wilson Report, H-1435-001) shall be used in the analysis.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.5.3.6.

How the system meets the requirements: The following analyses were performed:

- A fixed-base seismic analysis was performed because the building foundation is shallow. Soil structure interaction (SSI) shall be accounted for by peak broadening in the high-frequency range. This is consistent with the criteria given in DOE—STD-1020-94, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*, which states that it is permissible to ignore the beneficial effects of SSI and assume that the design basis event (DBE) ground motion applies to the foundation level of the structure provided that any frequency shifting caused by SSI is considered.

- An SSI analysis was performed based on site soil properties extracted from WHC-SD-W236A-TI-002, *Probabilistic Seismic Hazard Analysis, DOE Hanford Site, Washington,* Rev. 0 This ensures the fixed-base analysis is bounding. A fixed-base analysis neglects the benefits of foundation scattering and radiation damping. The effects of rocking modes are excluded in this approach, but are small for short buildings, such as the CVD Facility.

- Verification that the peak broadening approach for accounting adequately for SSI is appropriate was achieved by extending soil properties data given in WHC-SD-W236A-TI-002, *Probabilistic Seismic Hazard Analysis, DOE Hanford Site, Washington,* Rev 0.

An allowable soil-bearing pressure of 5,000 lb/ft^2 was used in the analysis.

20. **Requirements.** The resulting seismic forces for each element are reduced by the inelastic demand-capacity ratio (F_u) to obtain the inelastic seismic demand, which is then combined with other loads in accordance with Section 6.3.4.2.3 of the DRD to determine the total demand for the element. The capacities of the elements are obtained from code allowable ultimate or yield values. Once the capacity of an element is computed, it is compared to the total demand for that element.

For steel, the capacity is taken to be the stress limit coefficient times the ANSI N690 elastic capacity for allowable stress design or can be taken to be the plastic capacity according to AISC (M016), Chapter N. For concrete, the ACI ultimate strength capacities shall be used. Note that strength reduction factors, f, are retained.

Inherent to the acceptability of this procedure is the ability to develop ductility levels comparable to those achieved through the use of UBC (1994) design and detailing requirements.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.5.3.7 and standard structural engineering design practices.

How the system meets the requirements: The resulting seismic forces for each element were reduced by the inelastic demand-capacity ratio (F_u) to obtain the inelastic seismic demand, which was then combined with other loads in accordance with Section 6.3.4.2.3 to determine the total demand for the element. The capacities of the elements were obtained from code allowable ultimate or yield values. Once the capacity of an element was computed, it was compared to the total demand for that element.

For steel, the capacity was taken to be the stress limit coefficient times the ANSI N690 elastic capacity for allowable stress design or was taken to be the plastic capacity according to AISC (M016), Chapter N. For concrete, the ACI ultimate strength capacities were used. The strength reduction factors, f, were retained.

Inherent to the acceptability of this procedure was the ability to develop ductility levels comparable to those achieved through the use of UBC (1994) design and detailing requirements.

21. **Requirements**. Design in-structure response spectra (ISRS) are required as input for structure-supported PC-3 items such as substructures, equipment, or piping (DOE-STD-1020-94). Such ISRS shall be developed by one of two methods: time history or modified Singh. Requirements for the methods are described below.

Raw ISRS developed for locations shall be smoothed and peaks broadened according to procedures described in NRC Regulatory Guide 1.122, *Development of Floor Design Response Spectra for Seismic Design of Floor Supported Equipment or Components*. In order to limit the number of ISRS required for design or qualification of supported items, it is appropriate to envelop spectra generated from various response point locations to create design ISRS. Combination of components shall be in accordance with Section 2.2.5.5 of DOE-STD-1020-94.

- The generation of raw spectra shall use an acceptable response spectrum generation method similar to that used for generation of ground spectra. ISRS generation and development shall meet the general requirements of the NRC Regulatory Guide 1.122.

- In the modified-Singh method required enveloping, smoothing, and broadening shall conform to the criteria of NRC Regulatory Guide 1.122.

- When using the modified-Singh approach, one spectrum at each level shall be calculated using both time-history and the modified-Singh methods. The raw spectra shall be compared in order to provide assurance that all aspects of the modified-Singh analysis have been properly carried out.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.5.4.1.

How the system meets the requirements: Design in-structure response spectra (ISRS) were required as input for structure-supported PC-3 items such as substructures, equipment, or piping (DOE-STD-1020-94). Such ISRS were developed by one of two methods: time history or modified Singh.

- Raw ISRS developed for locations were be smoothed and the peaks were broadened according to procedures described in NRC Regulatory Guide 1.122, *Development of Floor Design Response Spectra for Seismic Design of Floor Supported Equipment or Components*. In order to limit the number of ISRS required for design or qualification of supported items, response spectra generated from various response point locations were enveloped to create design ISRS. Combination of components was done in accordance with Section 2.2.5.5 of DOE-STD-1020-94.

- The generation of raw spectra used an acceptable response spectrum generation method similar to that used for generation of ground spectra. The ISRS generation and development meet the general requirements of the NRC Regulatory Guide 1.122.

- In the modified-Singh method required enveloping, smoothing, and broadening conforms to the criteria of NRC Regulatory Guide 1.122.

- When using the modified-Singh approach, one spectrum at each level was calculated using both time-history and the modified-Singh methods. The raw spectra was compared in order to provide assurance that all aspects of the modified-Singh analysis were properly carried out.

22. **Requirements**: All items shall be designed to resist the overturning and sliding effects caused by earthquake loads. Items shall be positively anchored to supporting structures or foundations unless analysis shows that anchors are not required.

At the interface of major structural foundations with soil, the stability ratio for overturning and sliding shall be 1.0 for DBE loads. The stability ratio for overturning is the ratio of the dead load resisting moment and the earthquake-induced overturning moment. The sliding stability ratio is the ratio of applicable resisting forces (e.g., fractional and passive earth loads) and the maximum horizontal earthquake forces applied to the structure in a given direction at the foundation-soil interface.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.5.4.2 and standard engineering design practices for seismic analysis.

How the system meets the requirements: All items were designed to resist the overturning and sliding effects caused by earthquake loads. Items were positively anchored to supporting structures or foundations unless analysis shows that anchors are not required.

At the interface of major structural foundations with soil, the stability ratio for overturning and sliding is 1.0 for DBE loads. The stability ratio for overturning is the ratio of the dead load resisting moment and the earthquake-induced overturning moment. The sliding stability ratio is the ratio of applicable resisting forces (e.g., fractional and passive earth loads) and the maximum horizontal earthquake forces applied to the structure in a given direction at the foundation-soil interface.

23. **Requirements**. The CVD Facility design method is to achieve and maintain safe shutdown without the use of active components. However, the supply air isolation dampers, the exhaust isolation dampers, and the components in the SCHe purge system must change to their fail-safe positions and must perform their passive functions.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.5.4.3.

How the system meets the requirements: The CVD Facility design method is to achieve and maintain safe shutdown without the use of active components. However, the supply air isolation dampers, the exhaust isolation dampers, and the components in the

SCHe purge system are designed to change to their fail-safe positions and perform their passive functions.

24. **Requirements**:

- Equipment anchorage requirements shall be as defined in HNF-PRO-097, *Engineering Design and Evaluation*, and WHC-SD-GN-DGS-30006, 1993, *Seismic Design Guide for Safety Class 3 and 4 Equipment at the Hanford Site*, Rev 1, Westinghouse Hanford Company, Richland, Washington.

- Equipment supports shall be designed to avoid resonance resulting from the harmony between the natural frequency of the structure and the operating frequency of reciprocating or rotating equipment supported on the structure.

- The operating frequency of supported equipment shall be determined from manufacturer's data before the structural design was completed.

- Where economically practical, resonance shall be prevented by designing equipment isolation supports to reduce the dynamic transmission of the applied loads. Isolation supports shall be designed for seismic events.

- Anchor bolts and expansion anchors for safety-class, safety-significant, and general-service items shall follow the requirements in HNF-PRO-097 as specified by their Performance Category on the master equipment list (MEL).

- Piping systems classified as Performance Category 1 or Performance Category 2 shall be mounted according to the guidance of WHC-SD-GN-DGS-30006, *Seismic Design Guide for Safety Class 3 and 4 Equipment at the Hanford Site*, Rev 1, Westinghouse Hanford Company, Richland, Washington. Piping systems classified as Performance Category 3 shall comply with DOE-STD-1020-94.

- Threaded and bell and spigot joints are not to be used. Welded and bolted flanged connections are acceptable.

- Piping or tubing of 1 in. or less in diameter shall not be used to support eccentric masses, such as motor-operated or air-operated valves. Supports should be located at the locations of these eccentric masses. Supports shall not be placed on the valve operator without additional support of the valve body or the pipe immediately adjacent to the valve. The valve body and operator shall be supported on a common structure.

- Expansion joints shall be laterally supported. Support spacing shall not exceed the distances given in Table 3.4 of WHC-SD-GN-DGS-30006, *Seismic Design Guide for Safety Class 3 and 4 Equipment at the Hanford Site*, Rev 1, Westinghouse Hanford Company, Richland, Washington.

- No seismic analysis shall be required for PC-1 or PC-2 piping systems where the weight of sections between supports is less than 9 kg (20 lb.) according to Table 2.7 of WHC-SD-GN-DGS-30006, *Seismic Design Guide for Safety Class 3 and 4 Equipment at the Hanford Site*, Rev 1, Westinghouse Hanford Company, Richland, Washington.

- Sprinkler system shall be restrained in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems.*

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.5.4.4 and standard engineering design practices for equipment mounting.

How the system meets the requirements:

- Equipment anchorage requirements were as defined in HNF-PRO-097, *Engineering Design and Evaluation*, and WHC-SD-GN-DGS-30006, 1993, *Seismic Design Guide for Safety Class 3 and 4 Equipment at the Hanford Site*, Rev 1, Westinghouse Hanford Company, Richland, Washington.

- Equipment supports were designed to avoid resonance resulting from the harmony between the natural frequency of the structure and the operating frequency of reciprocating or rotating equipment supported on the structure.

- The operating frequency of supported equipment was determined from manufacturer's data before the structural design was completed.

- Where economically practical, resonance was prevented by designing equipment isolation supports to reduce the dynamic transmission of the applied loads. Isolation supports are designed for seismic events.

- Anchor bolts and expansion anchors for safety-class, safety-significant, and general-service items follow the requirements in HNF-PRO-097 as specified by their performance category on the safety equipment list (SEL).

- Piping systems classified as Performance Category 1 or Performance Category 2 are mounted according to the guidance of WHC-SD-GN-DGS-30006, *Seismic Design Guide for Safety Class 3 and 4 Equipment at the Hanford Site*, Rev 1, Westinghouse Hanford Company, Richland, Washington. Piping systems classified as Performance Category 3 comply with DOE-STD-1020-94.

- Threaded and bell and spigot joints were not used. Welded and bolted flanged connections were used.

- Piping or tubing of 1 in. or less in diameter is not used to support eccentric masses, such as motor-operated or air-operated valves. Supports are located at the locations of these eccentric masses. Supports are not placed on the valve operator without additional support of the valve body or the pipe immediately adjacent to the valve. The valve body and operator are supported on a common structure.

- Expansion joints are laterally supported. Support spacing does not exceed the distances given in Table 3.4 of WHC-SD-GN-DGS-30006, *Seismic Design Guide for Safety Class 3 and 4 Equipment at the Hanford Site*, Rev 1, Westinghouse Hanford Company, Richland, Washington.

- No seismic analysis was required for piping systems where the weight of sections between supports is less than 20 lb. according to Table 2.7 of WHC-SD-GN-DGS-30006, *Seismic Design Guide for Safety Class 3 and 4 Equipment at the Hanford Site*, Rev 1, Westinghouse Hanford Company, Richland, Washington.

- Sprinkler system is restrained in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems.*

25. **Requirements**: Should concrete be used for radiation shielding , the design shall comply with ACI-349.

    Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.5.5.

    How the system meets the requirements: The design of concrete used for radiation shielding complies with ACI-349.

26. **Requirement.** A subsurface investigation shall be performed as required for critical facilities (including radioactive material handling facilities) in accordance with DOE Order 6430.1A, Section 201-1. The data shall be used to verify conservative assumptions made in the foundation design and in analyzing SSI effects in the seismic analysis.

    Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.5.6.

    How the system meets the requirement: A subsurface investigation was performed as required for critical facilities (including radioactive material handling facilities) in accordance with DOE Order 6430.1A, Section 201-1. The data were used to verify conservative assumptions made in the foundation design and in analyzing SSI effects in the seismic analysis.

3.3.1.3 Architectural Design Requirements.

1. **Requirement**: The CVDF will be a facility constructed at the 100 K Basin site within a few hundred yards of the basins, as determined in the evaluation recorded in WHC-SD-SNF-SE-001, *Cold Vacuum Drying Site Evaluation Report.*

   The CVDF shall have process bays in which transport trailers, each loaded with a transportation cask containing an MCO, can be contained while free water is drained from the MCO and a vacuum and helium purge process is used to dry the SNF contained in the MCO. The CVDF shall have a support area housing a control room, change rooms, and other functions required to support and coordinate operations.

