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Cold Vacuum Drying Facility Condensate Collection System Design Description

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Abstract: This document describes the Cold Vacuum Drying Facility (CVDF) condensate collection system (CCS). The function of the CCS is to collect cooling coil condensate from air-handling units in the CVDF and to isolate the condensate in collection tanks until the condensate is determined to be acceptable to drain to the effluent drain collection basin.

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**COLD VACUUM DRYING FACILITY
CONDENSATE COLLECTION SYSTEM
DESIGN DESCRIPTION**

SYSTEM 19

TABLE OF CONTENTS

1.0 INTRODUCTION	1-1
1.1 System Identification	1-1
1.2 Limitations of This SDD.....	1-1
1.3 Ownership of This SDD.....	1-1
1.4 Acronyms.....	1-1
2.0 GENERAL OVERVIEW.....	2-1
2.1 System Functions.....	2-1
2.2 System Classification.....	2-1
2.3 Basic Operational Overview	2-1
3.0 REQUIREMENTS AND BASES.....	3-1
3.1 General Requirements.....	3-1
3.1.1 System Functional Requirements	3-1
3.1.2 Subsystem and Major Components	3-2
3.1.3 Boundaries and Interfaces.....	3-2
3.1.4 Codes, Standards, and Regulations.....	3-2
3.1.5 Operability	3-3
3.2 Special Requirements.....	3-3
3.2.1 Radiation and Other Hazards	3-3
3.2.2 ALARA.....	3-3
3.2.3 Nuclear Criticality Safety	3-3
3.2.4 Industrial Hazards	3-3
3.2.5 Operating Environment and Natural Phenomena	3-3
3.2.6 Human Interface Requirements	3-3
3.2.7 Specific Commitments.....	3-3
3.3 Engineering Disciplinary Requirements.....	3-4
3.3.1 Civil and Structural.....	3-4
3.3.2 Mechanical and Materials.....	3-4
3.3.3 Chemical and Process	3-4
3.3.4 Electrical Power	3-4
3.3.5 Instrumentation and Control	3-4
3.3.6 Computer Hardware and Software.....	3-4
3.3.7 Fire Protection.....	3-4
3.4 Testing And Maintenance Requirements.....	3-5
3.4.1 Testability	3-5
3.4.2 TSR-Required Surveillances.....	3-5
3.4.3 Non-TSR Inspections and Testing.....	3-5
3.4.4 Maintenance	3-5
3.5 Other Requirements	3-5
3.5.1 Security and Special Nuclear Material (SNM) Protection.....	3-5
3.5.2 Special Installation Requirements.....	3-5
3.5.3 Reliability, Availability, and Preferred Failure Modes.....	3-5
3.5.4 Quality Assurance.....	3-5
3.5.5 Miscellaneous	3-5

4.0	SYSTEM DESCRIPTION.....	4-1
4.1	Configuration.....	4-1
4.1.1	Description of System, Subsystems, and Major Components.....	4-1
4.1.2	Boundaries and Interfaces.....	4-1
4.1.3	Physical Location and Layout.....	4-1
4.1.4	Principles of Operation.....	4-1
4.1.5	System Reliability.....	4-2
4.1.6	System Control Features.....	4-2
4.2	Operations.....	4-2
4.2.1	Initial Configurations (Pre-startup).....	4-2
4.2.2	System Startup.....	4-2
4.2.3	Normal Operations.....	4-2
4.2.4	Off-Normal Operations.....	4-2
4.2.5	System Shutdown.....	4-3
4.2.6	Safety Management Programs and Administrative Controls.....	4-3
4.3	Testing And Maintenance.....	4-3
4.3.1	Temporary Configurations.....	4-3
4.3.2	TSR-Required Surveillances.....	4-3
4.3.3	Non-TSR Inspections, and Testing.....	4-3
4.3.4	Maintenance.....	4-3

LIST OF FIGURES

Figure 2-1. Condensate Collection System Diagram.....	2-2
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1.0 INTRODUCTION

The Cold Vacuum Drying (CVD) Facility provides required process systems, supporting equipment, and facilities to support the Spent Nuclear Fuel (SNF) Project mission.

1.1 System Identification

This system design description (SDD) addresses the Condensate Collection System (CCS). The CCS begins at the condensate outlet of the general process air-handling unit (AHU) and the condensate outlets for the process bays AHUs. The system terminates at each condensate collection tank (5 total). Figure 2-1 shows a simplified layout of the system, while Drawings H-1-82201, H-1-82204, and H-1-82205 provide detailed information.

