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16. KEY

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1	1	Cog. Mgr. G. D. Bazinet *G. D. Bazinet* 4/13/00			
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1	1	Safety L. J. Garvin *[signature]* 4/12/00			
		Env. N/A			

18.	19.	20.	21. DOE APPROVAL (if required)
S. B. Harrington *Sara Harrington* 4-5-00 Signature of EDT Originator Date	N/A Authorized Representative for Receiving Organization Date	G. D. Bazinet *G. D. Bazinet* 4/13/00 Design Authority/ Cognizant Manager Date	Ctrl. No. [ ] Approved [ ] Approved w/comments N/A [ ] Disapproved w/comments

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☐ Summary	☐ Internet
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☐ Full Paper	☒ Report
☐ Other ____	

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Spent Nuclear Fuel Project Canister Storage Building System Design Descriptions

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   ____ Manager's Signature Required

   If Yes ____ ADC Signature Required ☒ No ☐ Yes Classified

2. Internal Review Required? ☒ No ☐ Yes
   If Yes, Document Signatures Below

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3. References in the Information are Applied Technology ☒ No ☐ Yes

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D. M. Black *D M Black*
(Print and Sign)

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(Print and Sign)

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General Counsel	☐			Y / N
Office of External Affairs	☐			Y / N
DOE-RL	☐			Y / N
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☐ Business-Sensitive	☐ Patentable
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☐ UCNI	

K. If Additional Comments, Please Attach Separate Sheet

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Revision 0
EDT 628685

Spent Nuclear Fuel Project Canister Storage Building System Design Descriptions

D. M. Black
Fluor Hanford

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Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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SPENT NUCLEAR FUEL

SYSTEM DESIGN DESCRIPTIONS

CANISTER STORAGE BUILDING

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SPENT NUCLEAR FUEL
CANISTER STORAGE BUILDING

ELECTRICAL DISTRIBUTION (System #1 AND #18)

SYSTEM DESIGN DESCRIPTIONS

1.0 ELECTRICAL DISTRIBUTION SYSTEM DESCRIPTION (SYSTEM #1 AND #18)

1.1 Function

1.1.1 The Normal Electrical Distribution system is designed to provide three phase (3Ø) power from the 13.8 kV overhead power line (operated by the Electrical Utilities Group) for normal operation of the SNF CSB.

1.2 Operation

1.2.1 Electrical power from the 13.8 kV overhead utility circuit C8-L7 feeds through fused Cutout Switch DD-32-101 on Utility Pole E-2773. The cutouts provide electrical isolation during planned maintenance activities or circuit overloads. Primary Metering equipment for the Hanford Electrical Utilities kilowatt hour meter is also located on this pole. Power from the Cutout Switch is routed underground to the primary terminals of Pad Mounted Transformer XT-32-102.

1.2.2 The oil-filled Pad Mounted Transformer XT-32-102 is energized by 13.8 kV through its primary fuses. This transformer steps 13.8 kV down to 480Y/277 volts. Lightning arresters are located in the transformer, primary cabinet. These arresters are designed to protect the CSB building from voltage surges on the aerial lines. The transformer secondary provides power to the Utility Metering Cabinet UC-32-201.

1.2.3 Utility Metering Cabinet UC-32-201 houses a 1200 ampere, 3Ø main circuit breaker, which is the building service disconnect. This circuit breaker provides ground-fault protection as required by the National Electrical Code - 1993 (NEC).

1.2.4 Low Voltage Switchgear cabinet SG-32-202, located in Electrical Equipment Room (031), is constructed to house eight 3Ø circuit breakers. Four of these cubicles house circuit breakers to provide normal electrical power and over-current protection to four motor control centers in the SNF CSB; two of the remaining four cubicles are designated as spares (W/1600 AF Circuit Breakers) and the other two cubicles as spaces.

1.2.5 Motor Control Centers, MC-33-207 and MC-33-208 are energized by the Normal Electrical Power System from Indoor Switchgear SG-32-202. These two Motor Control Centers were originally designed to be supplied by either the NED feed source or backup generators. Changes to the facility have eliminated the connections to backup generators.

1.2.6 Two Motor Control Centers, MC-32-209 and MC-32-210, distribute Normal Electrical power to lighting circuits, motors, heaters, power supplies and distribution transformers. MC-32-209 and MC-32-210 are energized by the Normal Electrical Power System from Indoor Switchgear Cabinet SG-32-202.

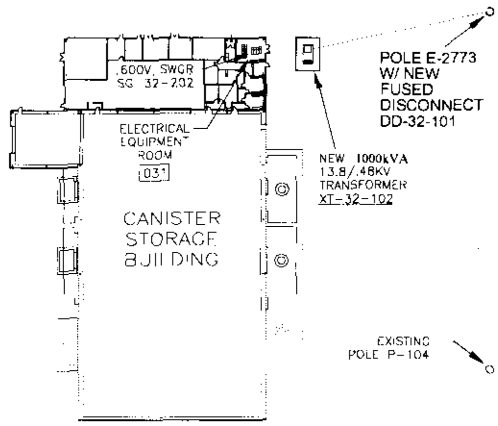

Figure 1: Site Plan

1.2.7 There are nine Distribution Panels in the CSB: A, B, C, D, F, G, H, J and K; Panel A is energized by MC-32-209, Panels B, D and J are energized by MC-32-210, Panel H is energized by MC-33-207, Panel G is energized by MC-33-208, Panels C and F are energized by the Uninterruptible Power Supply and Panel K is supplied by Panel J. These panels and their molded case circuit breakers distribute electrical power at 480Y/277 and 208Y/120 volts throughout the SNF CSB.

1.2.8 Uninterruptible Power Supply UP-33-213 has three power sources: Normal Power is supplied from MC-33-207, Battery Backup power is supplied from Battery BA-33-301, and Alternate Power is supplied from MC-33-210. If normal power is lost, backup power from the UPS battery will automatically supply power to the UPS for a limited time. Alternate Power from MC-33-210 is also selectable with Maintenance Bypass Switches located on the UPS.

1.3 Configuration

1.3.1 Three-phase power from the 13.8kV overhead supply line is coupled to a Cutout Switch located on utility pole E-2773, northeast of the SNF CSB Pad Mounted Transformer XT-32-102. Power leads connected to the bottom of the Cutout Switch are routed through underground conduit to the primary circuit of XT-32-102. *See Drawings H-2-122733 sheet 3, H-2-122736 sheets 3 & 4, and Figure 1: Site Plan*

1.3.2 Pad Mounted Transformer XT-32-102 and Utility Metering Cabinet UC-32-201 are mounted on a concrete pad located outside the northeast corner of the SNF CSB. The transformer primary circuit contains primary fuses; the secondary circuit is routed underground to the Utility Metering Cabinet. *See Drawings H-2-122733 sheet 3, Electrical Canister Storage Bldg Overall One Line Diagram* and H-2-122736 sheet 4, *Electrical Canister Storage Bldg. Site Underground Power & Grounding Plan.*

1.3.3 Utility Metering Cabinet UC-32-201 houses 3Ø circuit breaker CB-32-202 . Electric utility metering is performed by the primary metering method. The secondary side of the potential transformer that is mounted on Pole E-2773 is routed through a 1-inch conduit to a Meter and Field Data Acquisition System (FDAS) Logger in the CSB Electrical Equipment Room. This circuit breaker CB-32-202, provides power to the Low Voltage Switchgear cabinet through underground conduit routed between the Utility Metering Cabinet and the SNF CSB Electrical Equipment Room (031). *See Drawings H-2-122733 sheet 3, Electrical Canister Storage Bldg Overall One Line Diagram and H-2-122736 sheet 4, Electrical Canister Storage Bldg. Site Underground Power & Grounding Plan.*

1.3.4 Low Voltage Switchgear cabinet SG-32-202 is located in the SNF CSB Electrical Equipment Room (031). Four of the eight cubicles in the switchgear cabinet are currently utilized to distribute power to four Motor Control Centers (MCCs). The remaining four cubicles contain two spares (W/1600 AF Circuit Breakers) and two spaces for future expansion. *See Drawing H-2-122733 sheet 3, Electrical Canister Storage Bldg Overall One Line Diagram.*

1.3.5 There are four individual MCCs, three are located in the Electrical Equipment Room (031) and one located in the UPS Room (020) of the SNF CSB. Each one is energized from a circuit breaker located in the Low Voltage Switchgear Cabinet. Two Motor Control Centers, MC-33-207 and MC-33-208, originally had more than one power source; they are now energized only by Normal Electrical power from SG-32-202. Backup power supplied by the Emergency Diesel Generators EG-1A (for MC-33-207) or EG-1B (for MC-33-208) through their respective Automatic Transfer Switches TS-33-205 or TS-33-206 has been eliminated from the design. The two remaining MCCs, MC-33-209 and MC-33-210, are also energized only from the Normal Electrical Distribution system.

1.3.6 There is one Uninterruptible Power Supply, designated UP-33-213, to supplement the NED system. It is located in the UPS Room (020), UPS Back-up Battery cabinet BA-33-301, located in the CAEM Room 016. Normal UPS operation utilizes power from MC-33-207; if normal power is lost, then the UPS backup battery will automatically supply power for a short period of time.

1.3.7 There are nine Distribution Panels, designated A, B, C, D, F, G, H, J and K. *Ref. Drawing H-2-122744, shs-1 & 2* for load schedules.

A. The Distribution Panels are located in the following areas:

- Panels A, B & D are located on the West wall of the Electrical Equipment Room 031.
- Panel G and H are located on the South wall of the Electrical Equipment Room 031.
- Panels C & F are located in UPS Room 020. Feeders to Panels C & F may be connected to either MC-33-207 or MC-33-210 by closing the appropriate circuit breaker on UPS-33-213. In the event of a loss of power to the MCC supplying these panels, the UPS Batteries will continue supplying these panels for a short period of time.
- Panel J and Sub-Panel K are located in the south end of the CSB to Supply the Sample/Weld Station.

B. The Distribution Panels are fed from the following sources:

DISTRIBUTION PANEL SOURCE POWER

Panel	Source	Drawing (Loads)	Drawing (One-Line)
LX-32-215 (A)	MC-32-209	H-2-122744, sh 1	H-2-122733 sh 1
DA-32-302 (B)	MC-32-210		H-2-122733 sh 2
* DA-33-303 © * DA-33-304 (F)	MC-32-210		H-2-122734 sh 1
	MC-33-207		
	**BA-33-301		
DA-32-216 (D)	MC-32-210		H-2-122733 sh 2
XT-33-219 (G)	MC-33-207		H-2-122733 sh 5
XT-33-219 (H)	MC-33-207		H-2-122733 sh 4
DA-33-307 (J)	MC-32-209	H-2-122744, sh 2	H-2-122733 sh 1
DA-33-307 (K)	DA-33-307 (J)		

* Distribution panels C & F have the option of being energized via three different sources: MC-32-210, MC-33-207, or Back-up Battery BA-33-301.
** UPS Battery Cabinet

1.4 Requirements

1.4.1 *Design Requirements*: The NED System is supplied by the 13.8 kV distribution system at the Hanford site. The nominal systems supplied to the SNF CSB are:

- Building distribution - 480Y/277 V, 3Ø, 60 Hz.
- Lighting - 480Y/277 V, 3Ø, 60 Hz.
- Convenience outlets and UPS - 208Y/120 V, 3Ø, 60 Hz.

1.4.2 *Operational Requirements*:

NED OPERATIONAL REQUIREMENTS	VALUE
Outdoor temperature range - Electrical Equip.	115°F to -27°F
Indoor - general	104°F to 55°F
Indoor - Electrical Equip Rooms	104°F to 55°F
Indoor - Design Base Accident	120°F Max

1.4.3 *Maintenance and Surveillance Requirements*:

Cutout Switch

A. The Cutout Switch will be inspected and maintained by the Hanford Electrical Utilities in accordance with a site standard schedule.

Pad Mounted Transformer

B. The Pad Mounted Transformer must be periodically inspected (by the Electrical Utilities Group) including the following, or anytime the exterior has been damaged in accordance with *C-16320, 1.6.6; Pad Mounted Transformer - Operation and Maintenance Data, Service and Preparation*:

- Terminal Compartment Interior and All Operating Equipment for damage and leakage
- Gauges, Controls, Drains, Plugs, Mountings, and Switches

Utility Metering Cabinet

C. The Utility Metering Cabinet will be inspected and maintained by the Hanford Electrical Utilities in accordance with a site standard schedule.

Low Voltage Switchgear

D. All Low Voltage Switchgear must be inspected and tested including the following, at least every 12 months of operation or, anytime after a fault condition in accordance with *C-16330, 1.6.4; 480 Vac Low Voltage Switchgear Operation and Maintenance Manual; Appendix C, Section 1.1, Inspection and Maintenance*:

- Visual Check
- Operation (test for smooth operation)
- Interlocks
- Arc Chutes and Contacts
- Solid State Trip Units (secondary injection test only)
- Accessories

E. Anytime a breaker(s) is difficult to operate, or when the breaker is exposed to corrosive or caustic environment, the affected disconnect switch(es) may require lubrication in accordance with *C-16330, 1.6.4; 480 Vac Low Voltage Switchgear Operation and Maintenance Manual, Appendix B, Section IX, Maintaining the Switchgear.*

F. Inspections and tests for the following Low Voltage Switchgear components must be performed at least every 12 months or, anytime after a fault condition in accordance with *C-16330, 1.6.4; 480 Vac Low Voltage Switchgear Operation and Maintenance Manual, Appendix B, Section IX, Maintaining the Switchgear*:

- Breaker and Instrument Compartments
- Breakers
- Instruments, Instrument Transformers, and Relays
- Breaker Compartment Interiors
- Bus Area

- Cable and Busway Compartment
- Overall Switchgear
- Paint Refinishing
- Circuit Breaker Lifting Mechanism

<u>Motor Control Centers</u>

G. All Motor Control Centers must be inspected and tested including the following, at least every 12 months of operation or, anytime after a fault condition in accordance with *C-16482/C-16482B, 1.6.4, MCC Instruction Manual, Operation*:

- Visual Check
- Operation
- Interlocks
- Transformers
- Overload Relays and Fuses
- Insulation
- Latches and Mechanisms

H. Anytime a disconnect switch is difficult to operate, or when the switch is exposed to corrosive or caustic environment, the affected disconnect switch may require lubrication in accordance with *C-16482/C-16482B, 1.6.4, MCC Instruction Manual, Preventative Maintenance.*

I. The following inspections and tests for the 480 V Motor Control Centers must be performed at least every 12 months or, anytime after a fault condition in accordance with *C-16482/C-16482B, 1.6.4, MCC Instruction Manual, Preventive Maintenance*:

- Doors and enclosure sides for evidence of excessive heat
- Moisture or signs of dampness or drippings inside MCC
- Integrity of bus splice connections

- Proper function and freedom of movement (no sticking or binding) of the disconnect handle operating mechanisms and defeater mechanisms
- Bus stab connections for wear and corrosion
- Current carrying parts (i.e., fuse clips, knife blades of disconnects, and line and load terminals) for discoloration, corrosion or other signs of abnormalities
- Contacts for excessive wear and dirt accumulation
- Loose connections on power and control circuit terminals
- Coils for evidence of overheating (i.e., cracking, melting, or burnt insulation)
- Damaged or burned out Pilot Lights
- Damaged or blown Fuses

<u>Power Distribution Panels</u>

J. The Power Distribution Panels will be inspected and maintained by the Hanford Electrical Utilities in accordance with a site standard schedule.

<u>Uninterruptible Power Supply</u>

K. The following Uninterruptible Power Supply parameters must be inspected and tested at least every 12 months of operation, or anytime after a fault condition, in accordance with *C-16143, 1.6.6; Installation, Operation and Maintenance Manual, Routine Maintenance*:

- Air Filter inspection and cleaning
- Visual inspection for loose connections, overheated components, any abnormal setups or configurations
- Voltage adjustments
- Static Switch tested for proper transfer

L. The following parameters for the UPS Batteries must be read and recorded at least every 12 months or, anytime after an Equalizing Charge in accordance with *C-16143, 1.6.8; Installation, Operating & Maintenance Manual for the Station Batteries, Chapter 10 - Maintenance*:

- Corrosion around batteries and racks
- Individual cell or unit voltages (Volts)
- Cell-to-cell connection resistance (μohms)
- Terminal connection resistance (μohms)
- Ambient Temperature in the immediate battery environment
- Connection resistance

1.5 Safety

1.5.1 *Potential Safety Hazards and Concerns:*

A. Electrical equipment should be operated only by personnel adequately trained in the use of the equipment. For personnel safety, all electrical equipment should be assumed to be energized. Prior to performing any work on electrical equipment, ensure the equipment is de-energized from all sources and the manufacturer's operating and maintenance instructions are followed. Proper lockout and tagging procedures, as specified in the applicable site administrative manual, must be followed at all times.

B. All electrical installations located in the proximity of or adjacent to Safety Class equipment is designed to not affect the integrity of that equipment under accident conditions.

C. System protective devices are installed to minimize damage to the electrical system. The interrupting rating of electrical equipment has been selected to exceed the fault current available to the individual equipment by a minimum of 20 percent. In addition these devices have been selected and coordinated such that the interrupting device nearest the point of fault will open first and minimize disturbances to the rest of the system.

1.5.2 *Safety Classification*: The Normal Electrical Distribution System is classified as General Service (GS), because it is not required to mitigate an accident or to operate after an accident, and provides a limited function in protecting the facility worker from industrial and radiological hazards.

Under normal circumstances, the CSB receives electrical power from the Hanford Site transmission and distribution system via the 13.8 kV power pole near the north end of the building. The incoming voltage is stepped down through a dedicated 480 volt (V) transformer. From the 480 V transformer power is provided to four 480 V Motor Control Centers (MCCs) located in the support building of the CSB. All MCCs are classified as General Service (GS).

Safety Class and Safety Significant (SS) structures, systems and components (SCCs) supported by electrical power are designed to be fail-to-safe (an electrical power failure leaves them in a position that does not compromise safety).

Without electrical power, the capability of the CSB to continue receiving, servicing and moving of MCOs to storage would be suspended. Support activities, such as extended purging and re-inerting operations would be impossible.

1.5.3 *Quality Level*: A Quality Level I designation indicates that a system has more stringent quality requirements specified. Safety Class (SC) or Safety Significant (SS) Systems must be designated Quality Level I to provide increased assurance the System will function as designed. Quality Level II, which indicates that its functioning can be adequately assured with the normal level of Quality Assurance as implemented by the Operating Contractor's QA Plan. The quality levels of NED system components are listed as follows:

A. The Normal Electrical Distribution (NED) system is Quality Level II because it has a General Service (GS) designation and has no other special risk.

B. Motor Control Centers MC-33-207 & MC-33-208 are designed and built to Quality level I, because a loss of this system and the equipment that it supports could cause disruption of normal facility operations..

1.5.4 *Environmental Safety*: The SNF CSB does not have any connections to a chemical sewer or other means of direct disposal of hazardous chemical waste. All hazardous wastes generated during maintenance or other activities within the facility must be safely contained at the point of generation (i.e., fluids drained into buckets, rags and other materials placed in plastic bags), and removed to some other facility having suitable means of safe hazardous material disposal available.