   The CVDF building shall be a steel frame structure on a concrete pad located on the 100 K Basin site.

   The building plans shall include independent bays where transport trailers will be parked and processed. The number of bays shall be based on process time and the desired throughput. Truck access to each bay shall be through overhead doors.

   Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.4.1.

   How the system meets the requirements: The CVDF is constructed at the 100 K Basin site within a few hundred yards of the basins, as determined in the evaluation recorded in WHC-SD-SNF-SE-001, *Cold Vacuum Drying Site Evaluation Report* (see Figure 1-1). The CVDF has process bays in which transport trailers, each loaded with a transportation cask containing an MCO, can be contained while free water is drained from the MCO and a vacuum and helium purge process is used to dry the SNF contained in the MCO (see Figure 1-2). The CVDF also has a support area housing a control room, change rooms, and other functions required to support and coordinate operations. The CVDF building is a steel frame structure on a concrete pad located at the 100 K Basin site. The building plans include independent bays where transport trailers will be parked and processed. The number of bays is based on process time and the desired throughput. Truck access to each bay is through overhead telescoping doors (see Figure 4-5).

2. **Requirements**

   - The features of the CVD Facility shall be selected with the intent of creating a structure that can be dismantled and recycled with relative ease or that can be reconfigured for an unspecified, future alternative use.

   - The building code requirements shall be met as defined in the UBC (1994) for a Group H-7 occupancy for the process bay and support areas and a Group B occupancy for the administrative office areas. Exiting requirements shall conform to ANSI/NFPA 101, *Life Safety Code*. The facility is classified as special-purpose industrial in accordance with ANSI/NFPA 101. The facility classification criteria shall also conform to requirements established in DOE Order 6430.1A, Section 0110-99, "Nonreactor Nuclear Facilities," for special facilities, and Section 1320, "Irradiated Fissile Material Storage Facilities."

- The facility is exempt from accessibility requirements because of the operation requirements.

- The design of the facility and materials used shall consider 10 CFR 835.1002d in providing features allowing operations, maintenance, decontamination, and decommissioning.

- All masonry and concrete design shall comply with the current UBC (1994); ACI-207, ACI-318, ACI-224, ACI-349, and ACI-350 where applicable; and Precast Concrete Institute standard MNL-117.

- Insulation shall comply with the provisions of the Factory Mutual Class 1 standards.

- The process bays shall be connected by a common corridor. The corridor allows personnel access through step-off pads, it also acts as a chase for service header piping and conduits. Personnel shall enter the building through the support area at the end of the building where there shall be change rooms, bathrooms, a lunchroom, and facilities for control of building activities.

- The process bay walls shall be precast concrete panels to the maximum extent possible for shielding purposes; similar panels shall be used to provide shielding around the process water tank room. All other interior walls shall be painted gypsum board over steel studs.

- Mechanical systems that shall be distributed to each bay include chilled water, compressed air, firewater, PWC piping, and helium piping.

- Each bay shall be served by a dedicated ventilation system that circulates and filters the air through a high-efficiency particulate air (HEPA) filter. A local exhaust system will HEPA filter the process vents and air collected from the hood at the top of the MCO. A general exhaust system will HEPA filter air from the process bays. The local and general exhaust systems discharge into a stack that shall be monitored to detect radioactive emissions.

- There shall be no sanitary sewer connection to the CVDF. Sewage shall be collected in a tank and transferred to a tanker truck for transport to a sewage treatment plant offsite.

- Process water also shall be collected in a tank, processed, and transferred to a tanker truck periodically.

- The process-water- and sanitary-waste-handling systems shall have a space allotment at the CVD Facility that is accessible to trucks and portable or mobile cranes.

- All facilities shall be designed to accommodate both sexes. For design purposes, the personnel requirements are as shown below:

  – 15 people
    Single-shift operation (1.67 MCOs/week)
    One 8-hour shift/day, 7 days/week, 7 employees/shift

  – 45 people
    Three-shift operation (five MCOs/week)
    Three 8-hour shifts/day, 7 days/week, 7 employees/shift.

- Each process bay shall provide ground-floor space for enclosing a cask transporter without the tractor attached, access to the working level of the cask transporter, and access to the vacuum drying module equipment and pump assemblies. Engineered features (e.g., painted stripe and rear bumper/wheel chocks) shall be provided to allow locating the cask trailer within the process bay with a tolerance of ± 4 in. along the longitudinal trailer axis and ± 1 in. along the lateral axis.

- A cabinet for supplies and a health physics worktable shall be provided in each process bay.

- Radiological control shall be provided between a process bay and the access corridor where operators change clothing and are monitored for radiological contamination before admittance to the access corridor.

- Access to the working level of the cask shall be accomplished using a mezzanine level with space at the working level of the cask transporter for connections to the cask and access to the HVAC equipment and process hood assembly.

- A single decontamination room shall serve all process bays. The space shall accommodate clear standing space for the decontamination process, storage of decontamination materials and detection equipment, and one decontamination shower.

- A swipe/count room shall be provided to analyze and store samples taken from process bays or areas that have the potential for contamination. The room shall be sized to accommodate a laboratory bench workspace with desks and associated instrumentation equipment, equipment storage space, and wall space for mounting gas bottle equipment.

- Space shall be provided for the air compressor equipment.
- A room shall be provided to house the security equipment.
- A room shall be provided in the process area to store supplies.
- Process water removed from the MCO shall be collected, processed, and stored in tanks in an isolated room with controlled access.
- An administrative area shall be provided to control personnel access into the CVD Facility and provide for the following spaces and activities:
  - Training/conference room
    - Space for seating 12 people
    - Refrigerator space for 15 people's meals
    - Two microwave ovens
    - Casework with sink and storage
    - Fax and copy machine
  - Engineering support room

    Work space for two persons with desks and associated equipment
  - Shift manager room

    Work space for one person with desks and associated equipment.
  - Health physics technician and radiation monitoring room

    Workspace for one health physics technician with desk and associated equipment.
  - Control room

    Space for process bay control room functions, which shall hold, at a minimum, computer monitoring stations, security monitor, communications, Hanford Local Area Network, annunciator, SCIC equipment operator panels, and furniture
  - Electrical and telecommunications room

    Space for electrical and telecommunication systems and equipment

- Fire riser room

  Space for fire riser equipment

- Men's and women's restrooms

  Restroom facilities for both male and female employees (this function should be close to the respective change rooms)

- Men's and women's change rooms

  - Men's shower facilities
  - Women's shower facilities
  - Men's and women's storage lockers and benches
  - Space for storing change-room supplies.

- Access and egress control and personnel control monitoring shall be provided at the entrance to each process bay.

- All MCO transporter access doors shall be telescoping-type, fully weather-stripped, and shall be electrically operated with manual override. These doors shall be designed to withstand a wind pressure of 98 kg/m^2 (20 lb/ft^2).

- Occupied spaces shall be suitably lighted and ventilated for safe habitation during normal operations.

All fire doors and frames shall meet and shall be installed in accordance with all requirements of ANSI/NFPA 80 and ANSI/NFPA 101 and shall bear the Underwriters Laboratories (UL) or Factory Mutual label. Fire doors and frames shall be constructed from metal. All fire doors shall be provided with fitted frames that are anchored to, but separate from, the building structural members. The fire doors shall contain windows fitted with UL-approved, fire-resistant safety glass that is not removable from the outside of the door.

- All pedestrian doors, except for the main administrative entrance door, shall be classified as emergency exit doors. Exterior doors and frames shall be constructed of metal and connected to the facility security system. All doors shall be provided with fitted frames that are anchored to, but separate from, the building structural members. All exterior doors separating heated spaces from the outside environment shall be fitted with UL-approved double glazing and door frames insulated with UL-approved insulating materials, which must meet the fire rating requirements of the installation site.

- Doors that provide access to confinement areas shall be equipped with automatic closers. Selected doors shall be equipped with sidelights (windows).

- A minimum of 1.5 pair of ball-bearing butt hinges (1.5 pairs = 3 hinges) shall be provided on all doors.

- All pedestrian door hinges shall conform to the latest issues of ANSI-/BHMA A156.1 and ANSI/BHMA A156.7.

- All doors requiring locks shall meet the latest issue of Federal Specification FF-H-106 and BWP (1994) as authorized by the U.S. Department of Energy, Richland Operations Office (RL).

- Kick plates, 12 in. by door width, shall be provided on all external pedestrian doors.

- All administrative building interior unpainted metal, such as trim, hardware, cabinets, and cover plates, shall be polished chrome, polished stainless steel, or anodized aluminum.

- All administrative building painted metal, such as trim and cover plates, shall be painted with an approved enamel or epoxy-based paint suitable for the use and environment.

- All exterior metals to be painted shall be primed and painted in accordance with the standards developed by the National Association of Corrosion Engineers and the National Paint and Coating Association.

- Interior trim materials fabricated from plastic have a matte finish; the colors shall be coordinated with the interior color scheme.

- Exterior trim materials fabricated from plastic have a matte finish; the colors shall be coordinated with the exterior color scheme.

- Insulation shall be provided at the roof and walls of heated areas.

- Rigid insulation shall be provided around the administrative office area at the foundation perimeter at a minimum of 24 in. below grade.

- The minimum insulation "R" value for the roof's overall insulation shall be 30, for the walls, 19 (for the administrative building).

- Roofing shall comply with the UBC, Chapter 15 (1994), for roof construction and covering; UBC, Chapter 16 (1994), for roof and wind design; and Factory Mutual Class 1 or UL Class A for materials.

- The exterior roof of any of the secondary confinement areas (process bay and PWC tank room) shall be designed not to leak water at an internal secondary gauge pressure of -50 Pa (-0.2 in. w.g.).

- The minimum roof slope shall be 0.25 in./ft.

- The materials used shall be noncombustible to the maximum extent possible.

- Flashing shall be specified over doors, outside openings, and all wall and roof penetrations.

- Cracks and joints in exterior walls shall have caulking and sealant to make the building airtight and watertight. A single-moisture, medium silicone sealant shall be used on metal and glass surfaces. A polyurethane sealant shall be used on concrete surfaces except where decontamination coatings are used. In the process bays and PWC tank room, exposed concrete walls shall have a 100-percent solid epoxy surface that can be decontaminated easily.

- Concrete surfaces within the process bays and PWC tank room, including the floor and a 4-ft high wainscot on the precast wall faces, shall be prepared to meet the requirements for application of a decontaminable coating.

- Access-way construction materials (e.g., gypsum board, wood, concrete) shall be completely covered with a sealant to reduce the surface permeability to air.

- Except for the process bays, floors throughout the facility shall have finishes appropriate to the area's function and flexibility requirements. In the process bays, exposed concrete floors shall have 100-percent solid epoxy surfaces that can be easily decontaminated.

- Ferrous metals used as architectural materials shall have one coat of metal primer and at least one coat of enamel. Pre-finished metal panel surfaces shall not be painted.

- An integral system of internal and external building signage shall be incorporated into the facility design. Graphics shall be Helvetica medium typeface.

- Each bay shall include an overhead bridge crane with a capacity of 4,000 lb. The crane shall be designed in accordance with the criteria included in CMAA 74, *Specifications for Top Running and Under Running Single Girder Electric Overhead Traveling Cranes Utilizing Under Running Trolley Hoist*. The bridge, trolley, and hoist shall be driven by electric motors and be capable of operation from the ground floor or mezzanine level.

- Roof hatchways shall have removable sections that are easily removed, replaced, and resealed without requiring the fabrication of new roof materials or sealing materials after replacing the roof hatch.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Sections 6.4.2, 6.4.3 and 6.4.4, and standard architectural/engineering design practices for facilities.

How the system meets the requirements:

- The features of the CVD Facility were selected with the intent of creating a structure that can be dismantled and recycled with relative ease or that can be reconfigured for an unspecified, future alternative use.

- The building code requirements were met as defined in the UBC (1994) for a Group H-7 occupancy for the process bay and support areas and a Group B occupancy for the administrative office areas. Exiting requirements conforms to ANSI/NFPA 101, *Life Safety Code*. The facility is classified as special-purpose industrial in accordance with ANSI/NFPA 101. The facility classification criteria conform to requirements established in DOE Order 6430.1A, Section 0110-99, "Nonreactor Nuclear Facilities," for special facilities, and Section 1320, "Irradiated Fissile Material Storage Facilities."

- The facility is exempt from accessibility requirements because of the operation requirements.

- The design of the facility and materials used considers 10 CFR 835.1002d in providing features allowing operations, maintenance, decontamination, and decommissioning.

- All masonry and concrete design complies with the current UBC (1994); ACI-207, ACI-318, ACI-224, ACI-349, and ACI-350 where applicable; and Precast Concrete Institute standard MNL-117.