1.2 Limitations of This SDD

This SDD has been prepared with the best available information taken from approved design documents and drawings. Documents comprising the definitive design of the CCS include:

- Design Requirements Document (HNF-SD-SNF-DRD-002),
- Construction Specification for Project W-441, Section 15400, Plumbing Piping,
- Master Equipment List (SNF-4148),
- Safety Equipment List (HNF-SD-SNF-SEL-002),
- Calculation Matrix and Database (SNF-3001).

1.3 Ownership of This SDD

The CVD Design Authority assigned to the CCS 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

AHU	Air-Handling Unit
CCS	Condensate Collection System
CVD	Cold Vacuum Drying
PWC	Process Water Conditioning
SDD	System Design Description
SNF	Spent Nuclear Fuel

2.0 GENERAL OVERVIEW

2.1 System Functions

The function of the CCS is to collect cooling coil condensate from AHUs in the CVD facility and to isolate the condensate in collection tanks until the condensate is determined to be acceptable to drain to the effluent drain collection basin.

2.2 System Classification

All CCS components are designated general service and qualified for Performance Category 1 as defined in DOE-STD-1020-94.

2.3 Basic Operational Overview

During operation of the AHUs, excess moisture in the air stream condenses out as a liquid (condensate) on the outside of the cooling coils. The condensate gravity drains from the cooling coils to the condensate collection tanks. A sight glass on each condensate tank allows the liquid level in each tank to be visually checked. After sampling and verification that the liquid is acceptable, the condensate is drained via a flexible hose to an appropriate disposal container.. Figure 2-1 illustrates the system.

Figure 2-1. Condensate Collection System Diagram

3.0 REQUIREMENTS AND BASES

Requirements are excerpted from HNF-SD-SNF-DRD-002, *Cold Vacuum Drying Facility Design Requirements*, Section 2.2.9.

3.1 General Requirements

3.1.1 System Functional Requirements

Functional requirements of the condensate collection system include design requirements, safety requirements, environmental requirements, mission critical requirements, and general requirements.

3.1.1.1 Design Requirements

1. **Requirement:** Condensate collection and drainage systems shall be provided.

Basis: HNF-SD-SNF-DRD-002, Rev. 4, Section 2.2.9. A portion of the air stream provided by the process bay AHUs is recirculated air from the process bays. Therefore, the condensate collected from the AHU cooling coils is considered potentially contaminated. The condensate must be collected for sampling and analysis to identify the appropriate disposal method.

How the system meets the requirement: The CCS provides the drain lines and collection tanks necessary to collect condensate from the AHUs. Samples can be obtained for analysis from the tank drain connections to determine appropriate disposal methods.

3.1.1.2 Safety Requirements

There are no safety class, safety significant, or other safety requirements for the CCS.

3.1.1.2.1 Safety Class Requirements

There are no safety class requirements for the CCS.

3.1.1.2.2 Safety Significant Requirements

There are no safety significant requirements for the CCS.

3.1.1.2.3 Other Safety Requirements

There are no safety requirements for the CCS.

3.1.1.3 Environmental Requirements

There are no environmental requirements for the CCS.

3.1.1.4 Mission-Critical Requirements

There are no mission-critical requirements for the CCS.

3.1.1.5 General Requirements

There are no general requirements for the CCS.

3.1.2 Subsystem and Major Components

There are no subsystem or major component requirements for the CCS.

3.1.3 Boundaries and Interfaces

There are no system boundary or interface requirements for the CCS.

3.1.4 Codes, Standards, and Regulations

Code of Federal Regulations (CFR)

- 10 CFR 830.120, "Quality Assurance"
- 29 CFR 1910.120, "Occupational Safety and Health Standards."

U.S. Department of Energy

- DOE-STD-1020-94, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*
- DOE Order 5480.28, *Natural Phenomena Hazards Mitigation*

American Society of Mechanical Engineers (ASME) Codes

- ANSI/ASME, B16, Standard series, 1996, Fittings, Flanges and Valves, American Society of Mechanical Engineers, New York, New York.
- ANSI/ASME, B31.9, 1996, *Building Services Piping*, American Society of Mechanical Engineers, New York, New York.

American Water Works Association (ASME) codes

- ANSI/AWWA - D100a, 1989, Welded Steel Tanks for Water Storage, American Water Works Association, Denver, Colorado.

3.1.5 Operability

There are no unique operability requirements for the CCS.

3.2 Special Requirements

3.2.1 Radiation and Other Hazards

There are no radiation or other hazard requirements for the CCS.