1.6 References

1.6.1 Drawings relating to or referenced in this document are:

DWG #	DRAWING TITLE
D12976-1	One line Diagram UPS 120 VDC Bus
D12976-2	Outline & Mounting Dimensions 20 KVA 3PH UPS
H-2-122731 sheets 1&2	Electrical Canister Storage Bldg. Standard Drafting Symbols
H-2-122732 sheets 1-6	Electrical Canister Storage Bldg. Standard Assemblies

DWG #	DRAWING TITLE
H-2-122733 sheets 1-5	Electrical Canister Storage Bldg. One Line Diagram MC-32-209
H-2-122734	Electrical Canister Storage Bldg. One Line Diagram UP-33-213 (Uninterruptible Power Supply)
H-2-122735	Electrical Canister Storage Bldg. Equipment Arrangement Plan
H-2-122736 sheets 1-4	Electrical Canister Storage Bldg. Under Ground Conduit & Grounding Plan
H-2-122737	Electrical Canister Storage Bldg. Pole Line Details
H-2-122738 sheets 1-2	Electrical Canister Storage Bldg. Lightning Protection Plan
H-2-122740 sheets 1-5	Electrical Canister Storage Bldg. Above Ground Power Plan
H-2-122741 sheets 1-5	Electrical Canister Storage Bldg. Above Ground Power Details
H-2-122742 sheets 1-4	Electrical Canister Storage Bldg. Lighting & Receptacle Plan
H-2-122743	Electrical Canister Storage Bldg. LTG & RECP Sects & Dets
H-2-122744	Electrical Canister Storage Bldg. Panel Schedules
H-2-122745 sheets 1-4	Electrical Canister Storage Bldg. Instrumentation Plan
H-2-122746	Electrical Canister Storage Bldg. Instr Sections & Details
H-2-122747	Electrical Canister Storage Bldg. Comm & FA System Riser Diag
H-2-122748 sheets 1-4	Electrical Canister Storage Bldg. Comm & Fire Alarm Plan
H-2-122750 sheets 1-2	Electrical Canister Storage Bldg. Elementary Diagrams

1.6.2 Documents relating to or referenced in this document are:

DOC. #	DOCUMENT TITLE
96-05-04-01	SNF CSB System Safety Classification Forms, 1997, Electrical Supply

DOC. #	DOCUMENT TITLE
HNF-3553	Annex A, Canister Storage Building Final Safety Analysis Report, Section A2.8.1, Normal Electrical Power Distribution
HNF-3553	Annex A, Canister Storage Building Final Safety Analysis Report, Section A2.8.3, Uninterruptible Power System
HNF-PRO-704	Hazard and Accident Analysis Process
N/A	Design Basis Document, Section 5, *Electrical*
W-379-C-CSB-16122	15 kV Cable
W-379-C-CSB-16143	Uninterruptible Power Supply System
W-379-C-CSB-16110	Electrical Materials and Devices
W-379-C-CSB-16320	Pad Mounted Transformer
W-379-C-CSB-16330	480 Volt Switchgear
W-379-C-CSB-16482	Motor Control Centers
W-379-C-CSB-16482B	Motor Control Centers
W-379-C-CSB-16905	Electrical Testing
W-379-C-CSB-16905B	Electrical Testing
W-379-C-CSB-17861	Local Control Panels
W-379-C-CSB-17861B	Local Control Panels
C-13200, 1.6.2	Design for Low Voltage Switchgear SG-32-202 and Diesel Fuel Oil Storage Tank TK-001
C-16110, 1.6.1.W	Electrical Materials & Devices - Utility Metering Cabinet - Metering Drawing
C-16110, 1.6.1.Z	Electrical Materials & Devices - Load Break Fuse Links
C-16110, 1.6.4	Electrical Materials & Devices - Data Sheets for Transformers XT-32-214, XT-33-217, XT-32-218, XT-33-219
C-16110, 1.6.4	Electrical Materials & Devices - Dry Type Transformers & Mini Power Centers
C-16110, 1.6.4	Electrical Materials & Devices - Data Sheets for Enclosed Breakers

DOC. #	DOCUMENT TITLE
C-16110, 1.6.4	Electrical Materials & Devices - Data Sheets for Safety Switches
C-16110, 1.6.4	Electrical Materials & Devices - Data Sheets for Switchboards (Metering)
C-16110, 1.6.4	Electrical Materials & Devices - Data Sheets for Panelboards - DA-32-216, DA-32-302, DA-33-303, DA-33-304, LX-32-215, DA-33-305
C-16110, 1.6.6	Dry Type General Purpose Transformers
C-16110, 1.6.7.A	Instructions for Panelboard - Manufacturer's Installation
C-16110, 1.6.7.1.C	Installation Instructions for Dry-Type Distribution Transformers
C-16110, 1.6.7.1.C	Transformer - Cooper/Electric Materials & Devices
C-16110, 1.6.7.1.C	Utility Metering Cabinet - UMC - Installation Instructions Cutler-Hammer Switchboard Design
C-16143, 1.6.1	Design Drawings D12976-1 and D12976-2 Rev. A for the Uninterruptible Power Supply
C-16143, 1.6.6	Cyberex (UPS) Installation O&M Manual
C-16143, 1.6.8	Installation, Operating and Maintenance Manual for the Station Batteries
C-16143, 1.6.10	UPS Factory Acceptance Test Data
C-16330, 1.6.4	480 Vac Low Voltage Switchgear Operation and Maintenance Manual
C-16482, 1.6.1	Design Drawings for MCCs
C-16482/C-16482B, 1.6.1 - 1.6.4	1.6.1 - As-Builts, 1.6.3 - Spare Parts List, 1.6.2 - Materials Lists, 1.6.4 O&M Manuals

SPENT NUCLEAR FUEL CANISTER STORAGE BUILDING

INSTRUMENT/SERVICE AIR (System #2)

SYSTEM DESIGN DESCRIPTIONS

2.0 INSTRUMENT/SERVICE AIR SYSTEM DESCRIPTION (SYSTEM #2)

2.1 Function

2.1.1 The Instrument/Service Air (CA/IA/SA) system is designed to provide dry, oil- and particulate-free compressed air to components and locations throughout the SNF CSB. The Instrument/Service Air system consists of the Compressed Air (CA) system, which supplies the Instrument Air (IA) and Service Air (SA) subsystems (see Figure 1):

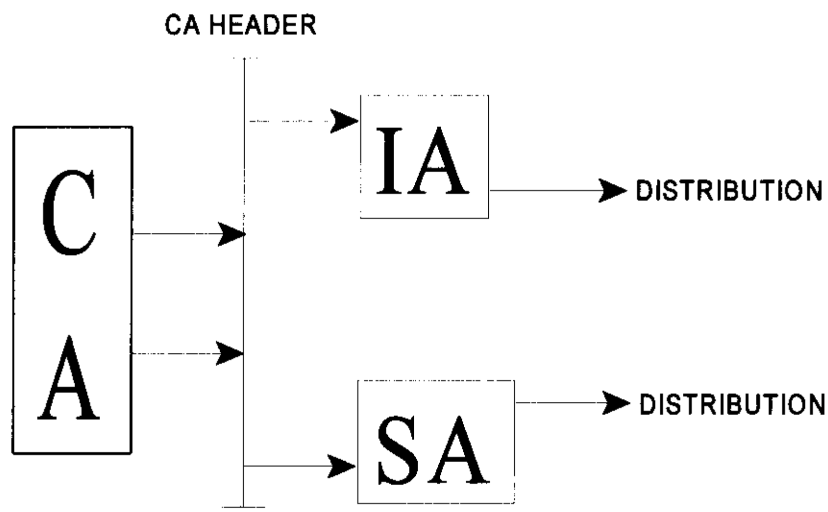

Figure 1 - Instrument/Service Air System Block Diagram

A. The Compressed Air System (CA) supplies compressed air at 100 - 125 psig for the two subsystems on a demand basis, and does not directly supply any end use.

B. The Instrument Air subsystem (IA) distributes compressed air at 0 - 20 psig to HVAC and other equipment (pneumatic actuators, control valves, dampers, instruments) throughout the SNF CSB.

C. The Service Air subsystem (SA) distributes compressed air at 100 - 110 psig to the MHM Festoon, to the Sampling/Weld Station, to the Cask Receiving Pit, and for general use (air tools, etc.) to utility stations in the north end of the SNF CSB, near the cask receiving area.

2.2 Operation

2.2.1 The CA begins at the intakes to two identical, two-stage, screw-type air compressors, CX-1A & CX-1B; the air compressors are located in the Instrument Air Equipment Room (Room 015) of the SNF CSB.

2.2.2 The two-stage compressors pressurize air to 125 psig. A 1st to 2nd stage Intercooler and an Aftercooler following the 2nd stage of the compressor reduce the temperature of the compressed air to $\leq$ 120 °F. Two Moisture Separators internal to each compressor remove entrained water droplets from the compressed air. The compressor lubrication system is designed to prevent the entry of oil particles into the air stream, thus delivering oil-free air.

2.2.3 The compressed air is routed through a particulate prefilter to remove remaining entrained water droplets and particulate matter, then enters the Air Dryer DR-1.

2.2.4 DR-1 consists of two drying towers containing activated alumina desiccant (water-absorbing) material, with one tower operating in drying mode while the other tower is in regeneration mode. Compressed air from the compressors passes through the active desiccant tower, where almost all of the water vapor contained in the air is adsorbed onto the desiccant. The dry, compressed air is routed through a particulate afterfilter to remove any entrained desiccant particles, then enters Air Receiver VX-1 as "Service Air".

2.2.5 VX-1 is a large 340 ft^3 cylindrical vessel provided as air reservoir and surge volume for dampening pressure and volume fluctuations. Dry, oil- and particulate-free compressed air from VX-1 enters the SA header, which supplies the IA and SA systems at 100 - 125 psig.

2.2.6 The IA splits-off from the SA header in the Instrument Air Equipment Room. Dry, oil- and particulate-free Service Air is first reduced to 85 psig by Pressure Control Valve PCV-250. Service Air at 85 psig is routed to the Load-in/ Load-out area from the SA header; then, following Pressure Control Valve PCV-261, the air pressure is further reduced to 20 psig for distribution as Instrument Air in IA piping to HVAC and other equipment (pneumatic actuators, control valves, dampers, instruments, etc.) requiring Instrument Air.

2.2.7 The SA begins at the outlet of the Air Dryer in the Instrument Air Equipment Room (Room 015). Dry, oil- and particulate-free compressed air is regulated to 110 psig by Pressure Control Valve PCV-252. SA at 110 psig is routed for distribution by SA piping to the MHM Festoon, Sampling/Weld Station Gantry Cranes, Pump P-4 of the Liquid Waste Collection System, into Pit G (which provides between-rail utilities for the Cask Receiving area), and to standard utility connection stations spaced approximately every 100 feet along the SA lines in the north end of the SNF CSB, near the MCO Receiving Area.

2.3 Configuration

2.3.1 Compressed Air (CA) system:

A. The CA system interfaces with the following systems:

- The Normal Electrical Distribution System (NED) provides electrical power for compressor operation
- The Distributed Control System (DCS) provides General Alarm annunciation for the Air Compressors and the Air Dryer
- The CA system provides compressed air to the IA and SA sub-systems.

B. All CA equipment is located in the Instrument Air Equipment Room of the SNF CSB.

2.3.2 Instrument Air (IA) subsystem:

A. The IA subsystem interfaces with the following systems:

- The IA draws its compressed air from the SA at the SA header, downstream of VX-1 in the Instrument Air Equipment Room
- The IA supplies compressed air to HVAC and other equipment (e.g., pneumatic actuators, control valves, dampers, instruments, etc.).
- The IA supplies compressed air to instruments on the Air Compressor local control panels.

B. IA piping and equipment is located throughout the SNF CSB.

2.3.3 Service Air (SA) subsystem:

A. The SA subsystem interfaces with the following systems:

- The SA receives compressed air from the CA at the discharge of Air Dryer DR-1 in the Instrument Air Equipment Room (Room 015)
- The SA supplies compressed air to the IA subsystem from the SA header downstream of VX-1 in the Instrument Air Equipment Room
- The SA supplies compressed air to the MHM Festoon system to supply the MHM.
- The SA supplies compressed air to utility stations throughout the northern end of the SNF CSB for use by air-driven tools and equipment

B. SA piping and equipment is located throughout the SNF CSB.

2.4 Requirements

2.4.1 Compressed Air System (CA):

A. *Design Requirements*: The CA must supply a volume of air 30% greater than the maximum simultaneous demand from both the IA and SA subsystems, at a pressure of up to 125 psig and maximum temperature of 120 °F. (See Table 1, *Compressed Air Load List*, for determination of the maximum system demands). The compressors are each capable of delivering 200 scfm.

B. *Operational Requirements*: CA operational requirements are given in the following table:

REQUIREMENT	VALUE
Oil and Particulate content	< 1 ppm
Suspended particles	≤ 3.0 microns
Dew point	- 40 °F
CA Header pressure	100 - 125 psig

- *Air Compressor High Temperature Alarms* must be responded to quickly, as the compressors may be damaged or destroyed by excessive temperatures during operation.
- *Air Dryer High Moisture* and *Failure to Switch Dryer* alarms must be responded to quickly, as instrumentation and equipment using Instrument Air becomes unreliable and unpredictable when exposed to excess moisture in the Instrument Air stream.

Table 1 - Compressed Air Load List

AIR SYS	USER SYSTEM	P&ID NUMBER H-2-	EQUIPMENT NUMBER	TYPICAL EQUIPMENT DESCRIPTION	NORMAL SA FLOW	MAXIMUM SA FLOW	NORMAL IA USAGE	MAXIMUM IA FLOW
					SCFM	SCFM	SCFM	SCFM
IA	HVAC	129580, 129582 - 129585, 129587	VARIOUS	HVAC Actuators, Dampers, control valves, and associated instrumentation			10	15
IA	MHM	**	VARIOUS	**	**	**		
SA	UTILITY STATIONS	123392	N/A	AIR TOOL-Typical 1-1/4" Steel drill*	0	50		
SA	UTILITY	123392	N/A	AIR TOOL-Typical 8" Wheel Grinder*	0	25		
MAXIMUM SIMULTANEOUS FLOW					0	75	10	15

TOTAL DEMAND (INCLUDES 15 SCFM INSTRUMENT AIR): 90
REQUIRED CAPACITY (30% OVERSIZE): 120

* Load factor of 0.5 ** Information may be obtained in the MHM System Design Description provided by the manufacturer

C. *Maintenance and Surveillance Requirements*:

- CA subsystem Pressure Indicators will be calibrated yearly
- CA subsystem Temperature Indicators will be calibrated yearly
- Air Dryer Moisture Indicator MI-1 will be checked frequently for indication of moisture and the indicating material replaced as needed
- Air Compressor Inlet Filter vacuum must be checked weekly, and the Inlet Filters replaced at least every six months or sooner, based on weekly checks (see I-R APDD 590B-95 § 4.4 "Standard Inlet Air Filter")
- Air Compressor oil and oil filter is changed after the first week (150 hours) of operation, and once per year (8,000 hours) thereafter (see I-R APDD 590B-95 § 4.6 "Oil and Oil Filter")
- Air Compressor Drive Motor lubrication is performed every three months, and Air Compressor Fan Motor lubrication is performed once per year (see I-R APDD 590B-95 § 4.10 "Motor Lubrication")
- Air Dryer Dew Point Monitor must be checked and calibrated yearly
- Air Dryer Solenoid and butterfly valve diaphragms and seats are replaced yearly
- Air Dryer Prefilter F-5 and Afterfilter F-6 elements are replaced yearly
- Air Compressor Condensate Strainers are inspected once per year (see I-R APDD 590B-95 § 4.9 "Condensate Strainers")
- The Dryer Prefilter drain valve and Dryer System Monitor Lights (on the Compu-Purge Controller panel) must be checked daily
- Dryer Exhaust Mufflers, Dryer Filter ΔP indicators, and Dryer Purge Exhaust valves must be checked weekly

- Dryer Desiccant is inspected yearly for oil contamination and broken desiccant (see I-R Bulletin 342 Rev. D, p. 9 for inspection criteria and Desiccant replacement instruction).

- Air Receiver VX-1 is an ASME pressure vessel which is inspected yearly. A bypass line is provided so the vessel can be opened for inspection without interruption of CA system operation.

- Safety (relief) valves PSV-246 (mounted on Dryer Inlet Shuttle valve CA-V-11) and PSV-249 (mounted on Air Receiver VX-1) must be tested and inspected every two years.

2.4.2 Instrument Air subsystem (IA):

A. *Design Requirements*: The IA requires dry, oil- and particulate-free compressed air at 0 - 20 psig and maximum temperature of 120 °F to reliably operate the equipment requiring instrument air. Compressed air meeting this requirement is supplied by the CA. If Instrument Air contains excess oil, moisture, or particulates, instruments and equipment that use Instrument Air may become fouled by the foreign material and begin acting erratically; some controls may begin acting randomly, and may fail in unsafe positions rather than the designed safe positions.

B. *Operational Requirements*: IA operational requirements are given in the following table:

REQUIREMENT	VALUE
Oil and Particulate content	< 1 ppm
Suspended particles	≤ 3.0 microns
Dew point	≤ - 40 °F

- If air pressure is lost, through failure of both compressors or other events, controls and equipment in the SNF CSB which use Instrument Air are designed to fail in a safe position.

C. *Maintenance and Surveillance Requirements*:

- IA subsystem Pressure Indicators PI-250 and PI-287 will be calibrated yearly.

- IA subsystem pressure control valves PCV-250 and PCV-261 will be calibrated yearly.

2.4.3 Service Air subsystem (SA):

A. *Design Requirements*: The SA requires dry, oil- and particulate-free compressed air at 90 - 110 psig and maximum temperature of 120 °F to reliably operate tools requiring compressed air. Compressed air meeting this requirement is supplied by the CA.

B. *Operational Requirements*: SA operational requirements are given in the following table:

REQUIREMENT	VALUE
Oil and Particulate content	< 1 ppm
Suspended particles	≤ 3.0 microns
Dew point	≤ - 40 °F

C. *Maintenance and Surveillance Requirements*:

- SA subsystem Pressure Indicators will be calibrated yearly
- SA subsystem pressure control valve PCV-252 will be calibrated yearly

2.5 Safety

2.5.1 *Potential Safety Hazards and Concerns*

A. Hazards of the Instrument/Service Air system include rotating and remote-start equipment, high noise levels from venting air, and possible high temperatures at some points in the system. Proper precautions, including proper use of Personal Protective Equipment appropriate to the hazard expected, should be taken.

B. If the CA becomes inoperable due to a power failure or other event, the VX-1 Air Receiver is sized to supply 15 scfm to the CA header for 40 minutes at normal loads.

C. Redundant air compressors are provided to improve plant availability in allowing for maintenance activities without disrupting normal operations; redundancy is not required for plant safety.

2.5.2 *Safety Classification*: The CA system, and the IA and SA subsystems of the Instrument/Service Air system are classified as General Service (GS) because they are not required to mitigate an accident or to operate after an accident, and provides a limited function in protecting the facility worker from industrial and radiological hazards.

Loss of the Instrument/Service Air System has no direct safety impact on any facility workers. A portable air supply can be brought into the facility if compressed air is required during an Instrument/Service Air System failure. The point-of-connection will be via line CA-2"-SA-003-G at valve CA-V-30-B (in room 18) or CA-V-30-A (in room 34).

2.5.3 *Quality Level*: All three subsystems of the Instrument/Service Air system are Quality Level II, which indicates that the System and its functioning can be adequately assured with the normal level of Quality Assurance as implemented by the Operating Contractor Quality Assurance Program Plan.

2.5.4 *Environmental Safety*: The SNF CSB does not have any connections to a chemical sewer or other means of direct disposal of hazardous chemical waste. All hazardous wastes generated during maintenance or other activities within the facility must be safely contained at the point of generation (i.e., fluids drained into buckets, rags and other materials placed in plastic bags), and removed to some other facility having suitable means of safe hazardous material disposal.