- Insulation complies with the provisions of the Factory Mutual Class 1 standards.

- The process bays are connected by a common corridor. The corridor allows personnel access through step-off pads, it also acts as a chase for service header piping and conduits. Personnel enter the building through the support area at the end of the building where change rooms, bathrooms, a lunchroom, and facilities for control of building activities are located.

- The process bay walls are precast concrete panels to the maximum extent possible for shielding purposes; similar panels are used to provide shielding around the process water tank room. All other interior walls are painted gypsum board over steel studs.

- Mechanical systems distribute chilled water, compressed air, fire water, PWC, and gases to each bay.

- Each bay is served by a dedicated ventilation system that circulates and filters the air through a high-efficiency particulate air (HEPA) filter. A local exhaust system HEPA filters the process vents and air collected from the hood at the top of the MCO. A general exhaust system HEPA filters air from the process bays. The local and general exhaust systems discharge into a stack that is monitored to detect radioactive emissions.

- The CVD Facility has no sanitary sewer connections. Sewage is collected in a tank and transferred to a tanker truck for transport to a sewage treatment plant offsite.

- Process water is collected in a tank processed and transferred to a tanker truck.

- The process-water- and sanitary-waste-handling systems have a space allotment at the CVD Facility that is accessible to trucks and portable or mobile cranes.

- All facilities are designed to accommodate both sexes. For design purposes, the personnel requirements are as shown below:

  - 15 people
    Single-shift operation (1.67 MCOs/week)
    One 8-hour shift/day, 7 days/week, 7 employees/shift

  - 45 people
    Three-shift operation (five MCOs/week)
    Three 8-hour shifts/day, 7 days/week, 7 employees/shift.

- Each process bay provides ground-floor space for enclosing a cask transporter without the tractor attached, access to the working level of the cask transporter, and access to the vacuum drying module equipment and pump assemblies. Engineered features (e.g., painted stripe and rear bumper/wheel chocks) are provided to allow locating the cask trailer within the process bay with a tolerance of ± 4 in. along the longitudinal trailer axis and ± 1 in. along the lateral axis.

- A cabinet for supplies and a health physics worktable are provided in each process bay.

- Radiological control is provided between a process bay and the access corridor where operators change clothing and are monitored for radiological contamination before admittance to the access corridor.

- Access to the working level of the cask is accomplished using a mezzanine level with space at the working level of the cask transporter for connections to the cask and access to the HVAC equipment and process hood assembly.

- A single decontamination room serves all process bays. The space accommodates clear standing space for the decontamination process, storage of decontamination materials and detection equipment, and one decontamination shower.

- A swipe/count room is provided to analyze and store samples taken from process bays or areas that have the potential for contamination. The room is sized to accommodate a laboratory bench workspace with desks and associated instrumentation equipment, equipment storage space, and wall space for mounting gas bottle equipment.

- Space is provided for the air compressor equipment.

- A room is provided to house the security equipment.

- A room is provided in the process area to store supplies.

- An isolated room with controlled access is provided to store process water removed from the MCO.

- An administrative area is provided to control personnel access into the CVD Facility and provide for the following spaces and activities:

  - Training/conference room

    - Space for seating 12 people
    - Refrigerator space for 15 people's meals
    - Two microwave ovens
    - Casework with sink and storage
    - Fax and copy machine

  - Engineering support room

    Work space for two persons with desks and associated equipment

  - Shift manager room

    Work space for one person with desks and associated equipment.

- Health physics technician and radiation monitoring room

  Workspace for one health physics technician with desk and associated equipment.

- Control room

  Space for process bay control room functions, which shall hold, at a minimum, computer monitoring stations, security monitor, communications, Hanford Local Area Network, annunciator, SCIC equipment operator panels, and furniture.

- Electrical and telecommunications room

  Space for electrical and telecommunication systems and equipment

- Fire riser room

  Space for fire riser equipment.

- Men's and women's restrooms

  Restroom facilities for both male and female employees (this function should be close to the respective change rooms).

- Men's and women's change rooms

  - Men's shower facilities
  - Women's shower facilities
  - Men's and women's storage lockers and benches
  - Space for storing change-room supplies.

- Access and egress control and personnel control monitoring are provided at the entrance to each process bay.

- All transporter access doors for bays 2 – 5 are of telescoping-type, fully weather-stripped, and are electrically operated with manual override. Bay 1 has a roll-up door. These doors are designed to withstand a wind pressure of 20 lb/ft^2.

- Occupied spaces are suitably lighted and ventilated for safe habitation during normal operations.

- All fire doors and frames meet and are installed in accordance with all requirements of ANSI/NFPA 80 and ANSI/NFPA 101 and bear the Underwriters Laboratories (UL) or Factory Mutual label. Fire doors and frames are constructed from metal. All fire doors are provided with fitted frames that are anchored to, but separate from, the building structural members. The fire doors contain windows fitted with UL-approved, fire-resistant safety glass that is not removable from the outside of the door.

- All pedestrian doors, except for the main administrative entrance door, are classified as emergency exit doors. Exterior doors and frames are constructed of metal and connected to the facility security system. All doors are provided with fitted frames that are anchored to, but separate from, the building structural members. All exterior doors separating heated spaces from the outside environment are fitted with UL-approved double glazing and door frames insulated with UL-approved insulating materials, which must meet the fire rating requirements of the installation site.

- Doors that provide access to confinement areas are equipped with automatic closers. Selected doors are equipped with sidelights (windows).

- A minimum of three ball-bearing butt hinges are provided on all doors.

- All pedestrian door hinges conform to the latest issues of ANSI-/BHMA A156.1 and ANSI/BHMA A156.7.

- All doors requiring locks meet the latest issue of Federal Specification FF-H-106 and BWP (1994) as authorized by the U.S. Department of Energy, Richland Operations Office (RL).

- Kick plates, 12 in. by door width, are provided on all external pedestrian doors.

- All administrative building interior unpainted metal, such as trim, hardware, cabinets, and cover plates, are polished chrome, polished stainless steel, or anodized aluminum.

- All administrative building painted metal, such as trim and cover plates, are painted with an approved enamel or epoxy-based paint suitable for the use and environment.

- All exterior metals to be painted are primed and painted in accordance with the standards developed by the National Association of Corrosion Engineers and the National Paint and Coating Association.

- Interior trim materials fabricated from plastic have a matte finish; the colors are coordinated with the interior color scheme.

- Exterior trim materials fabricated from plastic have a matte finish; the colors are coordinated with the exterior color scheme.

- Insulation is provided at the roof and walls of heated areas.
- Rigid insulation is provided around the administrative office area at the foundation perimeter at a minimum of 24 in. below grade.
- For the administrative building, the minimum insulation "R" value is 30 for the roof and 19 for the walls.
- Roofing complies with the UBC, Chapter 15 (1994), for roof construction and covering; UBC, Chapter 16 (1994), for roof and wind design; and Factory Mutual Class 1 or UL Class A for materials.
- The exterior roof of the process bay and PWC tank room is designed not to leak water at an internal secondary gauge pressure of -50 Pa (-0.2 in. w.g.).
- The minimum roof slope is 0.25 in./ft.
- The materials used are noncombustible to the maximum extent possible.
- Flashing is specified over doors, outside openings, and all wall and roof penetrations.
- Cracks and joints in exterior walls have caulking and sealant to make the building airtight and watertight. A single-moisture, medium silicone sealant is used on metal and glass surfaces. A polyurethane sealant is used on concrete surfaces except where decontamination coatings are used. In the process bays and PWC tank room, exposed concrete walls have a 100-percent solid epoxy surface that can be decontaminated easily.
- Concrete surfaces within the process bays and PWC tank room, including the floor and a 4-ft high wainscot on the precast wall faces, are prepared to meet the requirements for application of a decontaminable coating.
- Access-way construction materials (e.g., gypsum board, wood, concrete) are completely covered with a sealant to reduce the surface permeability to air.
- Except for the process bays, floors throughout the facility have finishes appropriate to the area's function and flexibility requirements. In the process bays, exposed concrete floors have 100-percent solid epoxy surfaces that can be easily decontaminated.
- Ferrous metals used as architectural materials have one coat of metal primer and at least one coat of enamel. Pre-finished metal panel surfaces are not painted.

- An integral system of internal and external building signage is incorporated into the facility design. Graphics are displayed in Helvetica medium typeface.

- Each bay includes an overhead bridge crane with a capacity of 4,000 lb. The bridge, trolley, and hoist are driven by electric motors and can be operated from the ground floor or mezzanine level. The cranes are designed in accordance with the criteria included in CMAA 74.

- Roof hatchways are removable sections that are easily removed, replaced, and resealed without requiring the fabrication of new roof materials or sealing materials after replacing the roof hatch.

3. **Requirements:**

The maximum travel distance to any exit discharge shall be 150 ft in accordance with ANSI/NFPA 101.

- Doors shall be operable from the inside without excessive force and without keys or special knowledge. The force requirements are 15 lb.f. to release the latch, 30 lb.f. to set the door in motion, and 15 lb.f to open the door to the minimum width.

- Exit ways shall be clearly marked and illuminated with an initial illumination of at least 1-foot candle (average) on the path of travel at all times.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.4.5 and standard architectural/engineering design practices for building life safety.

How the system meets the requirements: In addition to the safety functions and requirements described in Sections 2.1 and 3.3.1.2.11, the following specific safety features are incorporated into the design.

- The maximum travel distance to any exit discharge is 150 ft in accordance with ANSI/NFPA 101.

- Doors are operable from the inside without excessive force and without keys or special knowledge. The force requirements are 15 lb.f. to release the latch, 30 lb.f. to set the door in motion, and 15 lb.f to open the door to the minimum width.

- Exit ways are clearly marked and illuminated with an initial illumination of at least 1-foot candle (average) on the path of travel at all times.

3.3.2 Mechanical and Materials

There are no mechanical and materials requirements applicable to this system.

3.3.3 Chemical and Process

There are no chemical and process requirements applicable to this system.

3.3.4 Electrical Power

There are no electrical power requirements applicable to this system.

3.3.5 Instrumentation and Control

There are no instrumentation and control requirements applicable to this system.

3.3.6 Computer Hardware and Software

There are no computer hardware and software requirements applicable to this system.

3.3.7 Fire Protection Requirements

1. **Requirement**

- Fire resistance requirements and types of construction shall be in accordance with UBC (1994) criteria for fire-resistant materials used in the design and construction of fire-resistive designs as listed in the UL *Fire Resistance Directory*.

- Fire resistance ratings shall be based on UBC (1994) criteria and the improved risk criteria defined by DOE Order 6430.1A, DOE Order 5480.7A, and RLID 5480.7. This includes the separation of adjacent non-compatible groups by 2-hour fire barriers.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 6.3.5.7 and standard engineering design practices for fire protection.

How the system meets the requirements:

- Fire resistance requirements and types of construction are in accordance with UBC (1994) criteria for fire-resistant materials used in the design and construction of fire-resistive designs as listed in the UL *Fire Resistance Directory*.

- Fire resistance ratings are based on UBC (1994) criteria and the improved risk criteria defined by DOE Order 6430.1A, DOE Order 5480.7A, and RLID 5480.7. This includes the separation of adjacent non-compatible groups by 2-hour fire barriers.

Fire doors are provided as required by the fire hazards analysis, WHC-SD-SNF-FHA-003, *Fire Hazards Analysis for the Cold Vacuum Drying System Facility*; the UBC (1994); ANSI/NFPA 80, *Standard for Fire Doors and Fire Windows*; and ANSI/NFPA 101.

3.4 Testing And Maintenance Requirements

In general, since the design life and expected operating life of this facility is only 3 to 5 years, most of this section does not apply to the CIV system. The maintenance requirements revolve around periodic site maintenance, such as remarking or repaving the parking lot and repainting the building, if required. However specific TSRs are outlined in Section 3.4.2.

3.4.1 Testability

There are no unique testability requirements for this system.

3.4.2 TSR-Required Surveillances

There are no unique TSR required surveillances other than verification of facility operation consistent with the test specification.

3.4.3 Non-TSR Inspections and Testing

There are no non-TSR inspection and testing requirements not covered previously.

3.4.4 Maintenance

No specific maintenance requirements are assigned to the facility.

3.5 Other Requirements

3.5.1 Security and Special Nuclear Material Protection

The security requirements are detailed in SDD SNF-3089.

3.5.2 Special Installation Requirements

There are no special installation requirements associated with this system.

3.5.3 Reliability, Availability, and Preferred Failure Modes

In the event of a DBE, the administrative building and transfer corridor/mechanical room are designed to fail away from the process area and process water tank room.

3.5.4 Quality Assurance

The fire prevention system fabrication quality assurance/control program is based on the safety classification of the structures, systems, and components (SSCs) as detailed in the safety equipment list (HNF-SD-SNF-SEL-002) or the master equipment list (SNF-4148) and application of a graded approach as described in the Project Hanford quality assurance program description (HNF-MP-599).