3.2.2 ALARA

There are no ALARA requirements for the CCS.

3.2.3 Nuclear Criticality Safety

There are no nuclear criticality requirements for the CCS. However, the piping and collection tanks are criticality safe. See HNF-SD-SNF-CSER-006, *Criticality Safety Evaluation Report for the CVD Facility*.

3.2.4 Industrial Hazards

There are no industrial hazard requirements for the CCS.

3.2.5 Operating Environment and Natural Phenomena

There are no operating environment or natural phenomena requirements for the CCS.

3.2.6 Human Interface Requirements

There are no human interface requirements for the CCS.

3.2.7 Specific Commitments

1. **Requirement:** All aspects of the CCS shall be in compliance with the Hanford Federal Facility Agreement and Consent Order (Ecology 1994) and applicable federal, state, and local laws and American Indian treaty rights.

Basis: Site Agreement and State/Federal Law.

How the system meets the requirement: The design and construction and operation of the facility (including this system) have incorporated all aspects of these documents. Issuance of the facility operating permit will confirm compliance.

3.3 Engineering Disciplinary Requirements

3.3.1 Civil and Structural

There are no civil or structural requirements for the CCS.

3.3.2 Mechanical and Materials

1. **Requirement:** All piping and valves in the CCS shall be designed and tested in accordance with ANSI/ASME B31.9, *Building Services Piping*.

Basis: Standard engineering practice.

How the system meets the requirements: All piping and valves in the CCS were designed and tested in accordance with ANSI/ASME B31.9.

3.3.3 Chemical and Process

There are no chemical or process requirements for the CCS.

3.3.4 Electrical Power

There are no electrical power requirements for the CCS.

3.3.5 Instrumentation and Control

There are no instrumentation and control requirements for the CCS.

3.3.6 Computer Hardware and Software

There are no computer hardware or software requirements for the CCS.

3.3.7 Fire Protection

There are no specific fire protection requirements for the CCS. Fire protection is supported by the overall building fire protection system covered in a separate SDD. See SNF-3077, *Cold Vacuum Drying Facility Fire Protection System Design Description*.

3.4 Testing And Maintenance Requirements

3.4.1 Testability

There are no unique testability requirements for the CCS.

3.4.2 TSR-Required Surveillances

There are no TSR-required surveillances associated with the CCS.

3.4.3 Non-TSR Inspections and Testing

There are no inspection or test requirements for the CCS.

3.4.4 Maintenance

There are no maintenance requirements for the CCS.

3.5 Other Requirements

3.5.1 Security and Special Nuclear Material (SNM) Protection

There are no security or SNM Protection requirements for the CCS.

3.5.2 Special Installation Requirements

There are no special installation requirements for the CCS.

3.5.3 Reliability, Availability, and Preferred Failure Modes

There are no reliability, availability, or preferred failure mode requirements for the CCS.

3.5.4 Quality Assurance

There are no quality assurance requirements specific to the CCS. The CCS fabrication quality assurance/quality control program is based on the safety designation of the SSCs as detailed in SNF-4148, *Cold Vacuum Drying Facility Master Equipment List* and the application of a graded approach as described in HNF-MP-599, *Project Hanford Quality Assurance Program Description*.

3.5.5 Miscellaneous

There are no miscellaneous requirements not previously covered.

4.0 SYSTEM DESCRIPTION

4.1 Configuration

4.1.1 Description of System, Subsystems, and Major Components

The major components of the CCS are five condensate collection tanks and copper tubing between the collection tanks and the general supply AHU (1 total) and the process bay AHUs (4 total). Air-handling units are provided for process bay 2, 3, 4, and 5. Each AHU includes a cooling coil. The condensate collection tanks for the process bay AHUs are located under the mezzanine deck in the process bays. The collection tank for the general supply AHU is located in the transfer corridor under the mezzanine deck. Each collection tank is connected to one AHU cooling coil using 2-inch copper tubing. A trap with an 8-inch seal is provided on the inlet to each tank. An illustration of the CCS is provided in Figure 2-1.

Each condensate collection tank includes a sight glass for visual inspection of liquid level, a tank vent, and a tank drain. The tank drain includes a manual drain valve and a 1-inch capped NPT connection.

4.1.2 Boundaries and Interfaces

The CCS is bounded by the drain connection at the bottom each AHU cooling coil housing. The AHU cooling coils are the only direct interface for the CCS.

4.1.3 Physical Location and Layout

The physical location and layout of the CCS is described in Section 4.1.1.