2.6 References

2.6.1 Drawings relating to or referenced in this document are:

DWG #	DRAWING TITLE
H-2-122733 Sheets 1 - 5	Electrical Canister Storage Building One Line Diagram (MCC-32-209, MCC-32-210)
H-2-122744	Electrical Canister Storage Building Panel Schedules
H-2-123392	P&ID Instrument/Service Air System
H-2-125160 Sheet 1	Piping Operating/Support Areas Compressed Air/MCO Vac Plan
H-2-125160 Sheets 2 & 3	Piping Operating/Support Areas Compressed Air/MCO Vac Plan, Sections & Details
H-2-125161	Piping Operating/Support Areas Compressed Air/MCO Vac Plan
H-2-125163 Sheet 1	Piping Operating/Support Areas compressed Air/MCO Vac Sections and Details

DWG #	DRAWING TITLE
H-2-125163 Sheet 2	Piping Operating Area Section Compressed Air/MCO/VAC Sections & Details
H-2-125163 Sheet 3	Piping Operating/Support Areas Miscellaneous Sections and Details
H-2-125164	Piping Operating/Support Areas Compressed Air/MCO Vent Sections and Details

2.6.2 Documents relating to or referenced in this document are:

DOCUMENT #	DOCUMENT TITLE
HNF-PRO-704	Hazard and Accident Analysis Process
HFF-3553	Annex A, Canister Storage Building Final Safety Analysis Report, Section 2.8.5, "Instrument and Plant Air System"
SNF CSB System Safety Classification Forms	Section 96-05-04-02, Air Supply
N/A	Design Basis Document, Section 2, Process Systems
Ingersoll-Rand APDD 565A-94 (December 1994)	Intellisys System Controller Operators Instruction Manual / Parts List
Ingersoll-Rand Ref: 7904	Intellisys System Controller
Ingersoll-Rand APDD 590-B-95 (September 1995)	Sierra® 50 - 100 Horsepower All Units Operators Instruction Manual
Ingersoll-Rand APDD 618A-95 (September 1995)	Sierra® 50 - 100 Horsepower All Units Parts List Recommended Spares
Ingersoll-Rand Ref: 9300/9301/ 9302/9304	Sierra® 50 - 100 HP Air Cooled
Ingersoll-Rand Ref: 9000/9001/ 9002/9003	Sierra® Oil-Free Rotary Screw
Ingersoll-Rand Documents	Compressor Factory Acceptance Test Certifications
Ingersoll-Rand Sierra Team Work Instruction 10WI018 Rev. 0	SIERRA 50-200 HP Production Test (Factory Acceptance Test)

DOCUMENT #	DOCUMENT TITLE
Ingersoll-Rand Drawing # 39848791 Rev. 4 Sheets 1 - 2	Plan. Foundation Standard Air Cooled
Ingersoll-Rand Drawing # 39538061 Rev. 5	Transducer, Pressure
Ingersoll-Rand Drawing # 39541685 Rev. 1	Transducer, Pressure (0 - 100 psig)
Ingersoll-Rand Drawing # 39541693 Rev. 1	Transducer, Pressure
Ingersoll-Rand Drawing # 39568092 Rev 3	Sensor, RTD – .25 NPT
Ingersoll-Rand Drawing # 39843677 Rev. 5	Process and Instrumentation Diagram NLTS Air Cooled
Ingersoll-Rand Drawing # 39861901 Rev. 5	Schematic, Wiring Star Delta
Ingersoll-Rand Ref: 11501 Ingersoll-Rand Ref: 11502 Ingersoll-Rand Ref: 11503 Ingersoll-Rand Ref: 11504	Compressed Air Filters Data Sheets
Ingersoll-Rand Ref: 11221 Ingersoll-Rand Ref: 11222 Ingersoll-Rand Ref: 11223 Ingersoll-Rand Ref: 11224 Ingersoll-Rand Ref: 11226	Heatless Dryer HRD Data Sheets
Ingersoll-Rand bulletin 342 Rev. D (9/96)	HRD Heatless Compressed Air Dryers with Compu-Purge Control HRD Series Operator's Instruction Manual
Roy E. Hansen, Jr. Mfg. AF-783-B-1A	Instrument/Plant Air Receiver Vessel Nameplate Markings
Roy E. Hansen, Jr. Mfg. AF-783-B	Instrument/Plant Air Receiver Shop Drawing
W-379-C-CSB-13432	Instrument/Plant Air Receiver
W-379-C-CSB-15061	Piping Material, Fabrication, Erection, and Pressure Testing
W-379-C-CSB-15152	Instrument/Plant Air Compressors
W-379-C-CSB-15880	Instrument Air Dryer System

DOCUMENT #	DOCUMENT TITLE
W-379-C-CSB-16150	Motors - Induction for General Service
W-379-C-CSB-17601	Temperature Transmitters - Electronic
W-379-C-CSB-17612	Resistance Temperature Detectors
W-379-C-CSB-17614B	Thermocouples
W-379-C-CSB-17621	Self-Actuated Pressure Gauges
W-379-C-CSB-17626 W-379-C-CSB-17626B	Pressure Gauges
W-379-C-CSB-17663 W-379-C-CSB-17663B	Pressure Relief Valves
W-379-C-CSB-17667	Pressure Switches
W-379-C-CSB-17670	Solenoid Valves
W-379-C-CSB-17682C	Current to Pneumatic Converters
W-379-C-CSB-17703 W-379-C-CSB-17703B	Instrument Piping Materials
W-379-C-CSB-17704 W-379-C-CSB-17704B	General Instrumentation Installation and Testing
W-379-C-CSB-17705 W-379-C-CSB-17705B	Instrument Calibration and Checkout
W-379-C-CSB-17708 W-379-C-CSB-17708B	Instrument Piping Pressure Testing
W-379-C-CSB-17861 W-379-C-CSB-17861B	Local Control Panels
W-379-C-CSB-17864 W-379-C-CSB-17864B	Instruments Furnished with Mechanical Equipment Canister Storage Building

SPENT NUCLEAR FUEL CANISTER STORAGE BUILDING

FIRE PROTECTION SYSTEM (System #3)

SYSTEM DESIGN DESCRIPTIONS

3.0 FIRE PROTECTION SYSTEM DESCRIPTION (SYSTEM #3)

3.1 Function

3.1.1 The Fire Protection (FP) System is designed to supply raw water (RW) to the CSB Wet Pipe Sprinkler System and fire hydrants.

3.1.2 The FP System has two main subsystems: The Fire Detection and Alarm (FD&A) Subsystem and the Fire Automatic Wet Pipe Sprinkler subsystem (AWPS). The FD&A subsystem is designed to detect excessive smoke and heat present in the CSB, and to notify personnel in the CSB Support Area and the Hanford Fire Department for the appropriate emergency response. Upon detection, the AWPS is designed to provide fire suppression for the CSB Support Area and fire hydrants for manual fire fighting.

3.1.3 The raw water portion of the system also supplies fire water for the Fire Water Pump House Wet Pipe Sprinkler System and service water for wash-down and cleaning of equipment, and for filling water trucks that are used for roadway dust suppression, when required.

3.2 Operation

3.2.1 The Fire Protection System consists of the Fire Water Supply (FWS) subsystem that supplies water to the Automatic Wet Pipe Sprinkler (AWPS) subsystem, and the Detection and Alarm subsystem that provides activation of the appropriate alarms and local sprinkler systems inside the support area of the CSB. The operating area deck does not contain any wet pipe sprinklers.

3.2.2 The FWS subsystem delivers raw water from the 12-inch fire water main outside the CSB to the AWPS subsystem. The FWS subsystem operates at a pressure near 125 psig and is designed to a capacity of 1,150 gpm at 98 psig. Water from the FWS subsystem is provided on demand. The FWS subsystem consists of piping, valves, and fire hydrants. Post Indicating Valve (PIV) MV-FWX-311A isolates the 6-inch fire water line to the CSB from the 10-inch fire water line FWX-10"-500-004-RF and from the 12-inch fire water main RWX-12"-500-017-RF. As the water enters the building through a riser, it flows through a backflow preventer. The backflow preventer provides a positive drip-tight closure against the reverse flow caused by a cross connection, and ensures that the water remains contained within the AWPS piping.

3.2.3 The AWPS subsystem receives water from the FWS subsystem for fire suppression. Heat from a fire activates nearby sprinkler heads, initiating water flow. Water within the AWPS subsystem then flows from the FWS subsystem to the open sprinkler heads near the heat source.

3.2.4 The Detector and Alarm subsystem provides notification of fire to facility personnel and sends a radio signal to the Hanford Fire Department (HFD) to summon emergency aid. The Very Early Smoke Detection Alarm (VESDA®) Detector System detects smoke particles in sampled air from the upper portion of the operating area. The VESDA Detector System interfaces with the Fire Alarm Control Panel (FACP) initiating visible and audible alarms and notifying the HFD. The Heating, Ventilating and Air Conditioning (HVAC) duct smoke detectors interface with the HVAC control panel (LP-HV-001) initiating shut down of several HVAC air handling units in addition to visible and audible alarms and notifying the HFD. Also, there are manual fire alarm stations that activate the visible and audible alarms and notify the HFD if facility personnel detect a fire.

3.2.5 The FP System also has a backup water supply available via the Fire Water Pump House (FWPH) System that supplies fire water anytime significant pressure fluctuations occur, raw water system pressure decays or the raw water supply is unavailable. See *System Design Description Fire Water Pump House (FWPH) System (System 20)*.

3.3 Configuration

3.3.1 The Fire Protection System interfaces with the following systems:

- Electrical Distribution (System #1)
- Heating, Ventilating and Air Conditioning (Systems #6 & #7)
- Fire Water Pump House (System #20)
- Self contained battery backup

3.3.2 The Electrical Distribution and Uninterruptible Power Supply Systems provide power to the electrical equipment within the Fire Protection System. When the Detector and Alarm subsystem detects a fire in the ducts, the HVAC control panel (LP-HV-001) shuts down the associated HVAC equipment (i.e., AH-001, AH-002, and AH-003). The Fire Water Pump House System provides a backup source of water to the FWS subsystem.

3.4 Requirements

3.4.1 *Fire Water Supply Sub-System Design Requirements*:

A. The FWPH System distribution system incorporates a Post Indicating Valve (PIV). Sprinkler risers are located at exterior walls. Outside control valves are located a minimum distance of 40-feet from the FWPH and CSB buildings.

B. There is only one valve controlling a sprinkler supply lead-in. All lead-ins are connected with the sprinkler system at the base of the riser. Alarm valves are located as close as practical to the building entry point. Hydrants are provided so that hose lays from hydrants to all exterior portions of the CSB are not more than 300-feet. The hydrants are at least 50-feet from the building.

C. The FP System was designed to the following conditions:

PARAMETER	REQUIREMENT
Design Temperature	100 °F (piping) / – 20 °F - 150 °F (valve)
Design Pressure	150 psig (piping) / 175 psig (valve)
Design Life	40 years
System Flow	1,150 gpm @ 98 psi

3.4.2 *Automatic Wet Pipe Sprinkler Sub-System Design Requirements*: The sprinkler system is wet-pipe and installed per NFPA 13. NFPA 13 is used to determine water supply demand requirements for hose streams (gpm) and duration (minutes). The present system is based on a density of 0.19 gpm for 2,500 square feet. Determination of the adequacy of water supplies is made on the basis of actual flow test measurements gathered using methods in NFPA 13, Appendix B.

3.4.3 *Detector and Alarm Sub-System:* The Fire Alarm System interfaces with the Radio Fire Alarm Reporter (RFAR) Box System. The responsibility of this interface is limited to providing output fire alarm from CSB alarms, including fire, trouble, and supervisory signals. Fire detection and alarm devices are suitably listed by Underwriter's Laboratories (UL) or approved by Factory Mutual (FM). Devices and systems comply with NFPA 72 as applicable (6430.1A section 1530-8.1).

A. System Design:

Fire alarm systems have the following basic features:
(NOTE: Although subsequently replaced, NFPA 72 was the code of record for the design)

- Transmission of signals to the DOE facility fire department alarm center (i.e., HFD) and other constantly attended locations in accordance with the appropriate NFPA Signaling Systems Standard
- Local alarms for the building or zone in alarm
- Trouble signals in accordance with NFPA 72
- Emergency battery backup for system operation
- Electric supervision of circuits in accordance with NFPA 72

- Supervisory devices of critical functions (valve position switches, water level, temperature) in accordance with NFPA 72
- Capability of indicating at least three separate conditions; a) fire alarm, b) a supervisory alarm, c) a trouble signal indicating a fault in either of the first two conditions. Indication of each condition is separate and distinct from the other two.
- By-pass test switches is provided to allow smoke detector testing operation of dampers or shut down HVAC equipment.

B. Automatic Fire Detection Systems:

Smoke detectors are installed in areas required by NFPA 72 or by the cognizant DOE fire protection authority. Smoke detectors are photoelectric type and are installed in accordance with NFPA 72.

C. Fire Barriers:

Confinement systems, particularly the building shell and its associated ventilation system, are designed with the capability of retaining the confinement function during a Design Basis Fire.

Fire resistance requirements is specified by the Fire Hazards Analysis. The Fire Hazards Analysis considers conditions that may exist during normal operations and under special conditions (e.g., during periods of renovation, modification, repair and maintenance, and end-of-life decontamination and decommissioning.). The fire-resistant rating is at least two hours under conditions of failure of any fire suppression system not designed as a safety class item. Penetration through any firewall (i.e., wall separating the Support Area from the Operating Area, Support Area Deck and building exterior walls) incorporates, as a minimum, protection against Design Basis Fire exposures unless greater protection is required by other sections of these criteria (6430.1A para 0110-99.0.6).

3.4.4 *Operational Requirements*: FWPH System operational requirements are given in the following table:

REQUIREMENT	VALUE
Normal Operating Pressure	85 - 125 psig
Detectors and Alarms	Full-Time Operation

3.4.5 *Maintenance and Surveillance Requirements*:

NOTE - Testing and inspection for the Fire Protection System is performed by the Hanford Fire Department (HFD) in accordance with *HNF-PRO-351, Fire Protection System Testing/Inspection and Maintenance*.

A. Manual valves in the FWPH System must be exercised and lubricated at least annually.

NOTE - The surveillance for water leaks threatening erosion around the CSB foundations should be formalized as a surveillance requirement before CSB operation begins.

B. An outdoor surveillance for evidence of underground leaks (which may undermine the CSB foundations) from the 10-inch and 12-inch underground Fire, Sanitary and Raw Water lines located north and east of the facility, and from the smaller water lines in the immediate area of the facility, must be performed at least monthly; or, a flow totalizer must be added to the system and regularly observed.

3.5 Safety

3.5.1 *Potential Safety Hazards and Concerns*: Hazards of the Fire Protection System include:

- High pressure water
- High velocity water flow
- Wet electrical equipment after initiation of sprinklers

Pipe failure could endanger facility personnel because of the high pressure water and high velocity water flow. Inadvertent opening of a sprinkler head by mechanical damage or a heat source other that a fire (e.g., electrical heater).

3.5.2 *Safety Classification*: The FP System is classified as General Service (GS), because it is not required to mitigate an accident or to operate after an accident, and provides a limited function in protecting the facility worker from industrial and radiological hazards. The 6-inch fire water supply enters the Northwest corner of the Support Building, supplying water to the Support Building Automatic Wet Pipe Sprinkler System. There are no Safety Class (SC) or Safety Significant (SS) functions associated with the supply portion of this system. Water leakage from the FWPH System could cause water accumulation and drainage problems. If the leakage was allowed to remain unchecked, the prolonged soaking of the backfilled building perimeter could lead to the premature aging of the below-grade concrete structure. Safety Classification is based on the consequences of system failure.

3.5.3 *Quality Level*: The FP System is Quality Level II, which indicates that its functioning can be adequately assured with the normal level of Quality Assurance as implemented by the Operating Contractor QA Plan.

NOTE - The surveillance for water leaks threatening erosion around the CSB foundations should be formalized as a surveillance requirement before CSB operation begins.

3.5.4 The soil around underground RW and FWX lines must be checked monthly for evidence of leakage, to avoid the risk of building foundation failure resulting from a washout following a break of the lines. This includes the 10-inch FWX-10"-500-004-RF and 12-inch Fire, Sanitary and Raw Water lines to the north and east of the facility, and the smaller underground lines in the immediate area of the facility.

3.5.5 *Environmental Safety*: The SNF CSB does not have any connections to a chemical sewer or other means of direct disposal of hazardous chemical waste. All hazardous wastes generated during maintenance or other activities within the facility must be safely contained at the point of generation (i.e., fluids drained into buckets, rags and other materials placed in plastic bags), and removed to some other facility having suitable means of safe hazardous material disposal available, in accordance with "State Waste Discharge Permit Number ST-4508, as amended" Hanford Site.

3.6 References

3.6.1 Drawings relating to or referenced in this document are:

DWG #	DRAWING TITLE
H-2-117076	Civil Water Lines Plans & Notes
H-2-117077 sheets 1 - 3	Civil Water Lines Sections & Details
H-2-121500	Control Systems CSB Fire Protection Schematic
H-2-122747	Electrical Canister Storage Building Communication and Fire Alarm System Riser Diagram
H-2-122748	Electrical Canister Storage Building Communication and Fire Alarm Plan
H-2-125160 sheet 1	Piping Operating/Support Areas Compressed Air/MCO Vac Plan
H-2-125160 sheet 2	Piping Operating/Support Areas Compressed Air/MCO Vac Plan, Sections & Details

DWG #	DRAWING TITLE
H-2-125163 sheet 3	Piping Operating/Support Areas Miscellaneous Sections and Details
H-2-127156 sheet 1	Piping Operations Support Area Fire Protection Features Floor Plan
H-2-127156 sheet 2	Piping Operations Area Fire Protection Features Floor Plan

3.6.2 Documents relating to or referenced in this document are:

DOC. #	DOCUMENT TITLE
HNF-PRO-351	Fire Protection System Testing/Inspection and Maintenance
HNF-PRO-372	Hanford Fire Department
HNF-SD-SNF-FHA-002	Final Fire Hazard Analysis for the Canister Storage Building
HNF-3553	Annex A, Canister Storage Building Final Safety Analysis Report, Section A2.7.1, Fire Protection Features
N/A	Design Basis Document, Section 2, Process Systems
N/A	Design Basis Document, Section 11, Fire Protection
N/A	Creighton Engineering: Hydraulic Calculations for SNF Canister Storage Building
N/A	Westinghouse Hanford Company HWVP Raw Water and Fire Water System Operation & Maintenance Manual, Volumes: 1 - 3
NFPA 25, 1998	Inspection, Testing and Maintenance of Water Based Fire Protection Systems
NFPA 72, 1996	National Fire Protection Code
ST-4508	Hanford Site State Waste Discharge Permit
W-379-C-CSB-15501	Automatic Wet Pipe Sprinkler System
W-379-C-CSB-15061	Piping Material, Fabrication, Erection and Pressure Testing (Carbon Steel, Iron and Nonmetallic)
W-379-C-CSB-17697	Smoke and Heat Detectors
W-379-C-CSB-2220	Excavation And Backfill

SPENT NUCLEAR FUEL CANISTER STORAGE BUILDING

LIQUID WASTE COLLECTION (System #4)

SYSTEM DESIGN DESCRIPTIONS

4.0 LIQUID WASTE COLLECTION SYSTEM DESCRIPTION (SYSTEM #4)

4.1 Function

The Liquid Waste Collection System (LWC) is designed to collect water condensate from the HVAC Air Handling Unit cooling coils, and provide for transfer of the condensate to Department of Transportation (DOT)-certified containers for disposal. The LWC is not to be considered a floor drain or fire suppression water catchment.

4.2 Operation

4.2.1 Condensate that gathers on the cooling coils of the HVAC air handling units in the HVAC Equipment room of the SNF CSB drips into drip pans, then drains to Liquid Collection Sump SU-1. A maximum condensate generation rate of approximately 1 gallon per hour for 8 hours per day is expected, based on assumed HVAC operating time and maximum humidity levels.

4.2.2 When the water level in sump SU-1 reaches 50% (12 inches, 55 gallons) as sensed by Level Sensor LSH-119, DCS Alarm LAH-119 is activated.

4.2.3 After Alarm LAH-119 activation, an operator positions a container meeting DOT transportation requirements (as found in 49CFR171 & 49CFR172) next to Pump P-4, which is mounted near the sump and connected to the Service Air (SA) system with block valves, an air filter, and a regulator. The operator connects a suction hose to P-4, a discharge hose to the Dynamic Surge Suppressor (also known as a pulsation damper) mounted downstream of P-4, places the suction hose into the sump, and places the discharge hose into the container. When SA is valved in to the pump motor through the regulator, the pump transfers water from the sump to the container. This process continues until the pump is unable to lower the level any farther or the container is full, and Alarm LAH-119 has cleared.