3.5.5 Miscellaneous

A conceptual decontamination and decommissioning plan for the CVDF, as identified in the guidelines of DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*, is included in HNF-SD-SNF-SAR-002.

4.0 SYSTEM DESCRIPTION

The system description and operations presented in this section discuss those system features that satisfy the CVD Facility final safety analysis report (FSAR) functional requirements listed in Section 3 of this SDD. In addition, by demonstrating that the FSAR functional requirements are met, the system description also demonstrates that the FSAR safety functions listed in Section 2 are met. Engineering calculations in SNF-3001, *Spent Nuclear Fuel Project Cold Vacuum Drying Facility Calculation Database*, demonstrates that the design of the facility meets the FSAR and facility functional requirements.

4.1 Configuration

4.1.1 Description of System, Subsystems, and Major

Figures 1-2, 1-3, and 4-1 through 4-7 provide basic configuration information for the structure.

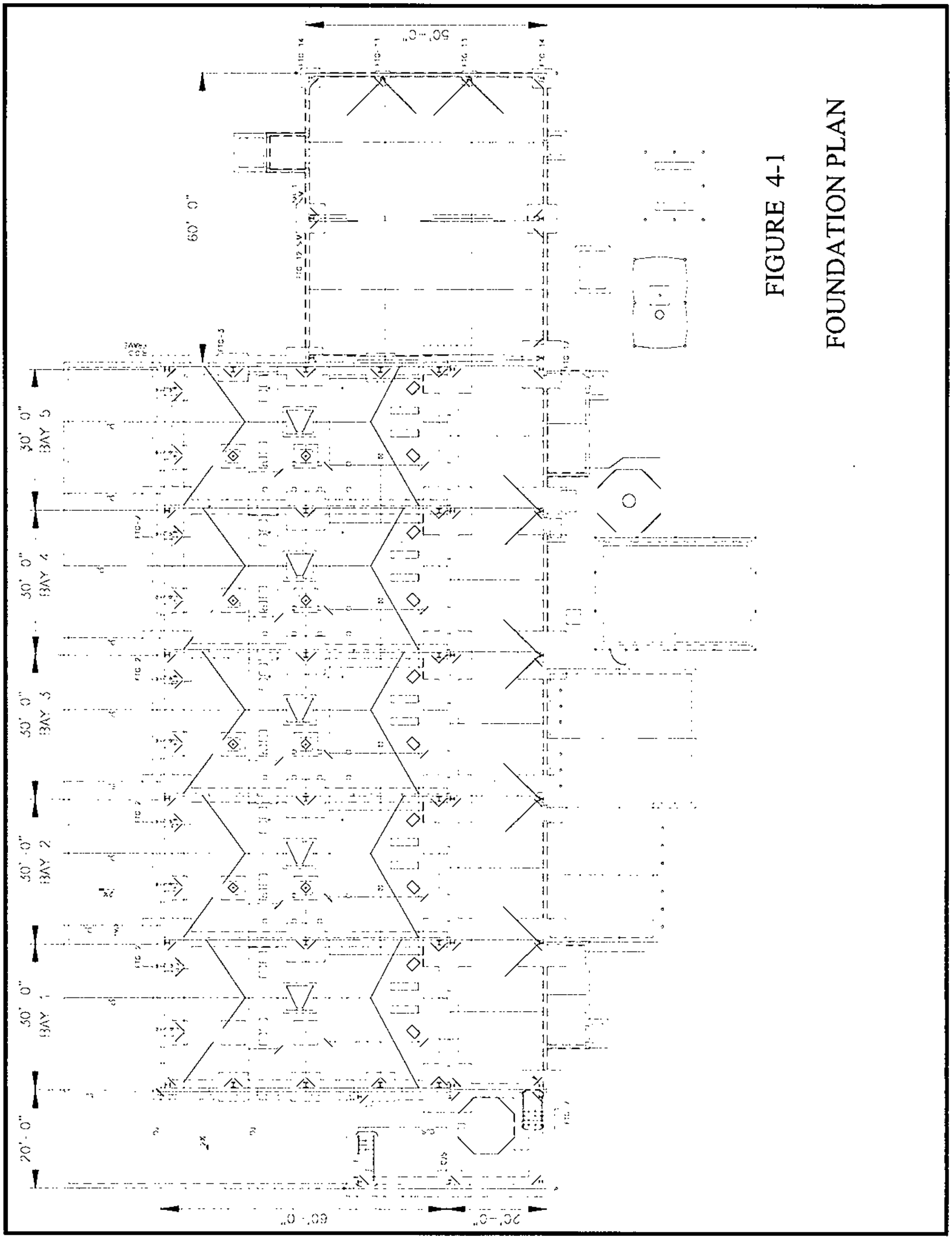
ADMINISTRATION BUILDING (CIV-A)

The administrative area is the normal CVD Facility personnel entry point. It provides space for a lunch or conference room, a Quality Assurance/Process Engineering office, a shift manager's office, a health physics technician and a radiation-monitoring office, a control room, an electrical and telecommunications room, a fire riser and mechanical room, men's and women's restrooms and change rooms, and access and egress control and personnel access control monitoring of the process bays. Other specific features of the administrative building include:

- An approximately 260 ft^2 lunch or conference room is provided with nominal seating for 12 people.
- An approximately 180 ft^2 Quality Assurance-Process Engineering office with workspaces for two persons is provided.
- An approximately 180 ft^2 shift manager's office is provided with workspace for one shift manager.

A health physics technician and radiation monitoring office with office space for one health physics technician is provided in an approximately 225 ft^2 L-shaped office. It includes workspace with associated instrumentation equipment, storage space for health physics equipment, and wall space for mounting gas bottle equipment. This room has access from both the north and south walls.

Figure 4-1. Foundation Plan



WVF: CV-STR_SNF-3061_F4-1 ACAD FILE: ZTL00002

Figure 4-2. North Elevation

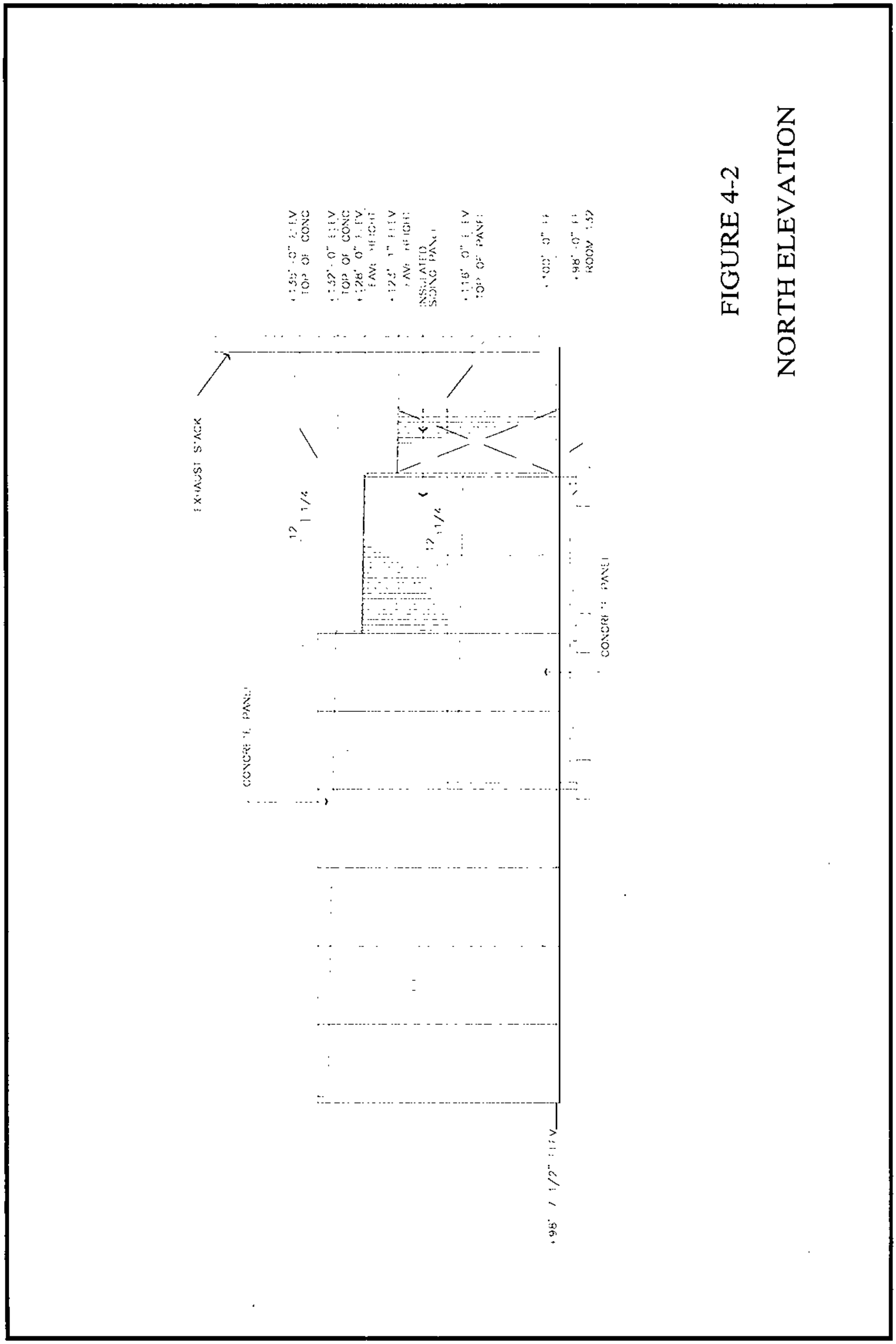
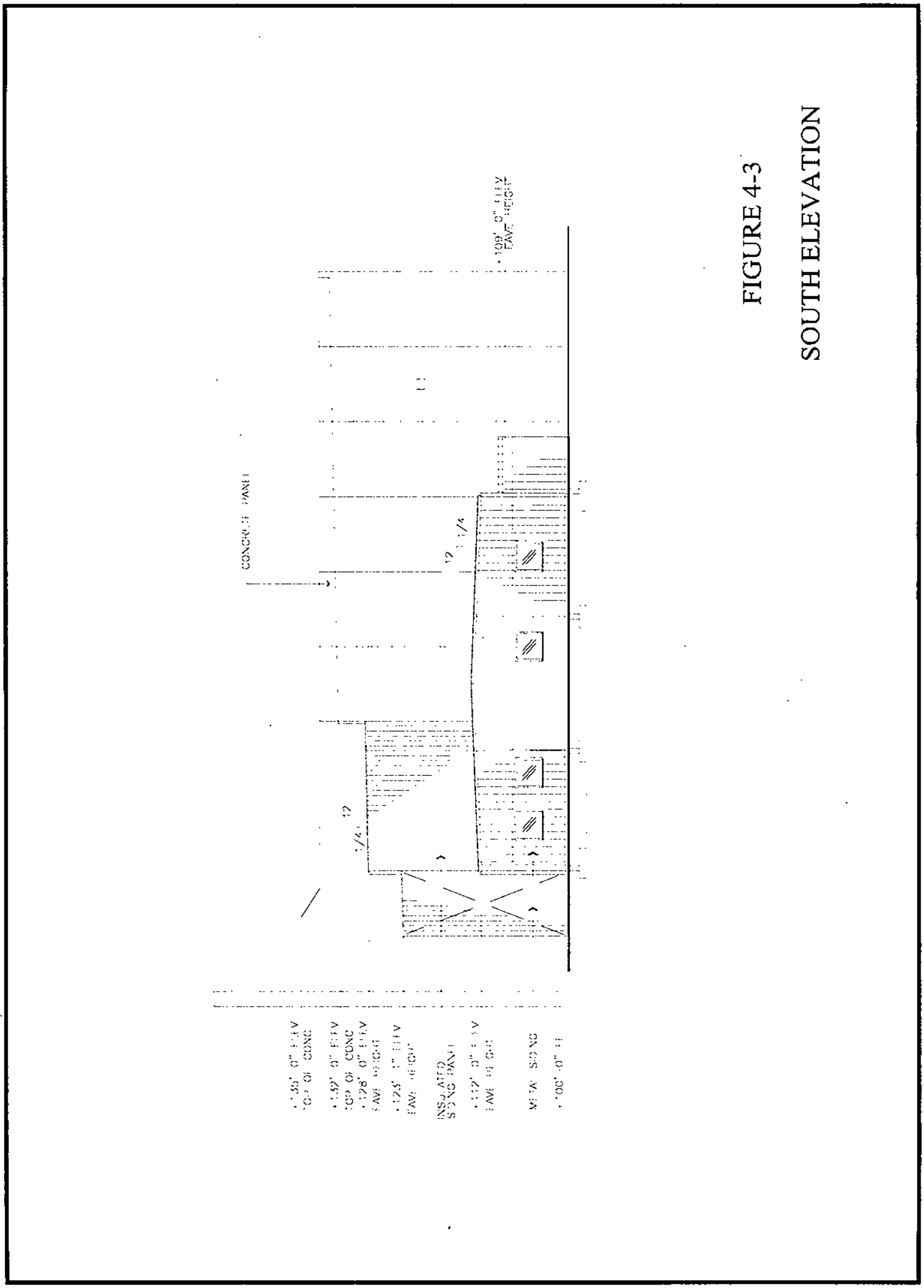