4.1.4 Principles of Operation

The CCS is a passive system that does not require any operator action except to periodically drain the condensate collection tanks. During operation of the AHUs, excess moisture in the air stream condenses out as a liquid (condensate) on the outside of the cooling coils. The cooling coil condensate gravity drains from the AHU to the condensate collection tanks.

The liquid level in the condensate collection tanks must be periodically checked. Tank level is checked by observing the liquid level in the tank sight glass. Prior to draining, tank contents are sampled and analyzed for radioactivity. A flexible drain hose is then connected to the tank drain and routed to a floor drain if the condensate is not contaminated and to the PWC system if the condensate is contaminated. The drain valve is then opened to drain tank contents.

4.1.5 System Reliability

The CCS is a passive system and only requires periodic operator attention to check tank levels and drain tank contents when required.

4.1.6 System Control Features

4.1.6.1 System Monitoring. The liquid level in each condensate collection tank must be periodically checked using the sight glass on the tank. There is no additional system monitoring necessary for the CCS.

4.1.6.2 Control Capability and Location. There are no controls associated with the CCS.

4.1.6.3 Automatic and Manual Actions. There are no automatic actions associated with the CCS. Visual inspections of tank liquid level and periodically sampling and draining are the only manual actions associated with the CCS.

4.1.6.4 Setpoints and Ranges. There are no setpoints or ranges required for this system.

4.1.6.5 Interlocks, Bypasses, and Permissives. There are no interlocks, bypasses, or permissives associated with the CCS.

4.2 Operations

4.2.1 Initial Configurations (Pre-startup)

The condensate collection tank drain valve should be closed before starting the AHU associated with that tank. Other initial configurations will be specified in the Test Specification.

4.2.2 System Startup

System startup and testing requirements required for the CCS will be provided in the CVD Test Specification.

4.2.3 Normal Operations

Normal operation of the CCS is described in Section 4.1.4. Operating procedures will be prepared which include operation of this system.

4.2.4 Off-Normal Operations

During off-normal operation, the AHU cooling coils could have some contamination on the surfaces and thus the condensate would be unacceptable to release. The response to this is described in Section 4.1.4, and will be detailed in the facility operating procedures.

4.2.5 System Shutdown

There is no system shutdown associated with the CCS.

4.2.6 Safety Management Programs and Administrative Controls

The condensate collected in the CCS is considered potentially contaminated until sampled and verified otherwise. Administrative controls will be developed and implemented to ensure the tanks do not overflow through the tank vents and that the pipe caps are reinstalled on the tank drain lines after sampling and draining activities. These controls will be detailed in the operating procedures.

4.3 Testing And Maintenance

4.3.1 Temporary Configurations

The only temporary configuration for the CCS is during tank draining. During tank draining, a flexible hose is connected to the tank drain and the drain valve is open. This configuration is only used during tank draining. The drain valve is closed, the drain hose removed, and the pipe cap reinstalled immediately following completion of tank draining.

4.3.2 TSR-Required Surveillances

There are no TSR-required surveillances associated with the CCS.

4.3.3 Non-TSR Inspections, and Testing

There are no planned inspections or tests.

4.3.4 Maintenance

There is no maintenance required for the CCS.

Appendix A

Source Documents

HNF-MP-599, *Project Hanford Quality Assurance Program Description*.

Hanford Federal Facility Agreement and Consent Order (Ecology 1994).

HNF-SD-SNF-DRD-002, *Spent Nuclear Fuel Project Cold Vacuum Drying Facility Design Requirements Document*, Revision 4, DE&S Hanford, Richland, Washington.

HNF-SD-SNF-CSER-006, *Criticality Safety Evaluation Report for the CVD Facility*.

W-441-C1, *Construction Specification for Project W-441*, Mactec-Meier and Associates, Kennewick, Washington.

SNF-4148, *Spent Nuclear Fuel Project Cold Vacuum Drying Facility Master Equipment List*, Rev. 0, DE&S Hanford, Richland, Washington.

HNF-SD-SNF-SEL-002, *Spent Nuclear Fuel Project Cold Vacuum Drying Facility Safety Equipment List*, DE&S Hanford, Richland, Washington.

SNF-3001, *Spent Nuclear Fuel Project Cold Vacuum Drying Facility Calculation Matrix and Database*, Revision 0, DE&S Hanford, Richland, Washington.

Appendix B
System Drawings

- Contract Drawings (H-1-82201, 82204, 82205, and 82223)

Appendix C
System Procedures

Procedures for the CCS have not been developed at this time.

DISTRIBUTION SHEET

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