4.2.4 The contents of the full container are sampled and tested for radiological and chemical contamination. When the contents are released for disposal, the container may be transported to a facility at which the contents can be transferred to the Treatment Effluent Disposal Facility (TEDF). Or, if the contents meet the criteria for discharge under Washington State Waste Discharge Permit ST 4509 for cooling water and condensate, the condensate may be used, as a "best management practice" for lawn irrigation or dust abatement. SNF Operations Management will be responsible for determining disposition of container contents that are found to be in excess of TEDF and/or State Waste Permit release limits.

4.3 Configuration

4.3.1 The LWC interfaces with the following systems:

A. The HVAC System is the primary source of liquid collected in the sump.

B. A sump High Alarm is present on the DCS.

C. The Service Air subsystem (SA) of the Instrument/Service Air System provides 100 psig compressed air to operate Pump P-4.

4.3.2 LWC sump SU-1 is located in the HVAC Equipment room. Pump P-4 is an air-operated pump that is located near the wall, and connected to the SA system with an upstream block valve, an air filter, a regulator, and a downstream "Bleed-type" Master air valve. The Dynamic Surge Suppressor is located near P-4, and connected to the discharge of P-4.

4.4 Requirements

4.4.1 *Design Requirements*: LWC design requirements are given in the following table:

REQUIREMENT	VALUE
Sump Construction	Impervious to water
Sump volume	110 gallons
Pump design flow	10 gpm
Pump design pressure	29.2 psig
Pump design temperature	110 °F
Pump design differential head	69.3 feet

4.4.2 *Operational Requirements*: LWC operational requirements are given in the following table:

REQUIREMENT	VALUE
Sump volume	110 gallons
Pump discharge pressure	29.2 psig
High Level Alarm (LAH-119)	12 inches / 55 gallons

4.4.3 *Maintenance and Surveillance Requirements*:

A. Pump P-4 must be inspected and cleaned in accordance with Plant Administrative Requirements.

B. Sump SU-1 must be cleaned and inspected in accordance with Plant Administrative Requirements.

C. The Dynamic Surge Suppressor must be cleaned and inspected in accordance with Plant Administrative Requirements.

4.5 Safety

4.5.1 *Potential Safety Hazards and Concerns*: There are few hazards associated with the LWC. Ear protection should be worn during Liquid Waste Collection Pump P-4 operation in accordance with site industrial safety requirements. Fifty-five gallons of water weighs approximately 450 pounds, and the container must be moved only with the appropriate handling equipment to avoid injury.

4.5.2 *Safety Classification*: The LWC System is classified as General Service (GS) because it is not required to mitigate an accident or to operate after an accident, and provides a limited function in protecting the facility worker from industrial and radiological hazards.

4.5.3 *Quality Level*: The LWC is Quality Level II, which indicates that functionality can be adequately assured with the normal level of Quality Assurance as implemented by the Operations Contractor Quality Assurance Plan.

4.5.4 *Environmental Safety*:

A. The SNF CSB does not have any connections to a chemical sewer or other means of direct disposal of hazardous chemical waste. All hazardous wastes generated during maintenance or other activities within the facility must be safely contained at the point of generation (i.e., fluids drained into buckets, rags and other materials placed in plastic bags), and removed to some other facility having suitable means of safe hazardous material disposal.

B. The LWC System functions by pumping condensate collected from the HVAC Air Handler Cooling Coils in a local sump into a DOT-certified container. This effluent discharge is considered potentially contaminated and is handled and stored according to radioactive liquid disposal regulations.

NOTE - Washington State Waste Discharge Permit ST 4509 (for the Hanford Site) will be approved before the CSB begins operations.

C. If LWC condensate meets the criteria for discharge under the State Waste Discharge permit for cooling water and condensate discharges, the condensate may be used, as a "best management practice" for lawn irrigation or dust abatement, or it may be sent to the TEDF.

D. If LWC condensate exceeds the State Waste Discharge permit and/or TEDF release limits, SNF Operations Management will be responsible for determining the means of disposal of the condensate.

4.6 References

4.6.1 Drawings relating to or referenced in this document are:

DWG #	DRAWING TITLE
H-2-123395	P & ID Liquid Waste Collection System

4.6.2 Documents referenced in this document are:

DOC. #	DOCUMENT TITLE
N/A	Design Basis Document, Section 2, Process Systems
HNF-PRO-704	Hazard and Accident Analysis Process
HNF-3553	Annex A, Canister Storage Building Final Safety Analysis Report, Section A2.8.6, Liquid Waste Collection
SNF CSB System Safety Classification Forms	Section 96-05-04, CSB Support Building
Code of Federal Regulations Title 49--Transportation; Chapter I--Research and Special Programs Administration, Department of Transportation	Part 171--General Information, Regulations, and Definitions
	Part 172--Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
W-379-C-CSB-15138	Air Diaphragm (Sump) Pump
W-379-C-CSB-17674	Level Switches
Graco® #308-178 Rev. A.	Instructions - Parts List: Dynamic Surge Suppressor for use with Double-Diaphragm Pumps and Low Pressure Reciprocating Pumps

DOC. #	DOCUMENT TITLE
Graco® #308-479 Rev. A.	Instructions - Parts List: Aluminum and Stainless Steel Husky™ 1040 Air-Operated Diaphragm Pumps
Warrick Controls Form 70	Type 1XXXX Liquid Level Controls Installation Instructions and Operation
Warrick Controls Form 173A	Recommended Electrode Fitting Grounding Methods

SPENT NUCLEAR FUEL CANISTER STORAGE BUILDING

COMMUNICATIONS (System #5)

SYSTEM DESIGN DESCRIPTIONS

5.0 COMMUNICATIONS SYSTEM DESCRIPTION (SYSTEM #5)

5.1 The Communications (COM) System Design Description is based on information provided by U.S. West Communications and will be provided at a later date.

SPENT NUCLEAR FUEL CANISTER STORAGE BUILDING

HEATING, VENTILATING, AND AIR CONDITIONING (Systems #6 and #7)

SYSTEM DESIGN DESCRIPTIONS

6.0 HEATING, VENTILATING AND AIR CONDITIONING SYSTEM DESCRIPTION (SYSTEMS #6 AND #7)

6.1 Function

6.1.1 The Heating, Ventilating, and Air Conditioning (HVAC) system is designed to act, along with physical barriers, as a part of the SNF CSB contamination confinement system to ensure contamination control within the building. The HVAC System provides a pressure gradient air flow of outside air inward through non-contaminated areas to potentially contaminated areas of the building, and out through HEPA filters and a monitored exhaust. The HVAC system also provides climate control to ensure that environmental conditions within the building are maintained in the required ranges for personnel and equipment. The HVAC System consists of two subsystems:

A. The Operating Area (OA) HVAC subsystem (OHVAC) uses forced-air ventilation to maintain required OA and HVAC Equipment room temperatures and contamination control.

B. The Support Area HVAC subsystem (SHVAC) uses forced-air ventilation to maintain required Support Area temperatures and contamination confinement for potentially contaminated rooms ("Entry-related rooms", i.e., those rooms located between airlocks) in the Support Area.

6.2 Operation

6.2.1 The OHVAC subsystem provides ventilation, air conditioning, and contamination confinement for the Operating Area of the building. The OHVAC recirculates air through the OA and HVAC Equipment rooms, with a continuous outside air makeup and HEPA-filtered exhaust which is continuously monitored for contamination. Air is drawn from outside the building through Electric Duct Heater CSB-EH-002 to Air Handling units CSB-AH-001 and CSB-AH-002, where it is mixed with air recirculating from within the OA. After passing through the OA or the HVAC Equipment room, a volume of air (variable, depending on operation of other exhaust systems) is exhausted through HEPA filter unit CSB-PF-001 or CSB-PF-002, associated exhaust fan CSB-EF-001 or CSB-EF-002, and out the main HVAC exhaust stack, where continuous radiation monitoring checks for contamination in the exhaust air. See *Health Protection (HP) System Design Description* for monitoring details. The MCO Sampling/Weld Station has an exhaust duct that is used to exhaust air from the sampling/weld hood out the exhaust stack. This duct is routed from the South wall of the CSB overhead to the OHVAC exhaust inlet plenum for HEPA filtered exhaust out the exhaust stack. See *MCO Sampling/Weld Station (MSW) System Design Description* for more details.

6.2.2 The Support Area subsystem provides ventilation, air conditioning, and contamination confinement for the support areas of the building, including the Control Room, Vestibule and Corridor, UPS room, CAEM room, Utility Rooms, Electrical Equipment room, Regulated Change room, HP office, Step-Off Pad (SOP) room, Bag room, Management office and the Count room. Air is drawn from outside the building through electric duct heater CSB-EH-001 to air handling unit CSB-AH-003 and passes through all of the support area rooms. Air from "Entry-related" rooms (rooms directly adjacent to the potentially contaminated areas of the building) is exhausted through a HEPA filter and discharged to the HVAC Equipment room through air handling unit CSB-AH-004.

6.3 Configuration

6.3.1 The HVAC System interfaces with the following systems:

A. The Normal Electrical Distribution system (NED) provides electrical power for HVAC equipment operation

B. The Instrument/Service Air system (ISA) provides dry, oil and particulate-free compressed air regulated to 20 psig for HVAC equipment requiring compressed air for operation (pneumatic actuators, dampers, instruments, etc.)

C. Smoke Detectors within the return ducts of CSB-AH-001, CSB-AH-002, and CSB-AH-003 provide smoke detection for the HVAC Systems

D. The Liquid Waste Collection (LWC) System receives condensate from CSB-AH-001, CSB-AH-002, and CSB-AH-003 cooling coils

E. The Support Area subsystem (SHVAC) interfaces with the OHVAC in the HVAC Equipment room; part of the Support Area air is exhausted through air handling unit CSB-AH-004 into the HVAC Equipment room, where it joins the OHVAC airstream.

6.3.2 Electric duct heaters of the OHVAC and SHVAC subsystems are located on the inlet ducts for those systems, in the HVAC Equipment Room.

6.3.3 Air Handling units of the OHVAC and SHVAC subsystems are located in the HVAC Equipment room; ductwork for the HVAC System extends throughout the OA.

6.3.4 Air cooled condensing units serving the Air Handling units of the OHVAC and the SHVAC Heat Pump unit are located outside, on the north side of the building.

6.3.5 Exhaust HEPA Filters for the OHVAC subsystem are located in the Filter Room, within the HVAC Equipment room.

6.3.6 Exhaust Fans for the OHVAC subsystem are located in the HVAC Equipment room.

6.4 Requirements

6.4.1 OHVAC subsystem:

A. *Design Requirements*: The OHVAC subsystem must supply the following airflows to provide proper environmental and contamination confinement control:

AIRFLOW	VALUE
Intake	6,750 cfm
Supply to OA and HVAC Equipment room	44,000 cfm
Recycle from OA & HVAC Equipment room	37,250 cfm
Exhaust	9,000 cfm (max)

B. *Operational Requirements*: OHVAC operational requirements are given in the following table:

REQUIREMENT	VALUE
Operating Area temperature, normal operations	60 - 85 °F
HVAC Equipment room temperature, normal operations	55 - 95 °F
OA operating pressure	Negative to Outside Air Pressure
Filter Room operating pressure	Negative to Outside Air Pressure

C. *Maintenance and Surveillance Requirements*:

- Air Handlers CSB-AH-001 & -002 filters will be changed as specified in the vendor information
- Exhaust HEPA Filters CSB-PF-001 & -002 will be changed as specified in the vendor information
- HVAC Pressure Indicators will be calibrated yearly
- HVAC Temperature Indicators will be calibrated yearly
- OHVAC Pressure Indicators will be tested yearly.
- OHVAC Pressure Indicators will be calibrated yearly.
- HVAC Exhaust Stack Flow Instrumentation will be tested AND Calibrated yearly.
- OHVAC Duct Heater CSB-EH-002 will be inspected yearly.
- Condensing Units CSB-CU-001 &-002 will be inspected and cleaned as specified in the vendor information.
- OHVAC components and conditions will undergo surveillance as specified by the Facility Operations department

6.4.2 SHVAC subsystem:

A. *Design Requirements*: The Support Area subsystem must supply 3,100 cfm of air to the office areas to provide proper environmental and contamination confinement control.

B. *Operational Requirements*: Support Area operational requirements are given in the following table:

REQUIREMENT	VALUE
Support Area temperature	72 - 78 °F
Entry-related rooms operating pressure	Negative to Outside Pressure

C. *Maintenance and Surveillance Requirements*:

- Air Handlers CSB-AH-003 & -004 Filters will be changed as specified in the vendor information.
- Condensing Unit CSB-CU-003 will be inspected and cleaned as specified in the vendor information
- SHVAC components and conditions will undergo surveillance as specified by the Facility Operations department

6.5 Safety

6.5.1 *Potential Safety Hazards and Concerns*: Hazards of the HVAC System include rotating equipment hazards from operating fans, electrical shock hazard from Fan motors, and contamination hazards from airflows through potentially contaminated areas. The SNF CSB is not anticipated to have any contaminated areas, only a potential for contamination.

6.5.2 *Safety Classification*: Most of The Heating, Ventilation, and Air Conditioning (HVAC) System is classified as General Service (GS), because it is not required to prevent or mitigate an accident or to operate after an accident, and provides only a limited function in protecting the facility worker from industrial and radiological hazards. The only exception to the majority of the HVAC System is the Sampling/Weld Station Exhaust System, which is classified as Safety Significant (SS).

The CSB HVAC System has two major subsystems, the Operating Area HVAC (OHVAC) subsystem and the Support Area HVAC (SHVAC) subsystem. The OHVAC provides temperature and pressure control for the Operating Area of the CSB. The SHVAC provides temperature and pressure control and fresh air for the CSB Support Building. The CSB HVAC System also provides a safety function of fire protection via fusible-link fire dampers, and duct-mounted smoke detectors.

There are no identified failures of the HVAC system that result in Safety Class (SC) or Safety Significant (SS) consequences. Failure of the OHVAC subsystem may allow the air temperature in the OA to become unacceptable for working over the deck for long periods of time, if any leaking MCOs are present, but no significant releases will result from failure of the OHVAC subsystem. Similarly, the failure of the SHVAC may result in undesirable working temperatures, but no releases will result from a failure of the SHVAC subsystem.

Failure of either HVAC subsystem will create potentially harmful working conditions for personnel who must work in the CSB. These conditions include excessively hot or cold temperatures (depending on time of year and work locations) and slightly increased exposures to radioactive gases. HVAC ductwork that is installed over the Operating Deck (including the SC Overpack Storage Tube Plugs), the MHM, the Service Station, and the Receiving Crane is designed to not fall and potentially cause damage to those pieces of equipment, or to personnel.

Features which constitute a confinement barrier for the MCO during sampling activities provide for continuity of primary confinement. Those features are classified as SS because no credible consequences of greater than SS level would occur as a result of their absence. Included in this category are HEPA Filter FH-009, the Sample Hood BARR-002, the Weld Hoods BARR-003 A & B, and the hood exhauster AH-006 and HEPA Filter, as well as appropriate piping and tubing.

6.5.3 *Quality Level*: The HVAC System is Quality Level II, indicating that functionality can be adequately assured with the normal level of Quality Assurance as implemented by the Operating Contractor Quality Assurance Plan.

6.5.4 *Environmental Safety*: The SNF CSB does not have any connections to a chemical sewer or other means of direct disposal of hazardous chemical waste. All hazardous wastes generated during maintenance or other activities within the facility must be safely contained at the point of production (i.e., fluids drained into buckets, rags and other materials placed in plastic bags), and removed to some other facility having suitable means of safe hazardous material disposal.

6.5.5 *Environmental Compliance*: The HVAC System functions by drawing air inward from inside the building to sweep any potential contaminants into the HVAC discharge HEPA Filters for containment.

Because the HVAC System thus has a potential to release radioactive contaminants to the atmosphere, the following documents control the operation of the SNF CSB HVAC System:

- HNF-AOP-97-1, *Hanford Site Air Operating Permit*
- DOE/RL-96-SD-195 Rev. 1, *Notice of Construction for State of Washington Department of Health, Phase 2 Spent Nuclear Fuel Canister Storage Building, Project W-379*

6.6 References

6.6.1 Drawings relating to or referenced in this document are:

DRAWING #	DRAWING TITLE
H-2-121202 sheets 1 - 4	Control Systems Canister Storage Building * Location Plan (* = HVAC, Generator, Instrument Air, & Storage Tubes)
H-2-122733 sheets 1 - 5	Electrical Canister Storage Building One Line Diagram (MCC-32-209, MCC-32-210, Overall, Generator 1A, Generator EG-1B)
H-2-129410	HVAC Legend and Symbols
H-2-129411	HVAC Operating Area Partial Plan
H-2-129412	HVAC Operating Area Partial Plan
H-2-129413	HVAC Operating Area Partial Plan
H-2-129414	HVAC Operating Area Partial Plan
H-2-129415	HVAC Operating Area Section
H-2-129416	HVAC Support Area Plan
H-2-129417	HVAC Support Area Sections & Details
H-2-129418	HVAC Support Area Partial Roof Plan
H-2-129419	HVAC Support Area Sections and Details
H-2-129420	HVAC Support Area Details
H-2-129421	HVAC Refrigeration Piping Isometric
H-2-129422	HVAC Small Exhaust Stack Arrangement
H-2-129423	HVAC Support Area Equipment Schedules
H-2-129450, Shts. 1- 4	HVAC Sampling Station Floor Plan
H-2-129455	HVAC Sampling Station Flow Diagrams
H-2-129580	HVAC System Composite Diagram
H-2-129582	P & ID HVAC Operating Area CSB-AH-001
H-2-129583	P & ID HVAC Operating Area CSB-AH-002
H-2-129584	P & ID HVAC Operating Area CSB-PF-001
H-2-129585	P & ID HVAC Operating Area CSB-PF-002
H-2-129586 Shts. 1- 2	P & ID HVAC Operating Area Exhaust Stack Monitoring
H-2-129587	P & ID HVAC Support Area Equipment

6.6.2 Documents relating to or referenced in this document are:

DOCUMENT #	DOCUMENT TITLE
N/A	Design Basis Document, Section 3, Safety
	Design Basis Document, Section 6, HVAC
	Design Basis Document, Appendix 10A, Seismic Analysis and Design
DOE/RL-96-SD-195 Rev. 1	Notice of Construction for State of Washington Department of Health, Phase 2 Spent Nuclear Fuel Canister Storage Building, Project W-379
HNF-AOP-97-1	Hanford Site Air Operating Permit
HNF-PRO-704	Hazard and Accident Analysis Process
HNF-3553	Annex A, Canister Storage Building Final Safety Analysis Report, Section A2.7.2, Heating, Ventilating, and Air Conditioning Systems
SNF CSB System Safety Classification Forms	Section 96-05-05, HVAC System
W-379-C-CSB-15010	HVAC Basic Requirements
W-379-C-CSB-15661	Air Cooled Condensing Units
W-379-C-CSB-15763	Air Handling Units
W-379-C-CSB-15771	Split System Heat Pumps
W-379-C-CSB-15817	Electric Duct Heaters
W-379-C-CSB-15820	Miscellaneous Fans (HVAC)
W-379-C-CSB-15840	Ductwork and Accessories
W-379-C-CSB-15880	Instrument Air Dryer System
W-379-C-CSB-15881	Air Filters (HVAC)
W-379-C-CSB-15883	HEPA Filter Housing
W-379-C-CSB-15950	Air Conditioning Indicating Controllers
W-379-C-CSB-15990	HVAC System Testing and Balancing
W-379-C-CSB-17626	Pressure Gauges
W-379-C-CSB-17682	Current to Pneumatic Converters
W-379-C-CSB-17697	Smoke Detectors
C-15661, 1.6.1, 1.6.2, 1.6.3, 1.6.4, 1.6.8	Carrier Form 38AH-7SI: 38AH024-034 Air-Cooled Condensing Units 50/60 Hz Installation, Start-up and Service Instructions