Figure 4-3. South Elevation



WVF: CIV-STR SNF-3061_F4-3   ACAD FILE: Z7LC0005

Figure 4-4. West Elevation

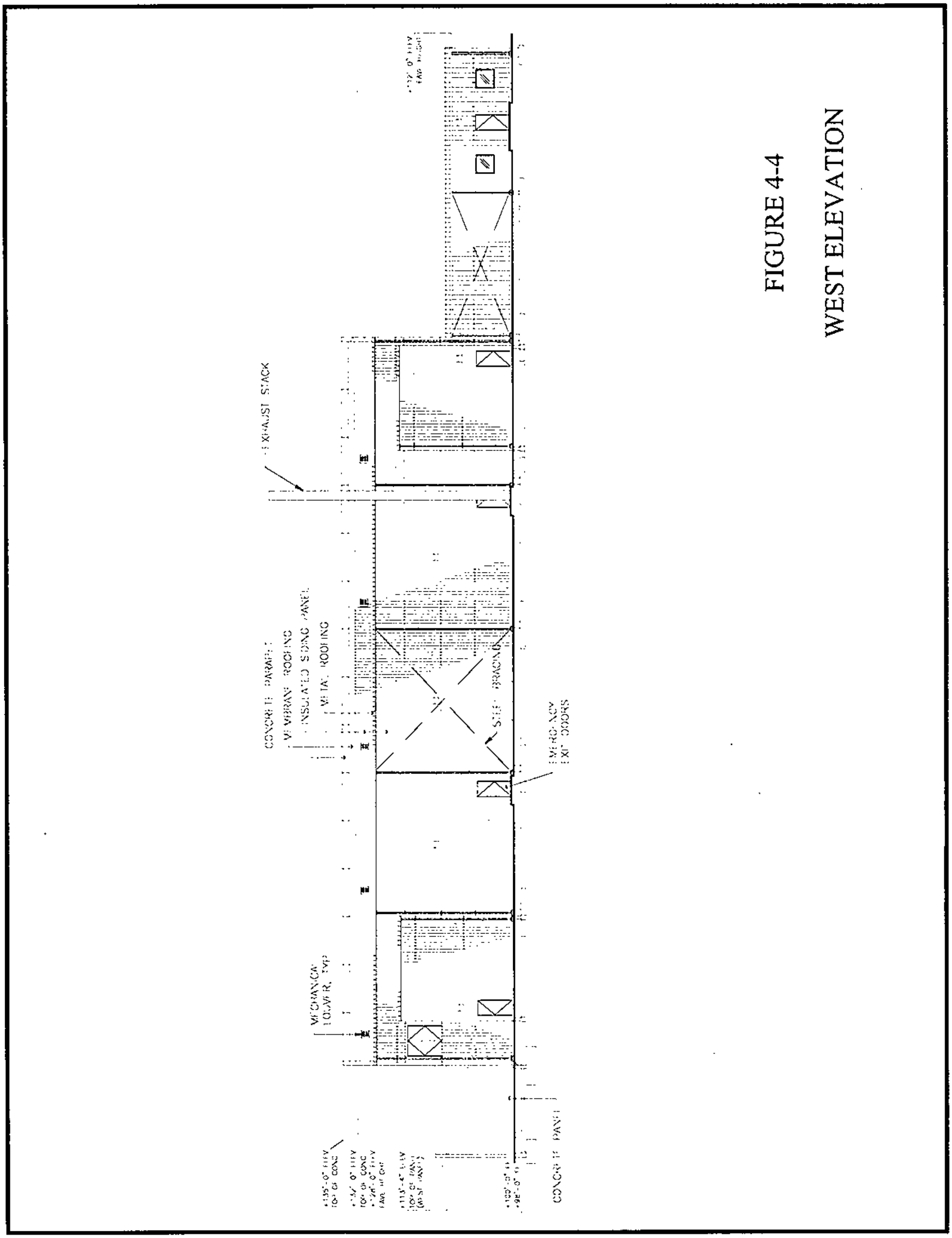


Figure 4-5. East Elevation

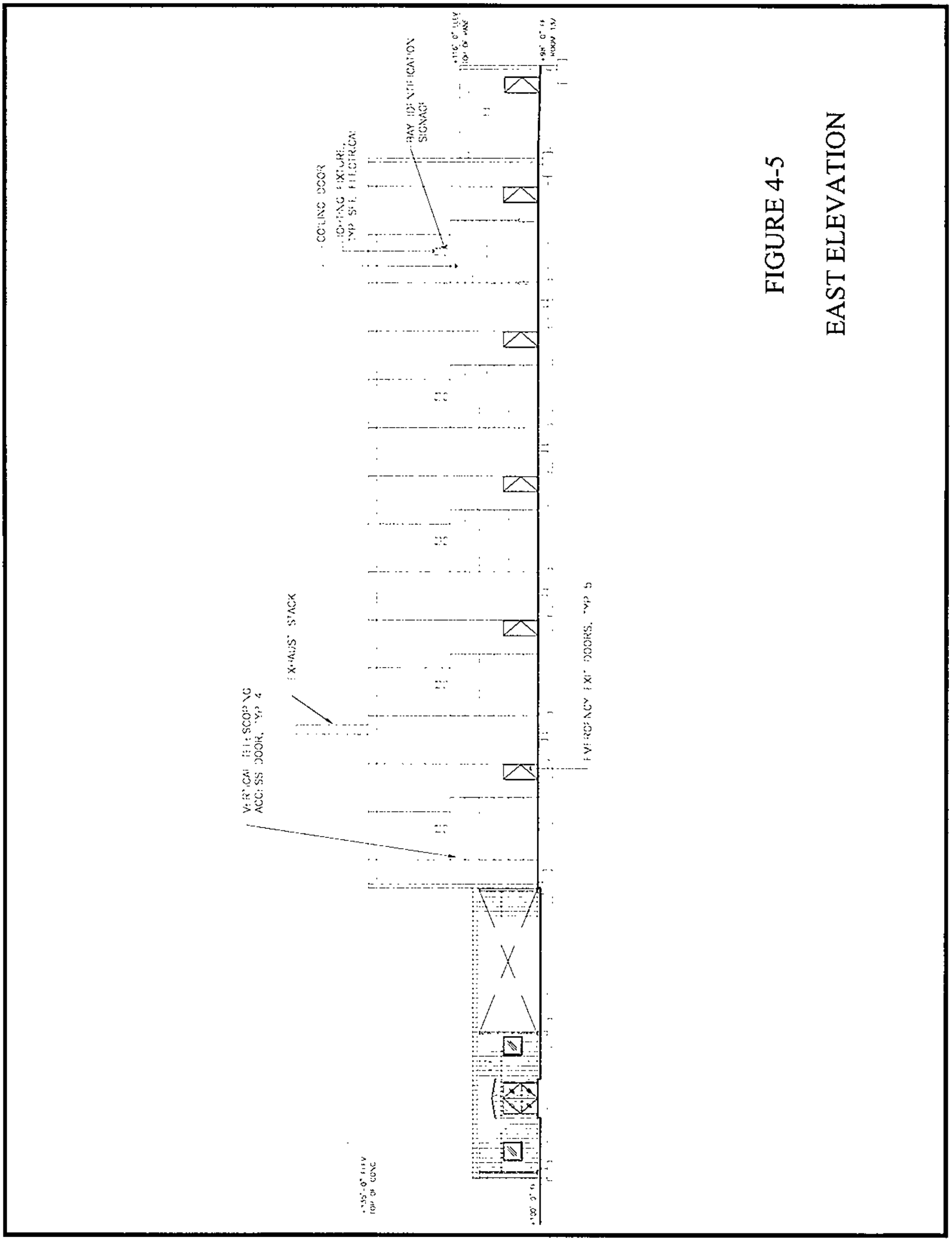


Figure 4-6. TYP Process Bay Layout - Side View

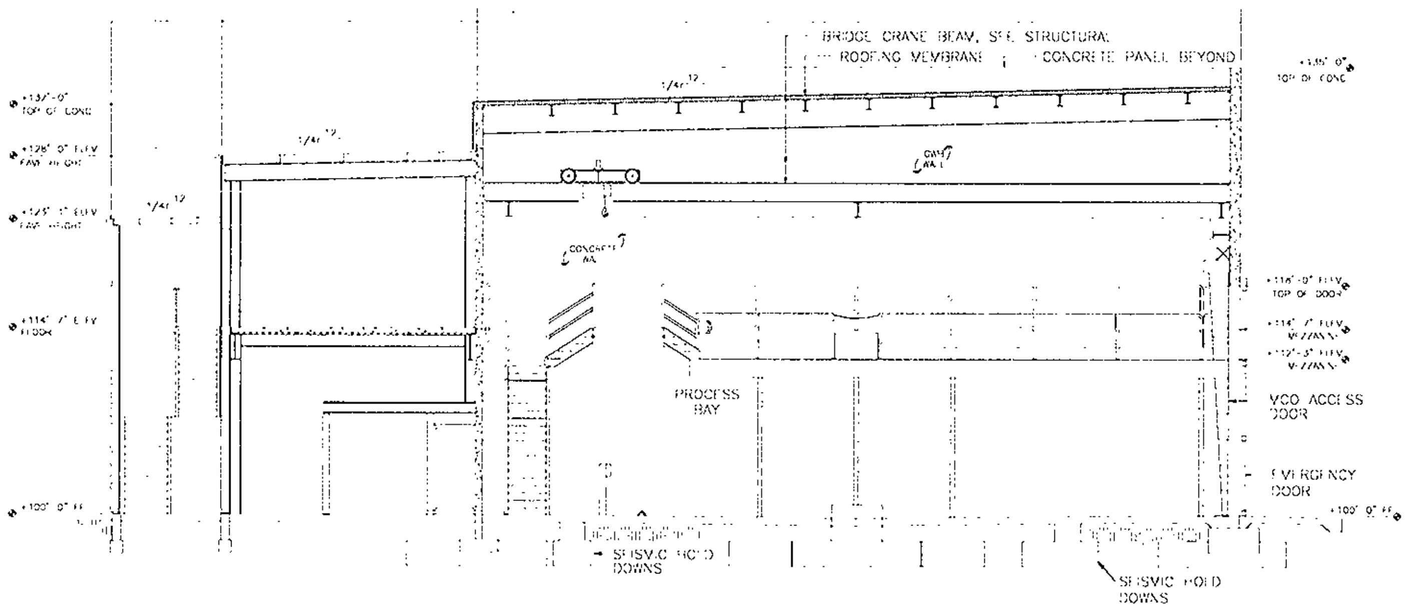
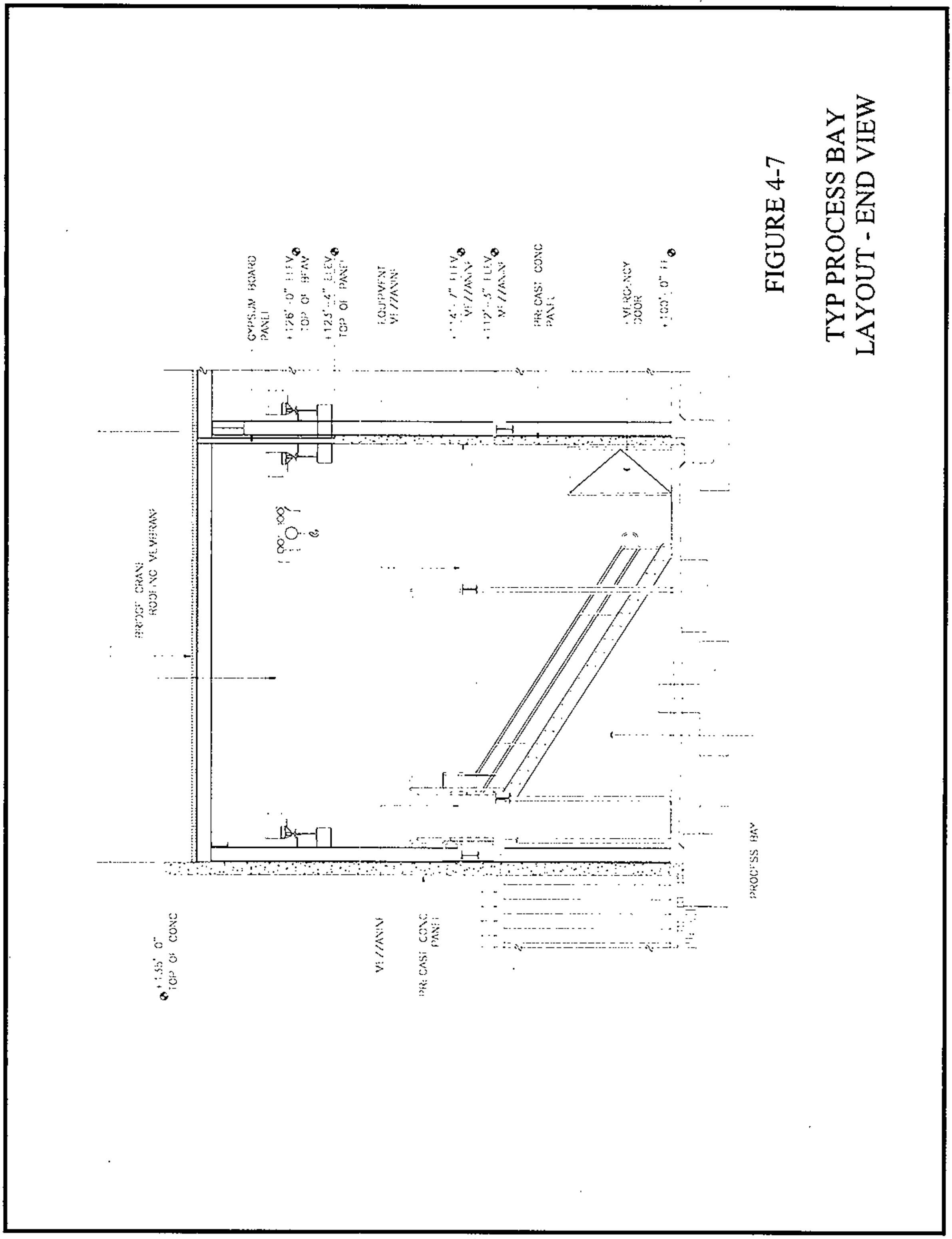


FIGURE 4-6

TYPICAL PROCESS BAY LAYOUT - SIDE VIEW

Figure 4-7. Typical Process Bay Layout – End View



WMF: CV-STR_SNF-3061_F4-7 ACAD FILE: ZTLC0010

An approximately 250 ft^2 control room provides space for process bay control room functions, including computer monitoring stations, MCS programmable logic controller cabinet space, auto temperature control for HVAC (ATC), SCIC annunciator panel, security monitors (two), and egress alarm panel.

An electrical and telecommunication room provides space for electrical and telecommunication systems and equipment. This is an approximately 150 ft^2-interior corner room.

An approximately 80 ft^2 fire riser and mechanical room provides space for a fire protection system alarm check valve riser and accessories and other support equipment.

Separate change room facilities are provided for male and female employees. The change room facilities include restrooms, shower facilities, storage lockers and benches, and space for storing change room supplies. Each change room has access from the administrative area on the east end and access toward the transfer corridor at the west end.

There is a 8ft-0in by 8ft-0in two door vestibule entry on the east side of the building.

Corridors are 5ft-0in wide and provide access to the various rooms in the building.

PROCESS BAYS (CIV-B)

Each of the four process bays 2 through 5 is designed to enclose a cask/MCO transporter, without the tractor attached, and to provide the operational space necessary to meet the function of the CVD Facility. The process bay design provides radiological separation and shielding between bays and ventilation confinement within each bay.

The process bay building design uses a system consisting of a steel frame and prestressed concrete panels. The building has a bay width of 30 ft and a nominal length of 60 ft. The height of the process bays is nominally 32 ft, which is dictated by the physical and functional requirements for the operations necessary in the CVD Facility.

Access to the process building is accomplished with a corridor that is contiguous with the main change room for radiological control of access and egress from the process area. Individual process bay access and egress control is through a change room vestibule with personnel doors to the transfer corridor and the process bay. The MCOs enter the process bays 2-5 through electrically operated telescoping doors that are nominally 13 ft by 18 ft.

Each 30-ft by 60-ft process bay provides ground floor space for the following:

- An enclosing a cask transporter without the tractor attached
- Personnel circulation and functional space around the cask transporter
- Vacuum drying and TW skid equipment and pump assemblies

- Access to the working level of the cask transporter
- Radiological control between a process bay and the access corridor where operators can change clothes and monitor for radiological contamination prior to admittance to the access corridor
- Bridge crane access to remove the cask lid, install the process hood, and perform maintenance on equipment
- A supply cabinet
- Electrical panels.

Access to the working level of the cask is accomplished using a mezzanine level with space for the following:

- Access to the working level of the cask transporter for connections from the vacuum equipment skid to the cask
- HVAC equipment
- Process hood support stand assembly
- Stairway access and egress.

Process bay number 1 is a spare bay with no equipment or mezzanine installed for processing the MCO casks. The door for this bay is a coiling type.

There is a lighting fixture and bay identification signage located over each bay truck access door.

PROCESS WATER TANK ROOM

The PWC room handles water drained from the MCO. It houses the process water equipment, including tanks, piping, and ion exchange modules. Water removed from a cask has the potential for being contaminated, and so is treated by ion exchange in the PWC system then returned to the K West Basin. The process water tank room is located directly adjacent to the CVD Facility process bays and transfer corridor on the north end. This room is located directly adjacent to bay 1 (unused bay) to allow a tanker truck to enter the bay and receive the transfer of cask water liquid from the storage tank. The process water tank room is approximately 20 ft wide, 40 ft long, and 13 ft high with a floor elevation 2 ft below the floor elevation of the rest of the CVD Facility. The PWC system is described in SDD SNF-3082.

TRANSFER CORRIDOR/MECHANICAL EQUIPMENT ROOM

The transfer corridor/mechanical equipment room (process support area) includes the transfer corridor and adjacent rooms on the first floor along with the second floor mechanical room. The process support area is 20 ft wide along the entire 150-ft length of the west side of the process bays. Ventilation for both floors of the process support area is provided by the general process supply/exhaust HVAC system.

The transfer corridor runs the length of the process area, along the west end of each process bay, ending at the process water tank room. This corridor is contiguous with the main change room at the south end of the administrative area. Individual process bay access control is provided through a change room area specific to each process bay. The corridor provides access to process support area rooms for personnel decontamination, analysis or storage of samples, and storage of material and equipment.

The process bay change room vestibule function as ventilation boundaries between the controlled process bay and the uncontrolled circulation corridor. They are approximately 230 ft^2. Each process bay access change room provides seating space for two, allowing for the dressing and undressing of special work procedure clothing, separate storage for both clean and dirty special work procedure clothing, and space for personnel contamination monitor equipment.

A single decontamination room serves all process bays via the transfer corridor. The personnel decontamination room provides clear standing space for the decontamination process, storage of decontamination materials and detection equipment, and one decontamination shower.

A swipe-count room is provided to analyze and store samples taken from process bays or areas with the potential for contamination. This room provides desk space for preparing testing reports, file space for storing records, space for counting equipment, and wall space for mounting gas bottle equipment.

A de-ionized water equipment room with approximately 120 ft^2 of enclosed floor space is located in the process support area.

An air compressor room with approximately 120 ft^2 of enclosed floor space is located in the support area.

A 20 ft by 150 ft mechanical equipment room is located on the second floor of the process support area above the transfer corridor, process bay change rooms, and other support rooms. Building ventilation equipment for the local process exhaust system and the general process supply/exhaust HVAC system is located in this room, along with chilled water equipment.

The paved areas, concrete floor, and parking slabs are capable of supporting a tractor-transporter weighing approximately 105,000 lb. All concrete design complies with American Concrete Institute requirements ACI-301, *Specifications for Structural Concrete for Buildings* (ACI 1989), ACI-318, *Building Code Requirements for Reinforced Concrete* (ACI 1992); and ACI-349, *Code Requirements for Nuclear Safety Related Concrete* (ACI 1991), where applicable. Except for the process bays, floors throughout the facility have finishes appropriate to the area's function and flexibility requirements. In the process bays, concrete floors have 100-percent epoxy-coated surfaces that can be easily decontaminated easily.

The CVD Facility structural design was selected to facilitate demolition of the facility and recycling of the structural materials when the CVD Facility mission is completed.

4.1.2 Boundaries and Interfaces

The CVD Facility is located near the west boundary of the 100K Area, west of the 165-KW Power Control Building. The main gate provides routine and emergency vehicle access to the facility to the 100K Area. This site was selected for the following reasons:

- Gradually sloped contours that minimize grading requirements
- Close proximity to all required utilities
- Within the existing security boundary of the 100 K Area
- Minimal interference with underground structures existing at the time of construction.

The facility is situated to provide a flat, level surface at the transport access doors with the building slab at grade to the south and above-grade to the north. The final site grading provides drainage to the north; no piping of storm water is provided. A parking area for maintenance vehicles is to be provided outside the building along with a large asphalt area where the cask transport can turn around.

Interfaces for Electrical Utilities. Normal building electrical power is to be provided from the 13.8 kV overhead power lines that come to the north edge of the site perimeter. The main power supply is converted from overhead lines to an underground circuit at the CVD Facility site boundary to supply a transformer located outside the facility. The underground primary conduit is to be concrete-encased and buried at least 2 ft below-grade, with conduit marking tape buried approximately 1 ft below-grade. Power is routed from the outside transformer into the building through underground conduits and distributed by a free-standing, metal-enclosed switchboard to be located in an electrical and telecommunication room. The electrical system is described in SDD SNF-3075.

Service Water. Service water (filtered river water) is supplied to the CVD Facility from the 100K Area service water. The fire protection line is an underground 8-in PVC pipe originating on the west side of 165-K cross-tie tunnel. The fire protection line forms a loop around the CVD Facility building. Fire hydrants are located at the northwest and southeast corners of the facility site. A 6-in. building service line enters the east side of the CVD Facility building supplying the building fire sprinkler system (dedicated for fire suppression only). The fire protection system (including service water) is described in SDD SNF-3077.

Potable Water. Potable water is supplied to the CVD Facility from the 100 K Area sanitary water loop located in the KW support tunnel. The water service main is an underground 2-in. PVC pipe originating from the west side of 165-KW and entering the east side of the administrative area. Backflow preventers and pressure reducing valves are to be located inside the CVD Facility. The potable water system is described in SDD SNF-3079.

Communications: Specific information on the communication system is contained in SNF-3065, *Cold Vacuum Drying Facility Communication System Design Description.*

4.1.3 Physical Location and Layout

Refer to Sections 3.3.1.1 and 4.1.2.

4.1.4 Principles of Operation

Not applicable.

4.1.5 System Reliability

Not applicable.

4.1.6 System Control Features

Not applicable.

4.1.6.1 System Monitoring. Not applicable.

4.1.6.2 Control Capability and Locations. Not applicable.

4.1.6.3 Automatic and Manual Actions. The process bay doors are operated using a manual push button control to activate electric motors that open and close the doors.

4.1.6.4 Setpoints and Ranges. Not applicable.

4.1.6.5 Interlocks, Bypasses and Permissives. Not applicable.

4.2 Operations

4.2.1 Initial Configurations (Pre-startup)

A test specification will be developed identifying the requirements for any testing associated with this system not covered as part of the installation testing required by the construction specification.

4.2.2 System Startup

Startup, alignment, prerequisite testing, and formal start up activities will be identified in the test specification.

4.2.3 Normal Operations

Normal operation of the EFS is described in Section 4.1.4.

Operational procedures providing detailed information on operating modes and activities (including alarm response, shutdown, etc.) will be developed.

4.2.4 Off-Normal Operations

No off-normal activities have been identified for this system.

4.2.5 System Shutdown

Not applicable.

4.2.6 Safety Management Programs and Administrative Controls

The necessary administrative control procedures will be developed and incorporated into the operating procedures to prevent manually draining contaminated water from a sump to the retention basin.

These controls and procedures are in accordance with the Spent Fuel Integrated Safety Management Plan.

4.3 Testing and Maintenance

4.3.1 Temporary Configurations

Not applicable.

4.3.2 TSR-Required Surveillances

See Section 3.2.4.

4.3.3 Non-TSR Inspections, and Testing

Not applicable.

4.3.4 Maintenance

There is no unique maintenance required due to the system design and short facility life. Maintenance procedures will be developed to address routine maintenance requirements are applied to support system operation.

Appendix A

Source Documents

GC-LOAD-01, 1996, *Standard Architectural-Civil Design Criteria, Design Loads for Facilities*, ICF Kaiser Hanford, Richland, Washington.

HNF 3001, Rev. 0, 1999, *Spent Nuclear Fuel Project Cold Vacuum Drying Facility Calculation Database*, DE&S Hanford, Richland, Washington.

HNF-3553, Rev.0, 1999, *Spent Nuclear Fuels Project Final Safety Analysis Report, Annex B. "Cold Vacuum Drying Facility Final Safety Analysis Report," DRAFT*, Duke Environmental Services Hanford, Richland, Washington.