DOCUMENT #	DOCUMENT TITLE
C-15661, 1.6.9	Thompson Mechanical Contractors, Inc., Construction Acceptance Test - 15661: Air-Cooled Condensing Units CU-001 and CU-002
C-15661, 1.6.1	Carrier Form 38AH-4SB: Air-Cooled Condensing Units: Performance Data / Certified Dimension Print
C-15763, 1.6.1	Carrier Form 39T-1APD: Advance product data: 39T Central Station Air-Handling Units (Nominal 2,000 to 55,000 Cfm)
C-15763, 1.6.7	Carrier Form 39T-1SI: 39T Central Station Air Handling Units Installation, Start-up and Service Instructions
C-15771, 1.6.1	Carrier Form 38AQS-1SB: Split System Heat Pump Outdoor Unit: Performance Data / Certified Dimension Print
C-15771, 1.6.8	Carrier Form 38AQS-4SI: 38AQS008 Air-Cooled Split System Heat Pump 50/60 Hz: Installation, Start-up, and Service Instructions
C-15817, 1.6.1	Indeeco Print #931-2-4122-029-A-0: EH-002 Schematic
C-15817, 1.6.1	Indeeco Certified Print: Certified Print for Finned Tubular Electric Duct Heaters
C-15817, 1.6.1	Indeeco Form #20-2066-81-2: Flange Type Finned Tubular Electric Duct Heaters
C-15817, 1.6.1	Indeeco Print #931-2-2122-021-A-0: EH-001 Schematic
C-15817, 1.6.1	Indeeco Form 20-2068-81: Flange Type Finned Tubular Electric Blast Coil Heaters
C-15817, 1.6.1	Honeywell 63-2489: T775A, B, C, D Remote Temperature Controller
C-15817, 1.6.3, 1.6.7	Indeeco form 10-2175-83-13: Installation, Operating and Maintenance Instructions for Indeeco Electric Duct Heaters
C-15817, 1.6.9	Thompson Mechanical Contractors, Inc. Construction Acceptance Test - 15817: Electric Duct Heaters EH-001 and EH-002

DOCUMENT #	DOCUMENT TITLE
C-15820, 1.6.9.0	Thompson Mechanical Contractors, Inc., Construction Acceptance Test - 15820: Miscellaneous Fans EF-001, EF-002, and EF-003
C-15820, 1.6.1, 1.6.2, 1.6.2.A	Aerovent Drawing #R-23377-00 Chg. E: Inlet Flanges Sizes 12 - 79
C-15820, 1.6.1, 1.6.2, 1.6.2.A	Aerovent Drawing #R-23751-00 Chg. B: Type "R" Inlet Vortex Damper for Centaxial SWSI & DWDI Fans
C-15820, 1.6.1, 1.6.2, 1.6.2.A	Aerovent IM-140: Installation and Maintenance: Centrifugal Fans
C-15820, 1.6.1, 1.6.2, 1.6.2.A	Mason Industries Form S-101-4a: Type Z-1225 All-Directional Seismic Snubber Sizes 250-2000
C-15820, 1.6.1, 1.6.2, 1.6.2.A	Aerovent Drawing #R-23376-00 Chg. C: Outlet Flanges for SWSI centrifugal Fans / Sizes 12 - 79
C-15820, 1.6.1, 1.6.2, 1.6.2.A	Mason Industries Form S-201-2: Type SLFH Unhoused Free Standing Mounts Sizes SLFH-A, B, C, 2
C-15820, 1.6.1, 1.6.2, 1.6.2.A	Aerovent Drawing #R-25726-00 Chg. B: SWSI Centrifugal Fans Arrg. 4 - Sizes 12 thru 25 / Rotatable Housings Class I, II, & III Construction
C-15840, 1.6.7, 1.6.8, 1.6.9, 2.1.2.3.G	Safe-Air Form PG-B: Pyro/Gard Fire Damper, Horizontal and Vertical, Model 150, Type B, U.L. Classified
C-15840, 2.1.2.3, 2.1.2.3.F	Northwest Commercial Air, Inc. Submittal Data: Milwaukee Butterfly Valve
C-15840, 2.1.2.3.E	Northwest Commercial Air, Inc. Submittal Data: Ruskin Relief Dampers
C-15840, 2.1.2.3.E	Northwest Commercial Air, Inc. Submittal Data: Ruskin Backdraft Dampers
C-15840, 2.1.2.3.C	Northwest Commercial Air, Inc. Resubmittal Data: Ruskin Manual Dampers
C-15840, 2.1.2.2.C	Northwest Commercial Air, Inc. Submittal Data: Titus Grilles, Registers and Diffusers
C-15840, 2.1.2.4	Air Equipment, Inc.: Breidert Model BGH - Fabricated Gravity - Relief/Intake Ventilators

DOCUMENT #	DOCUMENT TITLE
C-15881, 1.6.6	Thompson Mechanical Contractors, Inc. Construction Acceptance Test - 15881: Air Filters (HVAC)
C-15883, 1.6.1	Flanders/CSC® Technical Manual, Job #: 96508: Final test and inspection data for the Building Exhaust HEPA Filter Housings CSB-PF-001 and CSB-PF-002
C-15883, 1.6.1	Charcoal Service Corporation Control Job No. 96508: Complete System or Housing pressure boundary leak test report
C-15883, 1.6.F	Thompson Mechanical Contractors, Inc. Construction Acceptance Test - 15883: HEPA Filter Housing PF-001 and PF-002
C-15883, 1.6.1.A	Flanders / CSC Job #: 96508: Flanders / CSC Technical Manual: Leak test Reports, Weld Inspection Reports, QC Check List, Installation Check List, Prefilter Certificate of Conformance, and As-Built Drawings
C-15950, 1.6.1	Miscellaneous Catalog Cuts - LP-HV-001
C-15950, 1.6.2	Manufacturer's Installation Drawings and Instructions LP-HV-001
C-15950, 1.6.6	PLCs Plus Document: Test Results Report of the Canister Storage Building (CSB) Heating, Ventilation, and Air Conditioning (HVAC) System Control Panel LP-HV-01 FAT Procedure, Rev. 0
C-15990, 1.6.1, 1.6.3	Penn Air Control, Inc. Document package: Testing and Balancing Qualifications, & Detailed Testing and Balancing Procedures
C-15990, 1.6.7	Thompson Mechanical Contractors, Inc. Construction Acceptance Test - 15990: HVAC System Testing and Balancing
C-17626, 1.6.1, 1.6.2, 1.6.3, 1.6.4	Dwyer Bulletin A-27: Operating Instructions and Parts List, Magnehelic Differential Pressure Gage
C-17682, 1.6.1, 1.6.2, 1.6.3, 1.6.4	ABB Kent-Taylor Form IB-TIP Rev. 2A: technical Manual, Installation / Instructions / Troubleshooting Current to Pressure Transducer: TIP1 Series I/P, "Intrinsically Safe & NEMA 4X"
C-17682, 1.6.1	ABB Kent-Taylor Specification Sheet TIP, Issue 2, October 1995: Mode 1 TIP Field Mounted Current-to-Pressure Transducer

DOCUMENT #	DOCUMENT TITLE
C-17697, 1.6.1	Fire Control Instruments Document 9020-0356/03-95: Vesda® Series Air Sampling Smoke Detector
C-17697, 1.6.1	Fire Control Instruments Document E70-D Installation and Maintenance Instructions, Vesda® E70-D
C-17697, 1.6.1	Moon Security Services Drawing "Wiring Details - Fire Detection System", Rev. 2: Page F-13: "VESDA Wiring Details", Page F-14: "Device Wiring Details", Page F-15: "RFAR Device and Termination Details"
C-17697, 1.6.2, 1.6.4, 1.6.5, 1.6.7	Fire Control Instruments Documents (FAT/CAT): #9020-0370 v.1 "Design Criteria for Air Sampling Systems"; #9000-0351 "Air Sampling Modeling Program User Guide"; Form #VCF-E70-01, "Vesda® Commissioning Form for Vesda® E70-D Systems"
C-17697, 1.6.3	Smoke Detectors, Mfr. Operation & Maintenance Manual - Vesda® by Fire Control Instruments (FCI)

SPENT NUCLEAR FUEL CANISTER STORAGE BUILDING

SANITARY WATER (System #8)

SYSTEM DESIGN DESCRIPTIONS

7.0 SANITARY WATER SYSTEM DESCRIPTION (SYSTEM #8)

7.1 Function

The SW System is designed and limited to supplying a clear water source to the SNF CSB for process and sanitary water use. There are no identified uses for process or sanitary water in the SNF CSB at this time.

The SNF CSB SW System consists of a 2-inch High Density Polyethylene (HDPE) line, designated SWX-2"-490-094-R, running from 3-inch Sanitary Water Supply Main SWX-3"-490-094-R north of the building to an underground blind flange 5 feet north of the north wall of the Support Building.

7.2 Operation

7.2.1 The Sanitary Water System begins outside the north side of the SNF CSB at an underground connection to 3-inch Sanitary Water main SWX-3"-490-094-R. The 2-inch SW line SW-2"-490-094-R is an HDPE line which ends at an underground blind flange five feet north of the north wall of the CSB Support Building.

7.2.2 The overall SW system is intended for small, periodic water uses. The SW system may provide service for future process or sanitary uses at the SNF CSB.

7.2.3 Before the Sanitary Water System may be placed in service, it must be disinfected per WHC-379-C-CSB-15061 Attachment E, *Standard Specification for Disinfecting Sanitary water Systems and Instructions for the use of HPS-112-M Specification for Disinfecting Sanitary Water Systems.*

7.2.4 Water discharge from hydro testing, maintenance, and construction shall be in accordance with Hanford Site State Waste Discharge Permit #ST-4509, and with DOE/RL-97-67, "Best Management Practice Plan for Hydro Testing, Maintenance and Construction on the Hanford Site".

7.3 Configuration

7.3.1 The SW System interfaces with underground 3-inch Sanitary Water Main SWX-3"-490-094-R, located north of the SNF CSB.

7.4 Requirements

7.4.1 *Design Requirements*: The SW System must withstand the conditions as given in the following table:

REQUIREMENT	VALUE
Maximum Design Temperature	120 °F
Maximum Design Pressure	125 psig
System Flow	15 gpm
Line Size	120% of anticipated maximum flow
Design Life	40 years

7.4.2 *Operational Requirements*: The SW System must operate within the following requirements:

REQUIREMENT	VALUE
Normal Operating Pressure	40 - 100 psig

7.4.3 *Maintenance and Surveillance Requirements*:

A. The SW System should require only normal valve maintenance.

NOTE - The surveillance for water leaks threatening erosion around the CSB foundations should be formalized as a surveillance requirement before CSB operation begins.

B. An outdoor surveillance for evidence of underground leaks (which may undermine the CSB foundations) of underground lines from the 2-inch Sanitary Water Service line to the CSB must be performed at least monthly.

7.5 Safety

7.5.1 *Potential Safety Hazards and Concerns*: There are no identifiable safety hazards in the SW System beyond normal industrial hazards.

7.5.2 *Safety Classification*: The SW System is classified as General Service (GS), because it is not required to mitigate an accident or to operate after an accident, and provides a limited function in protecting the facility worker from industrial and radiological hazards. The 2-inch sanitary water supply line is closed off at a blind flange outside the northwest corner of the Support Building, available for connection to any future low-volume uses added to the facility. There are no Safety Class (SC) or Safety Significant (SS) functions associated with this system. Water leakage from the SW System could cause water accumulation and drainage problems. If the leakage was allowed to remain unchecked, the prolonged soaking of the backfilled perimeter could lead to the premature aging of the below-grade concrete structure. Safety Classification is based on the consequences of System failure.

7.5.3 *Quality Level*: The SW System is Quality Level II, which indicates that the System and its functioning can be adequately assured with the normal level of Quality Assurance as implemented by the Operating Contractor QA Plan.

NOTE - The surveillance for water leaks threatening erosion around the CSB foundations should be formalized as a surveillance requirement before CSB operation begins.

7.5.4 The soil around underground SW lines must be checked monthly for evidence of leakage, to avoid the risk of building foundation failure resulting from a washout following a break of the lines.

7.5.5 Before the Sanitary Water System may be placed in service, it must be disinfected per W-379-C-CSB-15061 Attachment E, *Standard Specification for Disinfecting Sanitary Water Systems and Instructions for the use of HPS-112-M Specification for Disinfecting Sanitary Water Systems*.

7.5.6 *Environmental Safety*: The SNF CSB does not have any connections to a chemical sewer or other means of direct disposal of hazardous chemical waste. All hazardous wastes generated during maintenance or other activities within the facility must be safely contained at the point of generation (i.e., fluids drained into buckets, rags and other materials placed in plastic bags), and removed to some other facility having suitable means of safe hazardous material disposal available, in accordance with "State Waste Discharge Permit Number ST-4509, as amended" Hanford Site.

7.6 References

7.6.1 Drawings referenced in this document are:

DRAWING #	DRAWING TITLE
H-2-117076	Civil Water Lines Plans & Notes
H-2-117077 sheets 1 - 3	Civil Water Lines Sections & Details
H-2-125160 sheet 1	Piping Operating/Support Areas Compressed Air/MCO Vac Plan
H-2-125160 sheets 2 - 3	Piping Operating/Support Areas Compressed Air/MCO Vac Plan, Sections & Details
H-2-125163 sheet 3	Piping Operating/Support Areas Miscellaneous Sections & Details

7.6.2 Documents referenced in this document are:

DOCUMENT #	DOCUMENT TITLE
N/A	Design Basis Document, Section 2, Process Systems
N/A	Design Basis Document, Section 13, Civil
ST-4509	Hanford Site State Waste Discharge Permit
DOE/RL-97-67	Best Management Practice plan for Hydro testing, Maintenance and Construction on the Hanford Site
W-379-C-CSB-15061	Piping Material, Fabrication, erection and Pressure Testing (Carbon Steel, Iron and Nonmetallic)
HNF-3553	Annex A, Canister Storage Building Final Safety Analysis Report, Section A2.8.7, Sanitary Water

SPENT NUCLEAR FUEL CANISTER STORAGE BUILDING

BACKUP POWER (System #9)

SYSTEM DESIGN DESCRIPTIONS

8.0 BACKUP POWER SYSTEM DESCRIPTION (SYSTEM #9)

8.1 The Backup Power (BP) System Design Description has been drastically reduced in scope due to the deletion of the Emergency Diesel Generators and associated backup systems.

8.2 The Uninterruptible Power Supply (UPS) System has a self-contained battery back-up power source. The UPS remains energized, for a short period, to allow for continuity of General Service (GS) data collection and monitoring during loss of normal power. See System Design Description, Electrical Distribution (System #1 and #18) for more information for more information on the UPS.

SPENT NUCLEAR FUEL CANISTER STORAGE BUILDING

HEALTH PROTECTION (Systems #10 AND #11)

SYSTEM DESIGN DESCRIPTIONS

9.0 HEALTH PROTECTION SYSTEM DESCRIPTION (SYSTEM #10 AND #11)

9.1 Function

9.1.1 The Health Protection (HP) System is designed to warn plant personnel of hazardous radioactive conditions which may occur as a result of malfunctions or accidents. The complete system provides monitoring, database management, and status reporting.

9.2 Operation

9.2.1 The HP System consists of radiation monitoring equipment and personnel contamination monitors. Personnel exposure data is recorded and processed using the Distributed Control System (DCS).

9.2.2 Local indications such as Count Rate Data and Radiation Field Intensities will be available from each monitor. If alarm conditions exist, there will be local visual and audible annunciation at the monitor, independent of the DCS.

9.2.3 A self-test of each radiation monitor is possible, using an independent check source that can be initiated locally. The check source is designed to test the monitor from the detector through to the DCS (when the device is connected to the DCS).

9.3 Configuration

The individual components of the HP System are located throughout the CSB. Each instrument of the HP System (HP) has the ability to operate independently from the DCS. Not all of the HP instruments are connected to the DCS. The data paths provided from the HP instrument to the DCS enable all data collected by the HP to be stored, compared, and displayed in one central location. The data stored on the Distributed Control System (DCS) could be accessed by other site systems if the interface connections are provided at a later time.

9.3.1 *Multichannel Analyzer (AN-650)*: See Drawing H-2-121101 sheet 2, Item 13. There is one Multichannel Analyzer in the HP System, located on the North wall of the Count Room (room 029) in the CSB. It is mounted between the Automatic Sample Changer and the Germanium (Ge) Detector. The Multichannel Analyzer is used to analyze radiological control samples such as air filters and swipes.

9.3.2 *Automatic Sample Changer (FM-650)*: See Drawing H-2-121101 sheet 2, Item 12. There is one Automatic Sample Changer in the HP System. The Automatic Sample Changer is located on the North wall of the Count Room (room 029) in the CSB. It is mounted to the left of the Multichannel Analyzer. FM-650 is a programmable α/β/γ (Alpha/Beta/Gamma) counting system that will handle up to 50 filters, smears or planchets consecutively.

9.3.3 *Hand and Foot Monitors (HFM-6 and HFM-7)*: See Drawing H-2-121101 sheet 2, Item 22. There are two Hand and Foot Monitors (HFMs) in the HP System, located on the South wall next to the Step Off Pad Room (room 030) of the CSB. HFM-6 and HFM-7 check personnel hands and feet for contamination. The chosen location ensures that personnel leaving the Operations Area can survey themselves before leaving the Radiological Buffer Area (RBA).

9.3.4 *Area Radiation Monitors (ARM-510 to ARM-533)*: See following table for locations and drawing numbers. There are 23 Area Radiation Monitors (ARMs) in the HP System, located throughout the CSB. ARMs monitor the general radiation level in the area where they are installed. Each ARM is provided with a minimum of five decades of detection dynamic range, from 0.01 mR/hr to 1 R/hr. All ARMs have a microprocessor-based rate meter with readouts, including Failure and High Alarms with audible and visual annunciation. ARMs connect to the DCS through a Remote Terminal Unit (RTU). ARMs 528, 529 and 531 are portable and will be used only when extra coverage is necessary.

AREA RADIATION MONITORS: H-2-121101 Sheets 2, 3, & 6				
Sheet #	**Item #**	**Location**	**Room #**	**Designation**
2	# 3	Regulated Change room	035	ARM-510
	# 6	Load in/Load out Area	036	ARM-511
	# 18			ARM-533
	# 29			ARM-525
	# 30			ARM-526
	# 7	Air Lock	025	ARM-512
	# 8	Filter room	037	ARM-513
	# 11	Trailer Vestibule	033	ARM-514
	# 28			ARM-524
	# 16	CAEM room	016	ARM-515
	# 19	Step-off Pad room	030	ARM-516
	# 20	Count room	029	ARM-517

AREA RADIATION MONITORS: H-2-121101 Sheets 2, 3, & 6				
Sheet #	**Item #**	**Location**	**Room #**	**Designation**
3	# 1	Operating Area	003	ARM-518
	# 4			ARM-519
	# 5			ARM-521
	# 6			ARM-522
	# 7			ARM-523
6	# 1	Weld Station Area	039	ARM-532
	# 3			ARM-531*
	# 6			ARM-530
	# 7			ARM-529*
	# 10			ARM-528*
	# 12			ARM-527

* These ARMs are portable and will only be used when extra coverage is required.

9.3.5 *β (Beta) Continuous Air Monitors (CAMs) (CAM-560 to CAM-570)*: See the following table for locations and drawing numbers. There are eight β CAMs in the HP System, including one mounted on the MHM, and one used in Containment Tent BARR-001. β CAMs monitor a pumped airflow for evidence of airborne β contamination. β CAMs are provided with a Geiger-Müller count rate meter. Alarms include Fail and High Radiation. Two of the β CAMs connect to the DCS through Remote Terminal Units (RTU's). β CAMs are located in occupied areas with a high potential for airborne contamination such as the Count room, Maintenance areas, and HVAC equipment areas. CAM-566 is portable and will be used only when extra coverage is necessary.

β (Beta) CAMs: H-2-121101 Sheets 2, 3, 4, & 6				
Sheet #	**Item #**	**Location**	**Room #**	**Designation**
2	# 4	Regulated Change room	035	CAM-560
	# 10	Filter room	037	CAM-561
	# 35			CAM-568
	# 24	Monitor / Decon room	022	CAM-562
3	# 2	Operating Area	003	CAM-563
6	# 5	Weld Station Annex	039	CAM-566*

β (Beta) CAMs: H-2-121101 Sheets 2, 3, 4, & 6				
Sheet #	**Item #**	**Location**	**Room #**	**Designation**
N/A		Containment Tent BARR-001, in Load-in/Load-out area	036	CAM-570 (mounted on a portable cart)

* This CAM is portable and will only be used when extra coverage is required.