HNF-PRO-097, Rev. 0, 1997, *Engineering Design and Evaluation*, Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-SD-SNF-SAR-002, Rev. 4a, 1998, *Safety Analysis Report for the Cold Vacuum Drying Facility, Phase 2, Supporting Installation of Processing Systems*, Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-SD-SNF-DB-003, Rev. 4a, 1998, *Spent Nuclear Fuel Project Path Forward additional NRC Requirements,* Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-SD-SNF-DRD-002, Rev 4, 1999, *Cold Vacuum Drying Facility Design Requirements,* Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-SD-SNF-SEL-002, Rev 6, 1999, *Spent Nuclear Fuel Project Cold Vacuum Drying Facility Safety Equipment List,* Fluor Daniel Hanford, Inc., Richland, Washington.

SNF-4148, Rev. 0, 1999, *Spent Nuclear Fuel Project Cold Vacuum Drying Facility Master Equipment List,* Numatec Hanford, Corporation., Richland, Washington.

WHC-SD-SNF-DB-010, Rev. 1, 1996, *Cold Vacuum Drying System Natural Phenomena Hazards*, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-SNF-FRD-020, Rev. 1, 1998, *K Basin SNF Cold Vacuum Facility Functions and Requirements,* Westinghouse Hanford Company, Richland, Washington.

WHC-SD-SNF-SE-001, Rev. 0, 1996, *Cold Vacuum Drying Site Evaluation Report*, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-W236A-TI-002, Rev. 1A, 1996, *Probabilistic Seismic Hazard Analysis DOE Hanford Site, Washington*, prepared by Geomatrix Consultants, Inc. for Westinghouse Hanford Company, Richland, Washington.

WHC-SD-SNF-DB-004, Rev. 24, 1997, *Spent Nuclear Fuel Project Seismic Design Criteria, Nuclear Regulatory Commission Equivalency Evaluation Report,* Westinghouse Hanford Company, Richland, Washington.

WHC-SD-GN-DGS-30006, Rev. 1, 1993, *Seismic Design Guide for Safety Class 3 and 4 Equipment at the Hanford Site*, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-SNF-FHA-003, Rev. 0, 1996, *Fire Hazards Analysis for the Cold Vacuum Drying System Facility*

Appendix B

System Drawings and Design Calculations

CIVIL DRAWINGS

H-1-82091, Page 1 of 1, Cold Vacuum Drying Facility Overall Site Plan
H-1-82092, Page 1 of 1, Cold Vacuum Drying Facility Civil Site Plan, Legend
H-1-82093, Page 1 of 1, Cold Vacuum Drying Facility Scanned Utilities Plan
H-1-82094, Page 1 of 1, Cold Vacuum Drying Facility Site Utility Details
H-1-82095, Page 1 of 1, Cold Vacuum Drying Facility Overhead Service Plan and Profile
H-1-82095, Page 1 of 2, Cold Vacuum Drying Facility Overhead Service Pole Plans
H-1-82095, Page 1 of 3, Cold Vacuum Drying Facility Overhead Service Pole Plans

ARCHITECTURAL DRAWINGS

H-1-82101, Page 1 of 1, Cold Vacuum Drying Facility Architectural First Floor Plan
H-1-82102, Page 1 of 1, Cold Vacuum Drying Facility Architectural Second Floor Plan
H-1-82103, Page 1 of 1, Cold Vacuum Drying Facility Architectural Detail Plans, Wall Types
H-1-82103, Page 1 of 2, Cold Vacuum Drying Facility Architectural Detail Plans
H-1-82104, Page 1 of 1, Cold Vacuum Drying Facility Architectural Sections
H-1-82105, Page 1 of 1, Cold Vacuum Drying Facility Architectural Sections
H-1-82106, Page 1 of 1, Cold Vacuum Drying Facility Architectural Exterior Elevations
H-1-82107, Page 1 of 1, Cold Vacuum Drying Facility Architectural Interior Elevations
H-1-82108, Page 1 of 1, Cold Vacuum Drying Facility Architectural Reflected Ceiling Plan
H-1-82109, Page 1 of 1, Cold Vacuum Drying Facility Architectural Reflected Ceiling Plan
H-1-82110, Page 1 of 1, Cold Vacuum Drying Facility Architectural Roof Plan
H-1-82111, Page 1 of 1, Cold Vacuum Drying Facility Architectural Room Schedule
H-1-82112, Page 1 of 1, Cold Vacuum Drying Facility Architectural Door Schedule, Details
H-1-82113, Page 1 of 1, Cold Vacuum Drying Facility Architectural Sections and Details
H-1-82114, Page 1 of 1, Cold Vacuum Drying Facility Architectural Details
H-1-82115, Page 1 of 1, Cold Vacuum Drying Facility Architectural Details

STRUCTURAL DRAWINGS

H-1-82121, Page 1 of 1, Cold Vacuum Drying Facility Structural Foundation Plan
H-1-82121, Page 1 of 2, Cold Vacuum Drying Facility Structural Foundation Plan
H-1-82122, Page 1 of 1, Cold Vacuum Drying Facility Structural Foundation Sections & Details
H-1-82122, Page 1 of 2, Cold Vacuum Drying Facility Structural Foundation Sections & Details
H-1-82123, Page 1 of 1, Cold Vacuum Drying Facility Structural Foundation Sections & Details
H-1-82124, Page 1 of 1, Cold Vacuum Drying Facility Structural Foundation Sections & Details
H-1-82125, Page 1 of 1, Cold Vacuum Drying Facility Structural Precast Panels
H-1-82126, Page 1 of 1, Cold Vacuum Drying Facility Structural Precast Panels
H-1-82127, Page 1 of 1, Cold Vacuum Drying Facility Structural Steel Second Floor Framing Plan
H-1-82128, Page 1 of 1, Cold Vacuum Drying Facility Structural Steel Roof Framing Plan
H-1-82129, Page 1 of 1, Cold Vacuum Drying Facility Structural Steel Framing Sections
H-1-82130, Page 1 of 1, Cold Vacuum Drying Facility Structural Steel Framing Sections
H-1-82131, Page 1 of 1, Cold Vacuum Drying Facility Structural Steel Stair Sections, Details
H-1-82132, Page 1 of 1, Cold Vacuum Drying Facility Structural Crane Plan, Sections, Details

CALCULATIONS

The following list of design calculations demonstrates how the design meets the design requirements. A more complete listing of all design calculations is contained in SNF-3001, Appendix H.

Originator	Document	Date	Rev #	Title
Civil Reports & Calculations				
MERRICK	MEI-2288-CV-01-A	08/21/96	0	Storm Runoff System
MERRICK	MEI-2288-CV-01-B	03/11/97	0	Flood
MERRICK	MEI-2288-CV-01-C	03/11/97	0	Storm 1
MERRICK	MEI-2288-CV-01-D	03/11/97	0	Storm 2
MERRICK	MEI-2288-CV-01-E	03/11/97	0	Flagnotes for page 202
MERRICK	MEI-2288-CV-01-F	03/11/97	0	Volume at point 1 from Area 1-3
MERRICK	MEI-2288-CV-01-G	03/11/97	0	Volume at point 2 from Area 3
MERRICK	MEI-2288-CV-01-H	03/11/97	0	Peak Flow and Time of Concentration
MERRICK	MEI-2288-CV-01-I	03/11/97	0	Point 3
MERRICK	MEI-2288-CV-01-J	03/11/97	0	Channel Section at Point 1 & 2
MERRICK	MEI-2288-CV-01-K	03/12/97	0	Check Channel Velocities
MERRICK	MEI-2288-CV-01-L	03/11/97	0	Storm 3
MERRICK	MEI-2288-CV-01-M	09/19/96	0	Retention Ponds
MERRICK	MEI-2288-CV-01-N	09/20/96	0	Area 2
MERRICK	MEI-2288-CV-01-O	09/20/96	0	Area 3 & 4
MERRICK	MEI-2288-CV-01-P	09/20/96	0	Area 5
MERRICK	MEI-2288-CV-01-Q	03/11/96	0	Time of Concentration
Structural Reports and Calculations				
MERRICK	MEI-228-ST-01-A	08/31/96	0	Snow Drifts
MERRICK	MEI-228-ST-02-A	04/29/96	0	Design Foundation, 50' x 60' Pre-Eng. Bldg.
MERRICK	MEI-228-ST-02-B	04/29/96	0	Footing Type A
MERRICK	MEI-228-ST-02-C	04/29/96	0	Snow
MERRICK	MEI-228-ST-02-D	01/25/95	0	F 202 Exterior
MERRICK	MEI-228-ST-02-E	04/29/96	0	Footing Type C & B
MERRICK	MEI-228-ST-02-F	01/25/95	0	F 201 Exterior
MERRICK	MEI-228-ST-02-G	08/20/96	0	Footing Type D

Originator	Document	Date	Rev #	Title
MERRICK	MEI-228-ST-02-H	02/14/95	0	F 204 Exterior
MERRICK	MEI-228-ST-02-I	08/21/96	0	Footing Type A
MERRICK	MEI-228-ST-02-J	08/30/96	0	Hair Pins Along Gridline 7 thru 9
MERRICK	MEI-228-ST-02-K	01/17/95	0	Hair Pins
MERRICK	MEI-228-ST-02-L	09/03/96	0	Allowable deflection of Building
MERRICK	MEI-228-ST-02-M	09/12/96	0	Office Vestibule
MERRICK	MEI-228-ST-02-N	09/12/96	0	Roof Section
MERRICK	MEI-228-ST-02-O	09/12/96	0	Joist
MERRICK	MEI-228-ST-02-P	09/12/96	0	Walls
Administration Area – Ceiling Framing				
MERRICK	MEI-228-ST-03-A	09/15/96	0	Size Ceiling Framing
MERRICK	MEI-228-ST-03-B	09/15/96	0	Size Header
MERRICK	MEI-228-ST-04-A	08/30/96	0	Wind Forces & Tornado
MERRICK	MEI-228-ST-04-B	08/30/96	0	Corners & Edges
MERRICK	MEI-228-ST-04-C	08/29/96	0	Missile Impact
MERRICK	MEI-228-ST-04-D	10/28/96	0	Revised Missile Criteria
Process Area - Wind Forces				
MERRICK	MEI-228-ST-05-A	08/30/96	0	Process Area Roof Design
MERRICK	MEI-228-ST-05-B	08/30/96	0	Roof Deck
MERRICK	MEI-228-ST-05-C	08/31/96	0	Roof Beam
MERRICK	MEI-228-ST-05-D	08/31/96	0	Purlins at Middle Roof
MERRICK	MEI-228-ST-05-E	08/31/96	0	Preliminary E-W Beam
MERRICK	MEI-228-ST-06-G	03/15/97	0	Seismic Forces on Bridge Crane
MERRICK	MEI-228-ST-06-H	03/15/97	0	STADD Model of Bridge Crane
MERRICK	MEI-228-ST-06-I	03/16/97	0	Check "Stub Beam" Connection
MERRICK	MEI-228-ST-06-J	03/15/97	0	Stub Beam
MERRICK	MEI-228-ST-06-K	03/16/97	0	Shear Stress
MERRICK	MEI-228-ST-06-L	03/24/97	0	Check Stress on Welded Connection
Process Area - Second Floor				
MERRICK	MEI-228-ST-07-A	06/26/96	0	Size Beams for 2nd Floor
MERRICK	MEI-228-ST-07-B	06/26/96	0	Check Deck Plate
MERRICK	MEI-228-ST-07-C	06/26/96	0	Stairs
MERRICK	MEI-228-ST-07-D	06/26/96	0	Beams A & B