9.3.6 *α (Alpha) Continuous Air Monitors (CAMs) (CAM-580 to CAM-585)*: See the following table for locations and drawing numbers. There are six α CAMs in the HP System, including one mounted on the MHM, and one used in Containment Tent BARR-001. α CAMs are essentially similar to β CAMs, in that they require less detector technology, and monitor a pumped airflow for evidence of airborne α contamination. None of the α CAMs are connected to the DCS. CAM-581 is portable and will be used only when extra coverage is necessary.

α (Alpha) CAMs: H-2-121101 Sheets 2, 4, & 6				
Sheet #	**Item #**	**Location**	**Room #**	**Designation**
2	# 9	Filter room 037		CAM-580
	#36			CAM-586
6	# 2	Weld Station Area	039	CAM-581
	# 8			CAM-582
	# 11			CAM-583
N/A		Containment Tent BARR-001, in Load-in/Load-out area	036	CAM-585 (mounted on a portable cart)

9.3.7 *Radioactive Gas Monitors (RGM-622)*: See the following table for locations and drawing numbers. RGMs monitor work areas for radioactive gases potentially liberated from MCOs during work activities. No RGMs are connected to the DCS.

RADIOACTIVE GAS MONITORS (RGMs)			
Drawing / sheet / Item #	**Location**	**Room #**	**Designation**
H-2-123394	Tube Purge Cart	003	RGM-622

9.3.8 *Germanium (Ge) Detector (RE-660)*: See drawing H-2-121101 sheet 2, Item 14. There is one Ge Detector, designated RE-660, in the HP System. The Ge Detector is located on the north wall of the Count room (room 029), to the right of Multichannel Analyzer AN-650.

9.3.9 *Body Frisker (BF-700)*: See drawing H-2-121101 sheet 2, Item 25. There is one Body Frisker (BF) in the HP System, designated BF-700. BF-700 checks personnel whole bodies for contamination. The BF is located at the north exit of the Monitor/Decon room (room 022), such that all personnel leaving the potentially contaminated portions of the CSB will have to pass through the BF to check for radioactive contamination before entering the uncontaminated areas of the building.

9.3.10 *Iodine Monitor (RE-406)*: See drawing H-2-129586 sheet 1. There is one Iodine Monitor in the HP System, mounted inside the CAEM cabinet in the HVAC room (room 019). The Iodine Monitor checks HVAC exhaust airflow for the presence of ^{129}I. The Iodine Monitor incorporates an activated charcoal filter impregnated with potassium iodide (KI). (This monitor may not be calibrated or used).

9.3.11 *Record Air Samplers (RAS-600 to RAS-608)*: See the following table for locations and drawing numbers. There are eight Record Air Samplers (RASs) in the HP System. Record Air Samplers provide a record of the workplace air environment in high-occupancy and frequently-traveled areas of the facility, and are placed to provide continuous monitoring in occupied areas with high potential for airborne contamination.

RECORD AIR SAMPLERS: H-2-121101 Sheets 2, 3, & 6				
Sheet #	**Item #**	**Location**	**Room #**	**Designation**
2	#5	Regulated Change room	035	RAS-600
	#15	Instrument Air Equipment room	015	RAS-602
	#17	CAEM room	016	RAS-603
	#21	Step-off Pad room	030	RAS-604
	#23	HP office	007	RAS-605
3	#3	Operating Area	003	RAS-606
6	#6	Weld Station Area	039	RAS-608
N/A		Mobile Containment Service Tent BARR-001, in Load-in/Load-out area	036	RAS-607

9.3.12 *Continuous Airborne Effluent Monitor (CAEM-1, ST-989)*: See the following table for locations drawing numbers. There is one CAEM unit in the HP System, located in the CAEM room (room 016), and connected to the DCS. CAEM-1, ST-989 monitors HVAC exhaust airflow for radioactive and chemical contamination. CAEM-1, ST-989 is classified as a General Service (GS) continuous airborne effluent monitor.

CONTINUOUS AIRBORNE EFFLUENT MONITOR CAEM-1, ST-989 Internal Instrumentation		
Description	**Drawing #'s**	**Instrument #**
α & β Detector	H-2-121101 sheet 8 H-2-129586 sheet 1	RE-403
Iodine Monitor (This monitor may not be calibrated or used).		RE-406
Record Air Sampler		RO-407

9.4 Requirements

9.4.1 *Design Requirements*: The HP System consists of a wide variety of monitors, sensors, processors, and interface equipment.

A. *Range*: Instrument displays must provide a dynamic range of 10^0 to 10^7 counts per minute.

B. *Sensitivity:* Effluent monitoring instrumentation sensitivity is stated as: a signal count rate associated with a specific nuclide, detectable at a 95% confidence level in the presence of a uniform background field of 2.0 mR/hr at 0.662 MeV.

C. *Temperature:* Instrumentation should be capable of operating with less than 5.0% change in calibration or response over a temperature range of 40 to 104 °F.

D. *Humidity:* All instrumentation shall be capable of continuous operation in non-condensing environments with relative humidities within 20% of the normal operating range.

E. *Power Requirements:* Each instrument shall be able to operate with voltage and frequency variations of ± 15%, with variations in output readings of no greater than ± 5.0% at the minimum detectable level.

F. *Electrical Effects:* Rejection of radio frequency and microwave signals of ≤ $10 \mu W/cm^2$ must result in reading variations of no greater than ± 5.0% at the minimum detectable level.

G. *Mechanical Effects:* Each instrument shall continue to function with reading variations of no greater than ± 5.0% when accelerations are ≤ 1.0 g in each of the three mutually orthogonal axes over a frequency range of 1.0 to 33 Hz.

H. *Radiation Alarm:* All instruments of this system are equipped with alarms capable of being externally set to annunciate at any point over the stated range. Each instrument's alarm is both audible and visible and is designed to be adjusted or reset by authorized personnel without removing the instrument from service.

I. *Failure Alarm:* Each instrument incorporates a latching contact and alarm that indicates the loss of the detector signal operating voltage or circuit power, to give notification of the instruments inability to alarm at any time the system is incapable of monitoring radiation.

J. *Calibration:* A thorough primary calibration of the entire HP System will be performed at least once using a radionuclide (liquid, solid, or gaseous) of known concentration and traceable to National Institute of Standards and Technology (NIST) standards.

9.4.2 *Operational Requirements*:

A. Multichannel Analyzer

MULTICHANNEL ANALYZER AN-650	
Requirement	**Value**
Data Channels	Minimum 8192, 20-Bit capacity
ADC	100 MHZ
Number of Inputs	Input ADC Interface
Display	CRT, 14-17"
Model No.	Canberra AccuSpec System, including software, MCA card, and electronics

B. Automatic Sample Changer

AUTOMATIC SAMPLE CHANGER FM-650	
Requirement	**Value**
Detector Type	Gas flow proportional anti-coincidence guard detector
Sample Changer	50 Planchet Automatic Changer
Controller	Microprocessor, automatically performing Plateau, Discrimination, Counting Sequence Background Subtraction, and Concentration Calculations
Counting Gas	P-10, with flow regulation and low flow indication
Display	CRT, 14-17"
Model No.	Tennelec, model LB5100 series 5 XLB, low level α/β counter

C. Hand & Foot Monitor

HAND & FOOT MONITORS HFM-6 AND HFM-7	
Requirement	**Value**
Detector Type	Gas Flow Proportional, 6 req.
Counting Gas	P-10, with gas bottle enclosure and automatic change-over
Local Alarms	High Radiation counts, low radiation counts, loss of counting gas, high background

HAND & FOOT MONITORS HFM-6 AND HFM-7	
Requirement	**Value**
Visual Alarms	LED'S
Audible Alarms	95 dB at 2 feet
Output	Serial
Height	67.5 inches
Width	21.0 inches
Depth	33.5 inches
Model No.	Eberline PM-6A with hand pod option

D. Area Radiation Monitors

AREA RADIATION MONITORS ARM-508 TO ARM-533	
Requirement	**Value**
Detector Type	DAI-6
Detector Energy Range	40 KEV-1.25 MEV
Analog Output	4-20 mA
Visual Rad Alarm	Red Beacon
Audible Rad Alarm	95 dB at 2 feet

E. β (Beta) CAMs

β CAMs CAM-560 TO CAM-570	
Requirement	**Value**
Detector Type	Geiger-Müller
Filter Type	47 mm Diameter
Detector LLD	8 DAC-hr under laboratory conditions
Visual Alarm	Red Beacon
Audible Alarm	95 dB at 2 feet

F. α (Alpha) CAMs

α CAMs CAM-580 TO CAM-586	
Requirement	**Value**
Detector Type	Silicon Diffuse Ion
Filter Type	47 mm Diameter
Detector LLD	8 DAC-hr under laboratory conditions
Visual Alarm	Red Beacon
Audible Alarm	95 dB at 2 feet

G. Radioactive Gas Monitor

RADIOACTIVE GAS MONITORS RGM-620 and RGM-622	
Requirement	**Value**
Detector LLD	0.5 $\mu Ci/m^3$
Detector ULD	10^4
Detector Type	Dual Ion
Visual Alarm	Red Beacon
Audible Alarm	95 dB at 2 feet

H. Ge (Germanium) Detector

Ge DETECTOR RE-660	
Requirement	**Value**
Detector Type	Reverse-Electrode Coaxial
Relative Efficiency	25%
Resolution	2.0 keV FWHM (1332 keV)
Accessories	Include cryostat, 30 liter Dewar, preamplifier, signal and power cables
Model No.	Canberra GR 2520 and model 767 detector shield

I. Body Frisker

BODY FRISKER BF-700	
Requirement	**Value**
Detector Type	Gas Proportional, 16 required
Counting Gas	P-10, with gas bottle enclosure
Local Alarms	Contaminated detectors, low gas pressure, low count rate per detector, high count rate per detector, and high background
Visual Alarms	Incandescent lamps
Audible Alarms	95 dB at 2 feet
Height	89.6 inches
Width	29.5 inches
Depth	44.0 inches
Model No.	Eberline PCM-1

J. RASs (Record Air Samplers)

RASs RAS-600 TO RAS-608	
Requirement	**Value**
Filter Type	Versapore 3000-H, 47mm Diam.
Vacuum Supply	Integral vacuum pump

K. CAEM (Continuous Airborne Effluent Monitor)

CAEM-1, ST-989	
Requirement	**Value**
α/β Detector Type	ZnS(Ag) Alpha scintillator film
γ Detector Type	Thallium-activated NaI (Sodium Iodide) Crystal
α/β Detector Minimum Detection Threshold (4 hr.)*	α Particulate > 4 MeV: 1.8×10^{-12} μCi/cc β Particulate: ^{90}Sr: 1.4×10^{-12} μCi/cc ^{60}Co 3.2×10^{-12} μCi/cc

CAEM-1, ST-989		
Requirement	**Value**	
α/β Detector Minimum Detection Threshold (168 hr.)	α Particulate > 4 MeV: β Particulate: ^{90}Sr: ^{60}Co:	4.3×10^{-14} μCi/cc 3.3×10^{-14} μCi/cc 7.3×10^{-14} μCi/cc
γ Detector Minimum Detection Threshold (4 hr.)	γ ^{129}I:	4.43×10^{-12} μCi/cc
γ Detector Minimum Detection Threshold (168 hr.)	γ ^{129}I:	1.0×10^{-13} μCi/cc
Local Alarms	Low Flow and High Radiation	
Visual Alarm	Red Beacon	
Audible Alarm	95 dB at 2 feet	
Vacuum Supply	Two integral vacuum pumps (primary and back-up)	

* Minimum Detectable Level measurements are given with: 1 mR/h ^{137}Cs & 0 Rn background, 1 SCFM flow rate, per ANSI N13.10.

9.4.3 *Maintenance and Surveillance Requirements*:

Multichannel Analyzer, AN-650

A. AN-650 operability checks must be performed by the Radiation Protection Group in accordance with *C-17320, 1.6.3; Canberra Industries, Inc., Model 1510 Integrated Signal Processor User's Manual* as follows:

- Daily - Source and Background
- Monthly - Background
- Quarterly - Background

B. AN-650 must be calibrated at least yearly by the Instrument and Controls Group in accordance with *C-17320, 1.6.3; Canberra Industries, Inc., Model 1510 Integrated Signal Processor User's Manual* and the applicable *Hanford Job Control (JCS)* procedure.

Automatic Sample Changer, FM-650

C. FM-650 operability checks must be performed by the Radiation Protection Group in accordance with *C-17320, 1.6.3; Oxford Instruments, Inc., Part #2051-0192, Tennelec Series 5 Service Manual, Section 1.0, Maintenance*: as follows:

- Daily - Source and Background
- Monthly - Background
- Quarterly - Background

D. FM-650 must be calibrated at least yearly by the Instrument and Controls Group in accordance with *C-17320, 1.6.3; Oxford Instruments, Inc., Part # 2051-0192, Tennelec Series 5 Service Manual, Section 1.0, Maintenance* and the applicable *Hanford Job Control (JCS)* procedure.

Hand and Foot Monitors, HFM-6 and HFM-7

E. HFM-6 and HFM-7 operability checks must be performed by the Radiation Protection Group in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model PM-6A Personnel Monitor Technical Manual, Section 4.0, Maintenance* and *HNF-IP-718, Health Physics Technical Practices and Procedures, Part I, Section 5.1, Automated Personnel Monitors Inspection and Source Check* as follows:

- Weekly - Source

F. HFM-6 and HFM-7 must be calibrated at least yearly by the Instrument and Controls Group in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model PM-6A Personnel Monitor Technical Manual, Section 4.0, Maintenance* and the applicable *Hanford Job Control System (JCS)* procedure.

Area Radiation Monitors, ARM-510 to ARM-533

G. ARM-510 through ARM-533 operability checks must be performed by the Radiation Protection Group in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model EC4S-X, Technical Manual, Section IV, Maintenance* and *HNF-PRO-640, Eberline EC-4 Area Radiation Monitor* as follows:

- Quarterly - Source

H. ARM-510 through ARM-533 must be calibrated at least yearly by the Pacific Northwest National Laboratories (PNNL) in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation Document, Model PM-6A Personnel Monitor Technical Manual, Section IV, Maintenance* and the applicable PNL procedure.

<u>Beta CAMs, CAM-560 to CAM-567 and CAM-569 to CAM-570</u>

I. CAM-560 to CAM-567 and CAM-569 to CAM-570 including vacuum pump operability checks must be performed by the Radiation Protection Group in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model AMS-3 Beta Air Monitor Technical Manual, Section 4.0, Maintenance; C-17320, 1.6.3; Hi-Q Environmental Products Document, VS-Series Pump VS-S23-0523CV, Maintenance and Operating Instructions* and *HNF-PRO-645, Eberline EMS-3 CAMs* as follows:

- Daily - Operability
- Weekly - Source
- Monthly - Alarm Check

J. CAM-560 to CAM-567 and CAM-569 to CAM-570 including vacuum pump must be calibrated at least yearly by the Pacific Northwest National Laboratories (PNNL) in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model AMS-3 Beta Air Monitor Technical Manual, Section 4.0, Maintenance; C-17320, 1.6.3; Hi-Q Environmental Products Document, VS-Series Pump VS-S23-0523CV, Maintenance and Operating Instructions* and the applicable PNL procedure.

<u>Beta CAM, CAM-568</u>

K. CAM-568 including vacuum pump operability checks must be performed by the Radiation Protection Group in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model AMS-4 Beta Particulate Monitor Technical Manual, Section IV, Maintenance*; *C-17320, 1.6.3; Hi-Q Environmental Products Document, VS-Series Pump VS-S23-0523CV, Maintenance and Operating Instructions* and *HNF-IP-718, Health Physics Technical Practices and Procedures, Part I, Section 5.2, CAM Performance Testing* as follows:

- Daily - Operability
- Weekly - Source

- Monthly - Alarm Check

L. CAM-568 including vacuum pump must be calibrated at least yearly by the Pacific Northwest National Laboratories (PNNL) in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model AMS-4 Beta Particulate Monitor Technical Manual, Section IV, Maintenance*; *C-17320, 1.6.3; Hi-Q Environmental Products Document, VS-Series Pump VS-S23-0523CV, Maintenance and Operating Instructions* and the applicable PNL procedure.

<u>Alpha CAMS, CAM-581 to CAM-586</u>

M. CAM-581 to CAM-586 including vacuum pump operability checks must be performed by the Radiation Protection Group in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model Alpha-5 Alpha Air Monitor Technical Manual, Section 3.0, Maintenance; C-17320, 1.6.3; Hi-Q Environmental Products Document, VS-Series Pump VS-S23-0523CV, Maintenance and Operating Instructions* and *HNF-PRO-646, Eberline Alpha-4, 5, 5A and 5AS* as follows:

- Daily - Operability
- Weekly - Source
- Monthly - Alarm Check

N. CAM-581 to CAM-586 including vacuum pump must be calibrated at least yearly by the Pacific Northwest National Laboratories (PNNL) in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model Alpha-5 Alpha Air Monitor Technical Manual, Section 3.0, Maintenance; C-17320, 1.6.3; Hi-Q Environmental Products Document, VS-Series Pump VS-S23-0523CV, Maintenance and Operating Instructions* and the applicable PNL procedure.

<u>Alpha CAM, CAM-580</u>

O. CAM-580 including vacuum pump operability checks must be performed by the Radiation Protection Group in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model Alpha-6A-1 Air Monitor Technical Manual, Section V, Maintenance; C-17320, 1.6.3; Hi-Q Environmental Products Document, VS-Series Pump VS-S23-0523CV, Maintenance and Operating Instructions* and *HNF-IP-718, Health Physics Technical Practices and Procedures, Part I, Section 5.2, CAM Performance Testing* as follows:

- Daily - Operability
- Weekly - Source
- Monthly - Alarm Check

P. CAM-580 including vacuum pump must be calibrated at least yearly by the Pacific Northwest National Laboratories (PNNL) in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model Alpha-6A-1 Air Monitor Technical Manual, Section V, Maintenance; C-17320, 1.6.3; Hi-Q Environmental Products Document, VS-Series Pump VS-S23-0523CV, Maintenance and Operating Instructions* and the applicable PNL procedure.

Radioactive Gas Monitors, RGM-622

Q. RGM-622 operability checks must be performed by the Radiation Protection Group in accordance with the applicable vendor manual.

R. RGM-622 must be calibrated at least yearly in accordance with the applicable vendor manual.

Germanium Detector, RE-660

S. RE-660 operability checks must be performed by the Radiation Protection Group in accordance with *C-17320, 1.6.3; Canberra Industries, Inc., Ge-USR, Germanium Detectors User's Manual, Section 7.0, Startup and Test* as follows:

- Daily - Source/Background
- Monthly - Background
- Quarterly - Background

T. RE-660 must be calibrated at least yearly by the Instrument and Controls Group in accordance with *C-17320, 1.6.3; Canberra Industries, Inc., Ge-USR, Germanium Detectors User's Manual, Section 7.0, Startup and Test* and the applicable *Hanford Job Control System (JCS)* procedure.

Body Frisker, BF-700

U. BF-700 operability checks must be performed by the Radiation Protection Group in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation Document, Model PCM-1B Personnel Contamination Monitor Technical Manual, Section 4.0, Maintenance* and *HNF-PRO-643, Eberline HFM-4/4A, HFM-6, and PCM-1B* as follows:

- Weekly - Source

V. HFM-700 must be calibrated at least yearly by the Instrument and Controls Group in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation Document, Model PCM-1B Personnel Contamination Monitor Technical Manual, Section 4.0, Maintenance* and the applicable *Hanford Job Control System (JCS)* procedure.