Originator	Document	Date	Rev #	Title
MERRICK	MEI-228-ST-07-E	07/08/96	0	Beams C & D
MERRICK	MEI-228-ST-07-F	07/09/96	0	Beams E & F
MERRICK	MEI-228-ST-07-G	07/09/96	0	Beam G
MERRICK	MEI-228-ST-07-H	07/09/96	0	Beam L
MERRICK	MEI-228-ST-07-I	07/09/96	0	Wind Girt
MERRICK	MEI-228-ST-07-J	09/09/96	0	Strut From Girt to 2nd Floor
MERRICK	MEI-228-ST-07-K	07/09/96	0	Mezzanine Columns
MERRICK	MEI-228-ST-07-L	07/09/96	0	Column C
MERRICK	MEI-228-ST-07-M	08/19/96	0	Footings for Mezzanine Columns
MERRICK	MEI-228-ST-07-N	03/18/97	0	Wind Girt at Line E/L = 10'-3"
MERRICK	MEI-228-ST-07-O	07/14/97	0	Check Mezzanine for Loads
Process Area: Wind Lateral Loads				
MERRICK	MEI-228-ST-08-A	09/13/96	0	Lateral Wind Loads Due to Wind and Tornado
MERRICK	MEI-228-ST-08-B	09/13/96	0	Design Wall Panel Line A&E
MERRICK	MEI-228-ST-08-C	09/13/96	0	East-West Direction
MERRICK	MEI-228-ST-08-D	09/13/96	0	Provide Brace to Transfer Force
MERRICK	MEI-228-ST-08-E	07/01/96	0	Bracing STADD Model
MERRICK	MEI-228-ST-08-F	10/28/96	0	Point Loads for Tornado
MERRICK	MEI-228-ST-08-G	10/30/96	0	Check Connection, detail 5, sht. 82129
MERRICK	MEI-228-ST-08-H	09/05/96	0	Endwall, Line 2 & 7
MERRICK	MEI-228-ST-08-I	08/28/96	0	Middle Endwall Columns
MERRICK	MEI-228-ST-08-J	09/06/96	0	Columns at Endwall
MERRICK	MEI-228-ST-08-K	09/06/96	0	Girts, Line A
MERRICK	MEI-228-ST-08-L	09/06/96	0	Section F
MERRICK	MEI-228-ST-08-M	09/05/96	0	Section E
MERRICK	MEI-228-ST-08-N	09/05/96	0	Shielding at Columns C & 1-7
MERRICK	MEI-228-ST-08-O	01/04/97	0	Tank Area
MERRICK	MEI-228-ST-08-P	01/04/97	0	East West
MERRICK	MEI-228-ST-08-Q	01/04/97	0	Shear Wall East
MERRICK	MEI-228-ST-08-R	01/04/97	0	Shear Wall A
MERRICK	MEI-228-ST-08-S	01/04/97	0	Shear Wall 7
MERRICK	MEI-228-ST-08-T	01/04/97	0	Shear Wall Line 2
MERRICK	MEI-228-ST-08-U	01/04/97	0	Shear Wall F & C.8

Originator	Document	Date	Rev #	Title
MERRICK	MEI-228-ST-08-V	01/04/97	0	Shear Wall Line 1
MERRICK	MEI-228-ST-08	01/13/97	0	Check Process Area for Tornado Loads from Admin. Bldg.
MERRICK	MEI-228-ST-08	01/13/97	0	Uplift from Admin. Bldg.
MERRICK	MEI-228-ST-08-Y	01/13/97	0	Uplift from Additional Admin. Bldg.
MERRICK	MEI-228-ST-08-Z	01/13/97	0	Uplift From Transfer Corridor
MERRICK	MEI-228-ST-08-AA	01/14/97	0	Check W12x50 Wind Girt
MERRICK	MEI-228-ST-08-BB	01/14/97	0	Check Increase in Uplift from Transfer Bldg.
MERRICK	MEI-228-ST-08-CC	01/17/97	0	RCR 4-6, Roof Plate Diaphragm
MERRICK	MEI-228-ST-08-DD	01/17/97	0	WL/E-W Direction
MERRICK	MEI-228-ST-08-EE	01/13/97	0	Spring Constant for Concrete shear Wall
MERRICK	MEI-228-ST-08-FF	01/13/97	0	Redo Shear Wall on pg. L43
MERRICK	MEI-228-ST-08-GG	01/17/97	0	WL/E-W/Tank Room
MERRICK	MEI-228-ST-08-HH	01/17/97	0	WL/N-S/Tank Room
MERRICK	MEI-228-ST-08-II	01/13/97	0	RCR 4-8 (Shear Wall)
MERRICK	MEI-228-ST-08-JJ	01/04/97	0	Redo Shear Wall on pg. L44
Process Area: Truck Restraints				
MERRICK	MEI-228-ST-09-A	08/02/96	1	Cast Trailer Support Foundations
Process Area: Foundation				
MERRICK	MEI-228-ST-10-B	08/23/96	0	Footing at FTG-5
MERRICK	MEI-228-ST-10-C	08/23/96	0	Footing along Gridline C
MERRICK	MEI-228-ST-10-D	08/23/96	0	Footing along Gridline A
MERRICK	MEI-228-ST-10-E	08/22/96	0	Continuous Footings
MERRICK	MEI-228-ST-10-F	01/08/97	0	Continuous Footing along Gridline F
MERRICK	MEI-228-ST-10-G	09/05/96	0	Process Area Floor Slab
MERRICK	MEI-228-ST-10-H	07/16/97	1	Check Skid Beam Anchorage
MERRICK	MEI-228-ST-10-I	01/08/97	0	Footing 7
MERRICK	MEI-228-ST-10-J	11/02/96	0	Footing Uplift
MERRICK	MEI-228-ST-10-K	03/29/97	0	Anchor Bolts at Tank Room
MERRICK	MEI-228-ST-10-L	03/29/97	0	Anchor Bolts at Line 2 & 7
MERRICK	MEI-228-ST-10-M	03/29/97	0	Anchor Bolts at C 3-6
MERRICK	MEI-228-ST-10-N	03/29/97	0	Anchor Bolts at A-3-6

Originator	Document	Date	Rev #	Title
MERRICK	MEI-228-ST-10-O	04/01/97	0	Anchor Bolts at E 3-6
MERRICK	MEI-228-ST-10-P	03/18/97	0	Revise Connection Section A/H-1-82126
MERRICK	MEI-228-ST-10-Q	03/18/97	0	Check Column for Shears
MERRICK	MEI-228-ST-10-R	03/18/97	0	Check Section Wt for Section A
MERRICK	MEI-228-ST-10-S	04/29/97	0	Precast Panel(s) Anchor Bolts
MERRICK	MEI-228-ST-10-T	04/30/97	0	Line 2
MERRICK	MEI-228-ST-10-U	04/30/97	0	Line 3, 4, 5, 6 (At line A or Line E)
MERRICK	MEI-228-ST-10-V	04/29/97	0	Line 3, 4, 5, 6 At location where (1) embed takes load from (2) panel
MERRICK	MEI-228-ST-10-W	04/30/97	0	Precast Panel(s) Footing Anchors
MERRICK	MEI-228-ST-10-X	04/30/97	0	Design Footing Anchor "F" for Maximum Seismic and Wind Loads From Precast Panels on Line E, C, 7, F, and 1.
MERRICK	MEI-228-ST-10-Y	04/30/97	0	Design Footing Anchor "E" for Twice the Maximum Seismic and Wind Loads used for Footing Anchor "F".
MERRICK	MEI-228-ST-10-Z	04/30/97	0	Base Connections at A&7, A&2, E&2, C.7 & 2
MERRICK	MEI-228-ST-10-AA	01/21/98	0	Design Sump Pit for Process Bays
Corridor & Spaces: Roof				
MERRICK	MEI-228-ST-11-A	09/03/96	0	Transfer Corridor Roof Framing
MERRICK	MEI-228-ST-11-B	07/09/97	0	Purlins
Corridor & Spaces: Ceiling Framing				
MERRICK	MEI-228-ST-12-A	06/26/96	0	Mechanical Room Beam Size
MERRICK	MEI-228-ST-12-B	06/26/96	0	Beam A & B
MERRICK	MEI-228-ST-12-C	06/27/96	0	Mechanical Room Mezzanine Column Size
MERRICK	MEI-228-ST-12-D	07/14/97	0	Maximum Loads due to HVAC Equipment
MERRICK	MEI-228-ST-12-E	07/15/97	0	Check Concrete Diaphragm for Ultimate Shear Load
Corridor & Spaces: Lateral Loads				
MERRICK	MEI-228-ST-13-A	09/05/96	0	Lateral Loads on "Lean To"
MERRICK	MEI-228-ST-13-B	09/05/96	0	Staad Model of "Lean To"
MERRICK	MEI-228-ST-13-C	01/06/97	0	Determine Kz for W10x49 Columns in "Lean To" Staad

Originator	Document	Date	Rev #	Title
MERRICK	MEI-228-ST-13-D	09/05/96	0	Wind in N-S Direction
MERRICK	MEI-228-ST-13-E	09/05/96	0	Braced Bay
MERRICK	MEI-228-ST-13-F	10/30/96	0	Size Rod Bracing to Transfer Loads
MERRICK	MEI-228-ST-13-G	01/06/96	0	Alternative to 1/2" Rod Bracing
Corridor & Spaces: Ceiling Framing				
MERRICK	MEI-228-ST-14-A	09/15/96	0	Area Under "Lean To" Mezzanine
MERRICK	MEI-228-ST-14-B	09/16/96	0	Alternative Header
Process tank Room				
MERRICK	MEI-228-ST-15-A	12/10/96	0	Size steel Section for Tank Room
MERRICK	MEI-228-ST-15-B	12/10/96	0	Roof Framing
MERRICK	MEI-228-ST-15-C	12/10/96	0	Beam D & F
MERRICK	MEI-228-ST-15-D	12/11/96	0	Columns & Roof Deck
MERRICK	MEI-228-ST-15-E	12/31/96	0	Footings
MERRICK	MEI-228-ST-15-F	02/14/95	0	F203 Exterior, Resistance to Uplift
MERRICK	MEI-228-ST-15-G	12/31/96	0	Footings at Gridlines E and Z
MERRICK	MEI-228-ST-15-H	12/31/96	0	Anchor Bolts
MERRICK	MEI-228-ST-15-I	12/31/96	0	Base Plates
MERRICK	MEI-228-ST-15-J	03/16/97	0	Wind Girt at Tank Room
MERRICK	MEI-228-ST-15-K	04/03/97	2	Tank Anchors
MERRICK	MEI-228-ST-15-L	04/03/97	0	Clip Angle
MERRICK	MEI-228-ST-15-M	04/03/97	0	Tank Foundation
MERRICK	MEI-228-ST-15-N	04/03/97	0	Wind Loads
MERRICK	MEI-228-ST-15-O	04/04/97	0	Angle Iron
MERRICK	MEI-228-ST-15-P	04/03/97	0	IXM Foundation
Exterior Stairways				
MERRICK	MEI-228-ST-16-A	09/12/96	0	Stair Tower
MERRICK	MEI-228-ST-16-B	09/12/96	0	Support Beam
MERRICK	MEI-228-ST-16-C	09/12/96	0	Wall Design
MERRICK	MEI-228-ST-16-D	09/12/96	0	Strap Bracing
MERRICK	MEI-228-ST-16-E	09/12/96	0	Shear Walls
MERRICK				*Anchor Bolts and Base Plates Structural Calculations for Project W-441-C1 Cold Vacuum Drying Facility*, Meier Associates, Inc., Kennewick, Washington.

Originator	Document	Date	Rev #	Title
MERRICK				*Cold Vacuum Drying Facility Structural Analysis Report*, Merrick & Company, Richland, Washington.
SAIC		08/01/96		*Analysis of Tornado/Tornado Missile Risk to New SNFP Facility*; Final Report, M. M. Beary, Contract MRV-SBW-482901, Science Applications International Corporation, Richland, Washington
SAIC				*Probabilistic Risk Analysis Tornado Missile Hazard to CVD System and HC System*, and M. Beary, B. Johnson, P. Lowry, and J. Cruz, Science Applications International Corporation, Richland, Washington
S&W	Report H-1435-01	March 1997		Shannon and Wilson, *Geotechnical Engineering Studies, Cold Drying Vacuum Facility, 100KW Area, Hanford Reservation, Washington*, Shannon and Wilson Company, Kennewick, Washington.
SNFP	SCS-W-96-1453	08/02/96		*Cold Vacuum Drying Trailer Seismic Restraints and Trailer Stability under Tornado-Generated Missile Loading*, External Letter, H. P. Shrivastava, ICF Kaiser Hanford to J. J. Irwin, Westinghouse Hanford Company.
SNFP	HNF-2179	03/05/98	0	*Seismic Analysis of the TN-DE&SH Cask Transportation Trailer System for the CVD Facility*, (RFP-W-A36182-GW), Packaging Technology, Inc., Tacoma, Washington.
MERRICK	MER-2288-S-02			Bridge Crane Support
MERRICK	MER-2288-S-010	03/21/98		Computer Program Validation for RISA-3D
MERRICK	MER-2288-S-11			HVAC Isolation Dampers Supports
MERRICK	MER-2288-S-014	04/16/97	0	Computer Program Validation for STAAD-III
MERRICK	MER-2288-S-017	05/06/98	0	Design of Transformer Support Rack in Room 108
MERRICK				Admin Area Seismic Analyses
MERRICK				Pre-cast Concrete Panel Calculations
MERRICK				Supports for Electrical Equipment

Originator	Document	Date	Rev #	Title
MERRICK				Mezzanines and Ancillary Structures
MERRICK				Transfer Corridor/Ancillary Spaces Seismic Analyses
MERRICK				Exterior Stairway Seismic Analyses
Advent	96004.1.2	12/18/96	0	Seismic Evaluation of Cold Vacuum Drying Facility Secondary Enclosure and Process Water Tank Room
M&D	TBD	1999	0	Revised Seismic Analysis

Appendix C

System Procedures

EMERGENCY RESPONSE PROCEDURES	
ER-CVD-001	Building Emergency Plan (BEP)

OPERATING PROCEDURES	
OP-CVD-001	Verify Process Bay is Ready for Use

SURVEILLANCE PROCEDURES	
SP-CVD-014	Perform Surveillance of Process Bay Truck Doors

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