Iodine Monitor, RE-406 (This monitor may not be calibrated or used)

W. RE-406 operability checks must be performed by the Radiation Protection Group in accordance with *C-17321, 1.6.4; Nuclear Research Corporation, TP#201689, Rev. -, Operation and Maintenance Manual for Continuous Airborne Effluent Monitoring System GEMS-100 (V1), Section 4.8, Recommended Maintenance Intervals*.

X. RE-406 must be calibrated by the Instrument and Controls Group in accordance with *C-17321, 1.6.4; Nuclear Research Corporation, TP#201689, Rev. -, Operation and Maintenance Manual for Continuous Airborne Effluent Monitoring System GEMS-100 (V1), Section 4.8, Recommended Maintenance Intervals* and the applicable *Hanford Job Control System (JCS)* procedure.

Record Air Samplers RAS-600 to RAS-608

Y. RAS-600 to RAS-608 including vacuum pump operability checks must be performed by the Radiation Protection Group in accordance with *C-17320, 1.6.3; Hi-Q Environmental Products, Mobile Cart Air Sampling System, MAV-0523CU, V-FLO-5QD, Operating Specifications* at least weekly or anytime the vacuum pump function is disrupted.

Z. RAS-600 to RAS-608 must be calibrated at least yearly by the Instrument and Controls Group in accordance with *C-17320, 1.6.3; Hi-Q Environmental Products, Mobile Cart Air Sampling System, MAV-0523CU, V-FLO-5QD, Operating Specifications* and the applicable *Hanford Job Control System (JCS)* procedure.

Continuous Airborne Effluent Monitor, CAEM-1, ST-989

AA. ST-989 operability checks must be performed by the Radiation Protection Group in accordance with *C-17321, 1.6.4; Nuclear Research Corporation, TP#201689, Rev. -, Operation and Maintenance Manual for Continuous Airborne Effluent Monitoring System GEMS-100 (V1), Section 4.8, Recommended Maintenance Intervals* as follows:

- Vacuum Pump Vanes, install kit every 20,000 operating hours
- Hastings Mass Flow Controller Filter Element, replace every 20,000 hours of operation
- Stack Flow Meter Cleaning, blow out taps with DP Cell isolated every 2.0 years
- System Functional Test, test every 1.5 years or after a long shutdown or major repair

BB. ST-989 must be calibrated by the Instrument and Controls Group in accordance with *C-17321, 1.6.4; Nuclear Research Corporation, TP#201689, Rev. -, Operation and Maintenance Manual for Continuous Airborne Effluent Monitoring System GEMS-100 (V1), Section 4.8, Recommended Maintenance Intervals* and the applicable *Hanford Job Control System (JCS)* procedure as follows:

- Hastings Mass Flow Controller every 1.5 years of operation
- Stack Flow Meter/DP Cell every 1.5 years of operation
- Stack and Sample Pressure Transducers every 1.5 years of operation
- MD-345 (V3) and MD-55 (V15) Detectors every 1.0 year and every 1.5 years after stability has been proven

9.5 Safety

9.5.1 HP System equipment should be operated only by personnel trained in the use of, and familiar with, the equipment. Manufacturer's operating and maintenance instructions must be followed.

9.5.2 There are three potential hazards in the use and handling of Germanium Detectors:

- High Voltage: Ge detectors may operate at bias voltages of 5,000 VDC or more. Always be sure that detectors are properly grounded through the SHV coaxial cable ground to a properly grounded Power Supply/NIM Bin. Also use extreme caution when adjusting internal preamplifier controls to avoid contact with the high voltage circuit

- Liquid Nitrogen: LN_2 can cause frostbite if not handled properly. Avoid skin contact with LN_2 or with surfaces cooled by LN_2.

- Vacuum Failure - Over pressurization: When a cryostat exhibits signs of catastrophic vacuum failure, such as heavy moisture or ice formation on the surfaces, extremely high LN_2 loss rate, etc., the absorber (molecular sieves or charcoal) which normally maintains vacuum may be virtually saturated.

  When allowed to warm up, the absorber will out gas and the pressure in the cryostat will rise. Canberra cryostats and Dewars sold by Canberra have a pressure relieving seal-off valve which is designed to prevent dangerous levels of pressurization.

  The pressure rise, however, can be high enough to break or break loose beryllium windows and/or end-caps. A frozen or ice clogged seal-off valve may fail to relieve pressure, resulting in dangerous levels of pressurization.

  Use the following precautions when handling a cryostat that exhibits symptoms of catastrophic vacuum failure:

  1. Stop using the failed unit immediately. Do not allow it to warm up until additional steps are taken to prevent damage or injury due to Over pressurization.

  2. Drape a heavy towel or blanket over the end-cap and point the end-cap away from personnel and equipment. If the unit is in a shield, close the shield door.

  3. Call the factory for instructions if the incident occurs during business hours.

  4. If it is impractical to keep the unit cold until advice is available from the factory, keep the end-cap covered with a heavy towel or blanket and place the unit in a restricted area in a container (e.g.,corrugated cardboard). If the unit is in a shield, let it warm up in the shield with the door closed.

5. After the unit has warmed up, cautiously check for over-pressurization (outwardly-bulging end-caps or windows). If there are no signs of pressure, the unit may be shipped to the factory for repair. Consult the factory for shipping information.

9.5.3 *Safety Classification*: The HP system is classified as General Service (GS), because it is not required to mitigate an accident or to operate after an accident. The HP system is designed to monitor and alert personnel of hazardous radioactive conditions that could occur as a result of malfunctions or accidents. The HP system is also designed to provide a limited function in protecting facility workers from industrial and radiological hazards without any off-site consequences. The HP system utilizes radiation monitoring (airborne and area dose radiation) and personnel contamination monitors for the facility worker. Criticality protection equipment is not included in the HP system due to analyses confirming that no criticality accident is considered credible.

9.5.4 *Quality Level*: The HP System is Quality Level II, indicating that System functionality can be adequately assured with the normal level of Quality Assurance as implemented by the Operating Contractor Quality Assurance Plan.

9.5.5 *Environmental Safety*:

A. The CSB does not have any connections to a chemical sewer or other means of safe disposal of hazardous chemical waste. All hazardous waste generated during maintenance or other activities within the facility must be safely contained at the point of generation (i.e., fluids drained into buckets, rags and other materials placed in plastic bags), and removed to another facility having suitable means to handle hazardous material.

B. Low-level waste, generated as a result of the HP system must be managed by the Hanford Site Contractor in accordance with the applicable Low-Level Waste Certification Plan.

9.6 References

9.6.1 Drawings referenced in this document are:

DWG #	DRAWING TITLE
H-2-120909 sheets 1 - 3	Mechanical CSB MCO Service Station Tent Assembly
H-2-120911 sheet 1	Mechanical CSB Tube Vent and Purge Cart Assy, Parts List and Notes

DWG #	DRAWING TITLE
H-2-121101 sheets 2 - 8	Control Systems Canister Storage Bldg HP Monitor Location Plan
H-2-121101 sheet 1	HPS Monitor Location Plan legend Placement Guidelines and General Notes
H-2-121118 sheets 1 - 5	HPS Monitor Location Plan Canister Storage Building Partial First Floor
H-2-121150 sheets 1 - 2	Health Protection Sys CSB Monitoring Equip Installation Details
H-2-121170 sheets 1 - 2	Health Protection Sys CSB CAEM Monitoring Installation Details
H-2-121180 sheet 1	Health Protection Sys CSB HP Office Equip Arrgt
H-2-121300 sheet 1	Control Systems Canister Storage Bldg Data Highway
H-2-122745 sheets 3 - 4	Electrical Canister Storage Building Instrumentation Plan
H-2-123390 sheets 1 - 2	P&ID Legend and Symbols INSTR/HVAC/PIPING
H-2-123394	P&ID Tube Purge System
H-2-129584	P&ID Operating Area CSB-PF-001
H-2-129585	P&ID Operating Area CSB-PF-002
H-2-129586 sheet 1	HVAC P & I Diagram Canister Storage Building Exhaust Stack Monitoring

9.6.2 Documents relating to or referenced in this document are:

DOC. #	DOCUMENT TITLE
N/A	Design Basis Document, Section 12, Radiation Protection and Shielding
HNF-3553	Annex A, Canister Storage Building Final Safety Analysis Report, Section A.2.7.3, Health Physics Protection
W-379-C-CSB-17320	Health Protection Instrumentation (HPI)
W-379-C-CSB-17321	Gaseous Effluent Monitoring System
W-379-C-CSB-17601	Temperature Transmitters - Electronic

DOC. #	DOCUMENT TITLE
W-379-C-CSB-17612	Resistance Temperature Detectors
W-379-C-CSB-17630	Mass Flow Meters
W-379-C-CSB-17682	Current to Pneumatic Converters
W-379-C-CSB-17703 W-379-C-CSB-17703B	Instrument Piping Materials
W-379-C-CSB-17704 W-379-C-CSB-17704B	General Instrumentation Installation and Testing
W-379-C-CSB-17705 W-379-C-CSB-17705B	Instrument Calibration and Checkout
W-379-C-CSB-17861 W-379-C-CSB-17861B	Local Control Panels
W-379-C-CSB-17864 W-379-C-CSB-17864B	Instruments Furnished with Mechanical Equipment Canister Storage Building
C-17320, 1.6.3	Oxford Instruments Inc. Part # 2051-0192, Tennelec Series 5 Service Manual, Version 1.0
C-17320, 1.6.3	Eberline Instrument Corporation Document, Model PM-6A Personnel Monitor Technical Manual
C-17320, 1.6.3	Eberline Instrument Corporation Document, Model EC4S-X [ARM] Technical Manual
C-17320, 1.6.3	Eberline Document: Model Alpha-5A Alpha Air Monitor Technical Manual (VI-19183 Supp. 02)
C-17320, 1.6.3	Eberline Document: Alpha-6A-1 Alpha Air Monitor Technical Manual (VI-19183 Supp. 05)
C-17320, 1.6.3	Eberline Document: Model AMS-3 Beta Air Monitor Technical Manual (VI-19183 Supp. 06)
C-17320, 1.6.3	Eberline Document: AMS-4 Beta Particulate Monitor Technical Manual (VI-19183 Supp. 08)
C-17320, 1.6.3	Eberline Instrument Corporation Document, Model PCM-1B Personnel Contamination Monitor Technical Manual
C-17320, 1.6.3	Canberra Industries, Inc. Document, AccuSpec NaI/A/B Acquisition Interface Boards
C-17320, 1.6.3	Canberra Industries, Inc. Document, Model 1510 Integrated Signal Processor [MCA-1]

DOC. #	DOCUMENT TITLE
C-17320, 1.6.3	Canberra Industries, Inc. Document, Model 1510 Integrated Signal Processor User's Manual
C-17320, 1.6.3	Canberra Industries, Inc. Document, Cable C1556 1510/1520 to AccuSpec/B Installation Guide
C-17320, 1.6.3	Canberra Industries Inc., Drawing #97188, System Interconnect
C-17320, 1.6.3	Canberra Industries, Inc., Drawing # 97193, System Layout and Assembly
C-17320, 1.6.3	Canberra Industries, Inc., Document Ge-USR, Germanium Detectors User's Manual
C-17320, 1.6.3	Hi-Q Environmental Products Document: VS-Series Pump VS23-0523CV #6303
C-17320, 1.6.3	Hi-Q Environmental Products Document: MRV-Series Mobile Cart Air Sampling System: MAV-0523CV, SN#6285, V-FLO-5QD, SN#6311
C-17321, 1.6.4	Nuclear Research Corporation Document MO702, Operation & Maintenance Manual for Continuous Airborne Effluent Monitoring System, GEMS-100 (V1)
C-17321, 1.6.4*	Nuclear Research Corporation Document MO495, Hardware and Maintenance Manual, Digital Ratemeter ADM-606(V1), (V2), (V3), (V4)
C-17321, 1.6.4*	Nuclear Research Corporation Document MO543, Hardware and Maintenance Manual, Universal Control Module
C-17321, 1.6.4*	Nuclear Research Corporation Document MO712, Operation and maintenance Manual, MD-345(V3), Alpha-Beta Scintillation Detector
C-17321, 1.6.4*	Nuclear Research Corporation Document MO713, Operation and Maintenance Manual, MD-55(V15), Gamma Scintillation Detector
C-17321, 1.6.4*	Nuclear Research Corporation Document MO542, Operation and Maintenance Manual for Preamplifier, PA-300E Series
C-17321, 1.6.4*	Nuclear Research Corporation Document TP#201689, Functional Test Procedure for GEMS-100(V1)

DOC. #	DOCUMENT TITLE
C-17321, 1.6.4*	Teledyne Brown Engineering / Hastings Instruments Document 131A, Hastings Model HFC Mass Flow Controllers HFC-202 & HFC-203
C-17321, 1.6.4*	Automatic Switch Company (ASCO) Form #V5827R1, Bulletins 8210/8211, Installation & Maintenance Instructions, 2-way Internal Pilot-Operated Solenoid Valves, Normally Closed Operation, ½" and 3/4" NPT - 5/8" Orifice
C-17321, 1.6.4*	Rosemount Measurement Document MAN 4294A00, Model 1151DR Alphaline® Draft Range Differential Pressure Transmitter
C-17321, 1.6.4*	Dieterich Standard Flow Measurement Systems Document DS-1246 (11/93), Annubar® Diamond II Model DCR-15/16, 25/26, 35/36, pak-Lok, Liquid & Gas Service, Horizontal & Vertical Pipe Installation Instructions

* Sub-documents within NRC MO702.

SPENT NUCLEAR FUEL
CANISTER STORAGE BUILDING

TRANSPORTATION CASK RECEIVING
(System #12)

SYSTEM DESIGN DESCRIPTIONS

10.0 TRANSPORTATION CASK RECEIVING SYSTEM DESCRIPTION (SYSTEM #12)

10.1 Function

10.1.1 The Transportation Cask Receiving (TCR) System is designed to off-load the MCO shipping cask from the transport semi-trailer sent from the Cold Vacuum Drying Facility (CVDF) to the SNF CSB Truck Vestibule. The cask is placed into the Cask Receiving Pit to prepare the MCO for staging into an MCO Storage Tube. The cask is pressure checked. If the pressure is within limits, the cask lid will be removed. If the cask pressure is not within limits, the cask atmosphere is sampled. The MCO Assembly Guide and the Cask Receiving Shield Hatch Assembly is then placed into the Cask Receiving Pit in preparation for MCO handling by the MHM. Upon completion of the transfer of the MCO to an MCO Storage Tube, Sampling/Weld Station or Weld Station, the MCO cask with a new empty MCO, is loaded onto the transport semi-trailer and returned to the K-Basins.

10.2 Operation

Normal Operation:

10.2.1 When the Transportation Cask Receiving System functions begin, the following conditions exist:

- An MCO has been prepared for shipping by the CVDF and secured into a shipping cask
- The MCO shipping cask has been secured to a transport semi-trailer and moved to the SNF CSB
- The Cask Receiving Pit is ready to receive the MCO shipping cask

10.2.2 At the K-Basins, spent reactor fuel elements are placed into an MCO. The MCO is treated by a cold vacuum drying process at the CVDF to purge moisture, hydrogen, and contaminants. The MCO in a shipping cask is shipped at atmospheric pressure 0.0 psig in the Cask, [11 psig (9.5 to 12.5) psig inside of the MCO] from the CVDF to the SNF CSB for interim staging in an MCO Storage Tube.

10.2.3 The MCO shipping cask is shipped from the CVDF to the SNF CSB on a transportation semi-trailer. The transportation semi-trailer carries the MCO shipping cask in a vertical position, to minimize handling operations and radiation exposures during loading and unloading of the shipping cask.

10.2.4 Upon arrival at the SNF CSB, the MCO cask is placed into the Cask Receiving Pit for removal of the cask lid and installation of the MCO Guide and Shield Hatch Assembly RSE-004. If high pressure is detected inside the cask, the Containment Tent, BARR-001, will be placed over the MCO for protection against any loose airborne particle contamination that may become present. This is an off-normal situation during which the cask lid may or may not be removed.

10.2.5 An "off-normal" condition exists anytime an unusually high pressure condition is detected inside the cask MCO shipping window (from K-Basin to SNF CSB) has been exceeded. A high Shipping Cask pressure may indicate that the MCO within the cask has a leak or breach in the MCO due to a high hydrogen pressure buildup caused by excess water inside the MCO. A normal Shipping Cask pressure indicates that the MCO is in normal status, and can immediately be moved to a Storage Tube without undergoing servicing.

10.2.6 The cask receiving process begins when the MCO shipping cask arrives from the CVDF, the outside truck vestibule air lock door is opened while the inside air lock door remains closed to maintain Zone III confinement. The MCO transport semi-trailer is backed into the truck vestibule air lock until it is properly positioned. The transportation semi-trailer is secured and the truck tractor is detached from the trailer and moved outside of the building. The outside air lock door is closed and the inside door is opened to the Zone III atmosphere. The MCO cask is smeared for contamination and the cask is prepared and removed from the trailer by the MCO Receiving Crane, CRN-001.

10.2.7 The MCO Receiving Crane CRN-001 is prepared for operation by ensuring the crane rail frogs are positioned to the Receiving Crane (RC) position. The two Rail Frogs create a railway intersection for the MCO Receiving Crane CRN-001 and the MCO Handling Machine CRN-004. The Rail Frogs must be properly oriented and bolted into position for the Receiving Crane to be safely operated.

10.2.8 The Shield Hatch Assembly RSE-004 is removed from the Cask Receiving Pit using 5.0 ton Tent Gantry Hoist CRN-008. The CRN-001 operator, stationed in the shielded operator station on the crane, or using the remote radio control, retrieves the cask lifting yoke from its storage place, positions the yoke over the MCO cask on the transport semi-trailer, aligns the yoke with the cask trunnion, and applies slight tension to the cask trunnion to secure the yoke to the cask. The MCO cask is lifted clear of the trailer mounting brackets and platform supports and is positioned over the Cask Receiving Pit. The cask is lowered into the Cask Receiving Pit until it rests on the Cask Receiving Impact Absorber. Then the yoke is removed from the cask and the Receiving Crane is returned to the proper storage area. The crane rail frogs are then positioned in the MCO Handling Machine (MHM) position for MHM CRN-004 operation.

10.2.9 An operator enters the Cask Receiving Pit area and then connects a quick-connect tool, with a pressure instrument, to the cask fitting on top of the cask lid. The pressure of the space between the cask and the MCO is measured to determine if there has been any gas leakage from the MCO. If the pressure in the cask space is greater than 3.0 psig, the cask is sampled and analyzed in accordance with *MCO Servicing (MS) System Operation Manual*, and Supervision is notified that an "off-normal" condition exists. An MCO recovery action will be considered (i.e., return to CVDF, temporary storage in the shipping cask or transfer to an Overpack Tube). No MCO Servicing is contemplated to take place at the CSB, even though minimal activities, such as venting and helium purging the cask, could be conducted. If servicing is to be performed, the MCO cask will be sampled, vented and purged in accordance with *MCO Servicing (MS) System Operation Manual*, and then the MCO will be removed and placed into an Overpack Tube for monitoring.

10.2.10 If a high pressure (>3.0 psig) was detected in the MCO Cask, the Containment Tent BARR-001 is moved from its designated staging area, and placed over the Cask Receiving Pit, and secured. The Cask Receiving Shield Hatch Assembly RSE-004 and the 5.0 ton Cask Receiving Hoist CRN-008 are placed in a designated area. The Zone II Portable Tent Exhaust Unit CSB-EF-005 is connected to the Containment Tent BARR-001 exhaust unit opening in the tent and started, to provide a negative air balance between the Zone III Operating Area and the Zone II BARR-001 environment. The cask is then vented to atmospheric pressure through a connection to the CSB HVAC system in pit G. Radiological protection requirements for entry into the Zone II access area will require personnel in the area to wear protective clothing for surface and airborne contamination. Use of the Containment Tent will be at the direction of Operations Management, no routine use is planned.

10.2.11 An operator removes the cask lid bolts (only after the cask is at 0.0 psig) using the cask lid automated torque tool. The cask lid is removed using 5.0 ton Tent Gantry Hoist CRN-008. The MCO process port cover plate(s) will remain intact, except as necessary at the Sampling Station for sampling, or for MCO Servicing (Off-Normal Operation only). In this event, these items will be removed with a suspended impact wrench or long-reach tools.

10.2.12 The Tent Gantry Hoist CRN-008 is used to place the MCO Guide and Shield Hatch Assembly RSE-004 onto the Cask Receiving Pit.

10.2.13 After the high pressure (>3.0 psig) detected in the MCO Cask is vented, Zone II Portable Tent Exhaust Unit CSB-EF-005 is shut down and disconnected from the Containment Tent BARR-001 exhaust unit opening in the tent, then the tent is moved to the appropriate staging area. The 5.0 ton Tent Gantry Hoist CRN-008 is removed from the pit area. The Cask Receiving Pit area is surveyed for release by checking radiation levels and contamination.

10.2.14 The MCO is now ready for transfer via MHM CRN-004 to the selected Storage Tube, Sampling/Weld Station in accordance with the *MCO Handling Machine (MHM) Operation Manual.*

10.2.15 When the MHM has picked up the MCO, 5.0 ton Tent Gantry Hoist CRN-008 is placed in the pit area, and the MCO Guide and Shield Hatch Assembly RSE-004 are removed from the pit. The top of the MCO Cask and Cask Receiving Pit area are surveyed by checking radiation levels and contamination. Then, the crane rail frogs are repositioned to Receiving Crane (RC) position. An empty MCO is prepared, inspected and placed by Receiving Crane CRN-001 into the MCO Cask for transport back to the CVDF. The cask lid seals are inspected for damage or wear and the cask lid is replaced and secured onto the MCO Cask using Tent Gantry Hoist CRN-008 and re-bolted into place using the cask lid automated torque tool.

10.2.16 The Receiving Crane operator, stationed in the shielded operator station on the crane, or using the remote radio control, retrieves the cask lifting yoke from the storage rack, positions the yoke over the MCO cask in the Cask Receiving Pit, aligns the yoke with the cask trunnion, and tightens the yoke. The MCO cask is lifted clear of the Cask Receiving Pit, the MCO Cask is surveyed for release by checking radiation levels and contamination, and the MCO Cask is positioned over the transport semi-trailer. The powered receiving crane rotating hook rotates the MCO shipping cask to correctly orient the cask with the trailer mounting brackets and platform supports, and the cask is lowered into the trailer mounting brackets and platform supports until the MCO cask rests on the truck trailer. Then, 5.0 ton Cask Receiving Hoist CRN-008 is placed in the pit area, and MCO Guide and Shield Hatch Assembly RSE-004 is replaced onto the Cask Receiving Pit.

10.2.17 The cask is secured to the transport semi-trailer by attaching the shackles, tie-downs and platforms. Receiving Crane CRN-001 yoke is removed from the cask and placed into the storage rack. The Receiving Crane is then returned to its proper storage area and the inside air lock door is closed.

10.2.18 The Cask Receiving Pit Area is surveyed for final release by checking radiation levels and contamination.

10.2.19 The transport tractor will connect to the transportation semi-trailer after first opening the outside truck vestibule telescoping door while the inside air lock door remains closed to maintain Zone III confinement. The MCO transport connects to the semi-trailer as it is backed into the truck vestibule air lock. The transport tractor is attached to the trailer and moved outside of the building.

Emergency Operation:

10.2.20 If any of the following conditions exist with an MCO in the Cask Receiving operation:

- MCO cask inner space pressure on portable pressure gauge reads greater than 3.0 psig.

The transportation Cask is placed into a safe configuration in accordance with *MCO Cask Receiving System Operation Manual, MCO Receiving System Valve and Electrical Lineup for Operation.* This is to ensure all operating equipment (i.e., receiving crane, containment tent, etc.) is placed into a safe configuration for further action. The cask is sampled and analyzed in accordance with *MCO Servicing (MS) System Operation Manual*, Supervision is notified of the condition, and a recovery team is convened and the situation is analyzed for contingency actions. The appropriate recovery action is determined (i.e., Return the MCO To the CVDF for analysis, Temporarily store the MCO in the Cask until a recovery plan can be instituted, or Sample, Vent and Purge the MCO Cask and place the affected MCO into an Overpack Tube for monitoring). If the chosen recovery action is to send the cask back to the CVDF for analysis, the MCO Cask is transported back to the CVDF via the transport semi-truck. If the chosen recovery action is to temporarily store the MCO in the Cask until a recovery plan can be instituted, the MCO Cask is placed into the Cask Receiving Pit in accordance with *Transportation Cask Receiving System Operation Manual, Perform MCO Receiving Operation.* If the chosen recovery action is to service the MCO cask, the MCO Containment Tent is positioned and the cask space is sampled, vented and purged in accordance with *MCO Servicing System (MS) Operation Manual.* When the cask pressure has stabilized below 1.0 psig, the cask lid is removed and the MCO is prepared for MHM transport to either the Storage Tube, Sample Station or Weld Station in accordance with *MCO Handling Machine (MHM) Operation Manual.* The MCO cask is now considered to be in "Normal Status".

10.2.21 If any of the following conditions exist with an MCO in the Cask Receiving Pit:

- Obvious leak or breach in the MCO cask

The MCO Cask is placed into a safe configuration in accordance with the *Transportation Cask Receiving System Operation Manual, MCO Receiving System Valve and Electrical Lineup for Operation*. This is to ensure all operating equipment (i.e., receiving crane, containment tent, etc.) is placed into a safe configuration for further action. Supervision is notified of the condition, a recovery team is convened and the situation is analyzed for contingency actions. When the cask is stabilized, it is prepared for MCO removal for transport to the Storage Tube, Sample Station or Weld Station in accordance with *Section Transportation Cask Receiving System Operation Manual, Perform MCO Receiving Operation*. The MCO cask is now considered to be in "Normal Status".

10.2.22 If any of the following conditions exist with an MCO in the Cask Receiving Pit:

- Loss or interruption of 13.8 kV power to the SNF CSB
- Loss or interruption of 480V Normal Power from MCC-32-210
- Loss or interruption of 120VAC power to the Cask Receiving operation.

The MCO Receiving System is placed into a safe configuration in accordance with the *Transportation Cask Receiving System Operation Manual, MCO Receiving System Valve and Electrical Lineup for Operation*. This is to ensure all operating equipment (i.e., receiving crane, containment tent, etc.) is off and the system is placed into a safe configuration for further action. Supervision is notified of the condition, a recovery team is convened and the situation is analyzed for contingency actions. If normal power is lost, Maintenance is requested to troubleshoot and repair the affected equipment. When normal power is restored, the cask is prepared for MCO removal for transport to either the Storage Tube, or Sampling/Weld Station in accordance with *Transportation Cask Receiving System Operation Manual, Perform MCO Receiving Operation*. The MCO Receiving System is now considered to be in "Normal Status".

10.2.23 If any of the following conditions exist with an MCO in the Cask Receiving Pit:

- Failure of a Receiving Crane CRN-001 component (i.e., damaged or broken cable, interlock failure, loss of controls, etc.)
- Failure of a Containment Tent BARR-001 component (i.e., breach or tear in the tent, damaged or broken cable on 5.0 ton hoist, interlock failure, loss of controls, broken seal, failure of CAM Unit, etc.)
- Mechanical failure of a transportation semi-trailer bracket component

The MCO Receiving System is placed into a safe configuration in accordance with the *Transportation Cask Receiving System Operation Manual, MCO Receiving System Valve and Electrical Lineup for Operation.* This is to ensure all operating equipment (i.e., receiving crane, containment tent, etc.) is off and the system is placed into a safe configuration for further action. Supervision is notified of the condition, a recovery team is convened and the situation is analyzed for contingency actions. Maintenance is requested to troubleshoot and repair the affected component. When the affected component has been repaired, the cask is prepared for MCO transport to either the Storage Tube, Sampling/Weld Station in accordance with *Transportation Cask Receiving System Operation Manual, Perform MCO Receiving Operation*. The MCO Receiving System is now considered to be in "Normal Status".

10.2.24 If any of the following conditions exist with an MCO in the Cask Receiving Pit:

- Cask Pressure is >3.0 psig
- Zone II Portable Tent Exhaust Fans CSB-EF-005 (A and B) have shut down
- The Containment Tent BARR-001 has been breached with a rip or tear (i.e., the tent cannot maintain negative pressure relative to the operating area)

The Transportation Cask Receiving System is placed into a safe configuration in accordance with the *Transportation Cask Receiving System Operation Manual, MCO Receiving System Valve and Electrical Lineup for Operation.* This is to ensure all operating equipment (i.e., receiving crane, containment tent, etc.) is off and the system is placed into a safe configuration for further action. Supervision is notified of the condition, a recovery team is convened and the situation is analyzed for contingency actions. Personnel are directed to leave Containment Tent BARR-001. Health Physics is then requested to sample the air inside the tent. If power is available to the 5.0 ton hoist and the contamination protection barrier is still out of service, the servicing equipment is detached and the lid reinstalled on the cask with personnel using the proper radiological protection equipment. This maintains a temporary confinement area inside the cask until the ventilation can be re-established. When the ventilation for the contamination protection barrier has been re-established, Health Physics clears the tent for re-entry, personnel reenter the tent and the cask is prepared for MCO transport to either the Storage Tube, Sample Station or Weld Station in accordance with *Transportation Cask Receiving System Operation Manual, Perform MCO Receiving Operation*. The MCO Receiving System is now considered to be in "Normal Status".

10.2.25 If the following condition exists with an MCO in the Cask Receiving Pit:

- Both Operating Area HVAC (OHVAC) Exhaust Fans CSB-EF-001 and CSB-EF-002 are shut down (Zone III)

The MCO Receiving System is placed into a safe configuration in accordance with the *Transportation Cask Receiving System Operation Manual, MCO Receiving System Valve and Electrical Lineup for Operation*. This is to ensure all operating equipment (i.e., receiving crane, containment tent, etc.) is off and the system is placed into a safe configuration for further action. The operator is routed to the *Respond to the Loss of HVAC Exhaust Fans*, of the *MCO Heating, Ventilation and Air Conditioning (HVAC) Operation Manual.* If power is available to the 5.0 ton hoist and Zone III confinement is still out of service, the lid is reinstalled on the cask. This maintains a temporary contamination protection barrier inside the cask until the Zone III ventilation can be reestablished. When Zone III ventilation has been re-established, personnel reenter the tent and the cask is prepared for MCO transport to either the Storage Tube, Sample Station or Weld Station in accordance with *Transportation Cask Receiving System Operation Manual, Perform MCO Receiving Operation*. The MCO Receiving System is now considered to be in "Normal Status".

10.3 Configuration

10.3.1 The Transportation Cask Receiving System interfaces with the following systems:

A. The Normal Electrical Distribution System (NED) provides electrical power to Receiving Crane CRN-001 and auxiliary equipment during Receiving operations.

B. Containment Tent BARR-001 to provide a portable confinement around the Cask Receiving Pit, anytime an abnormal pressure (> 3.0 psig) exists inside the MCO cask.

C. During a high pressure event inside the MCO Cask Zone II Portable Tent Exhaust Unit CSB-AH-005 provides filtered exhaust ventilation for Containment Tent BARR-001.

D. The Truck Vestibule provides an air lock for the transport truck and semi-trailer to enter and leave the SNF CSB without opening the Zone III air space.

E. The Instrument/Service Air System provides dry, filtered and oil-free compressed air required to operate Cask Receiving instrumentation and portable tools.

F. Semi-Truck and trailer provides transportation of the MCO cask and MCO to and from SNF CSB to CVDF.

G. The Health Protection System provides the necessary radiological detection during MCO Receiving Operations.

10.3.2 The Transportation Cask Receiving System components and equipment are located in the Receiving Area, at the north end of the SNF CSB and span the entire east-west portion of the building.

10.3.3 The Transportation Cask Receiving System is described and depicted in Drawings H-2-123393, *P&ID MCO Servicing System* and H-2-120902, *Mechanical CSB MCO, MCO Service Station Plan and Section.*

10.4 Requirements

10.4.1 *Design Requirements*:

RECEIVING CRANE CRN-001	
Requirement	**Value**
Design Life	40 years
Gantry Design Capacity	60 tons
Auxiliary Hoist Capacity	10 tons
Gantry Total Lifting Capability	37 ft
Seismic Peak Horizontal Acceleration Limit	0.74 g @ 0.13 - 0.61 seconds
Seismic Peak Vertical Acceleration Limit	0.49 g @ 0.13 - 0.61 seconds
Gantry Wheels	Double-flanged, Lateral Displacement of 3/4" total
Gantry Maximum Speed	40 ft/min
Gantry Creep Speed	1.0 ft/min
Trolley Maximum Speed	40 ft/min
Trolley Creep Speed	1.0 ft/min
Maximum Main Hoist Speed	10 ft/min
Maximum Auxiliary Hoist Speed	10 ft/min
Maximum Main Hoist Creep Speed	0.5 ft/min
Maximum Auxiliary Hoist Creep Speed	0.5 ft/min

RECEIVING CRANE CRN-001	
Requirement	**Value**
Powered Rotating Hook Rotation Speed	0.5 rpm, no limits
Maximum anticipated Outside Cask Temperature	150 °F
Maximum anticipated Inside Cask Temperature	200 °F
Minimum anticipated Cold Temperature	-27 °F

PORTABLE TENT EXHAUST UNIT CSB-EF-005	
Requirement	**Value**
Design Capacity	1,000 scfm
Static Pressure	4.5 in wg
Barometric Pressure	29.16 in Hg
Face Velocity (HEPA)	250 fpm
ASHRAE Efficiency (Prefilter)	30%
HEPA Filter Efficiency	99.97% @ 0.3 μm
Clean Pressure Drop (HEPA)	1.0 in wg
Maximum Pressure Drop (HEPA)	3.0 in wg

CONTAINMENT TENT BARR-001	
Requirement	**Value**
Tent Material Thickness	20 ga
Maximum Pressure Range	0.5 to -0.25 in wg
Maximum Leachable Chloride Concentration	100 ppm

TENT GANTRY HOIST CRN-008	
Requirement	**Value**
Maximum Load	5.0 tons
Maximum Gantry Speed	35 ft/min.

TENT GANTRY HOIST CRN-008	
Requirement	**Value**
Maximum Lift Speed	10 ft/min.
Maximum Trolley Speed	25 ft/min.

MCO GUIDE AND SHIELD HATCH ASSEMBLY RSE-004	
Requirement	**Value**
N/A	N/A

TRUCK VESTIBULE (ROOM 033) DOORS	
Requirement	**Value**
Maximum Telescoping Door Speed	60 ft/min.
Maximum Curtain Door Speed	40 ft/min.

PORTABLE ALPHA CAM-585, BETA CAM-570, AREA RADIATION MONITOR ARM-511	
Requirement	**Value**
Range	10^0 - 10^7 cpm
Sensitivity	95% @ 20 mR/hr at 0.662 MeV
Temperature	< 5.0% change in calibration over 40 - 104 °F
Humidity	20 - 95% rh
Power Requirements	Operate with voltage and frequency ± 15% with output variations ± 5.0%
Electrical Effects	Operate with ± 5.0% when subjected to rf signals $\leq 10 \mu W/cm^2$
Mechanical Effects	Operate with ± 5.0% when seismic accelerations ≤ 1.0 g within a frequency range of 1.0 - 33 Hz
Radiation Alarm	Audible over operating range

PORTABLE ALPHA CAM-585, BETA CAM-570, AREA RADIATION MONITOR ARM-511	
Requirement	**Value**
Failure Alarm	Activates anytime any other alarm fails
Calibration	At lease once within NIST standards

10.4.2 *Operational Requirements*:

RECEIVING CRANE CRN-001	
Requirement	**Value**
Gantry Speed	0 - 20 ft/min. (slow) 0 - 40 ft/min. (fast)
Trolley Speed	0 - 20 ft/min. (slow) 0 - 40 ft/min. (fast)
Hoisting Speed	5.0 ft/min (slow) 0 - 10 ft/min (fast)
Powered Rotating Hook Rotation Speed	0 - 0.5 rpm clockwise and counter-clockwise
Anticipated Cask Temperature under Normal Conditions	60 °F Min. and 85 °F Max.
Anticipated Cask Temperature with Loss of Power Conditions	5.0 °F Min. and 115 °F Max.

PORTABLE TENT EXHAUST UNIT CSB-EF-005	
Requirement	**Value**
Normal Operating Pressure Range	Approx. -4.5 in. wg

CONTAINMENT TENT BARR-001	
Requirement	**Value**
Normal Operating Pressure Range	-0.05 to - 0.10 in wg
Anticipated Normal Operation Temperature	50 - 85 °F

TENT GANTRY HOIST CRN-008	
Requirement	**Value**
Normal Range Lift Speed	0 - 10 ft/min.
Normal Range Trolley Speed	0 - 25 ft/min.

MCO GUIDE AND SHIELD HATCH ASSEMBLY RSE-004	
Requirement	**Value**
N/A	N/A

TRUCK VESTIBULE (ROOM 033) DOORS	
Requirement	**Value**
Maximum Telescoping Door Speed	30 - 60 ft/min.
Maximum Curtain Door Speed	40 ft/min.

PORTABLE ALPHA CAM-585, BETA CAM-570, AREA RADIATION MONITOR ARM-511	
Requirement	**Value**
Beta CAM-570	
Detector Type	Geiger-Müeller
Filter Type	47 mm Diameter
Detector LLD	8 DAC-hr under laboratory conditions
Visual Alarm	Red Beacon
Audible Alarm	95 dB at 2 feet
Alpha CAM-585	
Detector Type	Silicon Diffuse Ion
Filter Type	47 mm Diameter
Detector LLD	8 DAC-hr under laboratory conditions
Visual Alarm	Red Beacon
Audible Alarm	95 dB at 2 feet

PORTABLE ALPHA CAM-585, BETA CAM-570, AREA RADIATION MONITOR ARM-511	
Requirement	**Value**
ARM-511	
Detector Type	DAI-6
Detector Energy Range	40 KEV-1.25 MEV
Analog Output	4-20 mA
Visual Rad Alarm	Red Beacon
Audible Rad Alarm	95 dB at 2 feet

10.4.3 *Maintenance and Surveillance Requirements*:

Receiving Crane CRN-001

A. Receiving Crane CRN-001 Lubrication Requirements are listed in the table below, in accordance with *C-01730, ACECO Receiving Crane Rev. 1 O&M Manuals, Volume 1, Section 1.0, General Information*:

RECEIVING CRANE CRN-001 LUBRICATION REQUIREMENTS	
COMPONENT	**FREQUENCY**
Hoist Sheave Bearings	200 hours or 2.0 months
Hook Block Sheave	200 hours or 2.0 months
Wire Rope	200 hours or 2.0 months
Bridge Wheel or Flange Bearings	600 hours or 6.0 months
Trolley Wheel or Flange Bearings	600 hours or 6.0 months
Trolley Cross Shaft Bearings	600 hours or 6.0 months
Bridge Cross Shaft Bearings	600 hours or 6.0 months
Couplings	1200 hours or 12 months
Hoist Reducer	1200 hours or 12 months
Hoist Motor	1200 hours or 12 months
Trolley Reducer	1200 hours or 12 months
Trolley Motor	1200 hours or 12 months
Bridge Reducer	1200 hours or 12 months
Bridge Motor	1200 hours or 12 months

B. Receiving Crane CRN-001 General Requirements are listed in the table below, in accordance with *C-01730, ACECO Receiving Crane Rev. 1 O&M Manuals, Volume 1, Section 1.0, General Information*:

RECEIVING CRANE CRN-001 GENERAL REQUIREMENTS				
Item	**Description**	**Daily**	**Monthly**	**Yearly**
Functional List	Check crane operation	✓	✓	✓
Oil and Fluid Leakage	Check cause and repair	✓	✓	✓
Safety	Check per procedures	✓	✓	✓
Safety Guards	Check condition	✓	✓	✓
Warning Devices	Check operation	✓	✓	✓
Wire Rope	Check for wear and damage	✓	✓	✓
Hooks	Check for cracks and deformation	✓	✓	✓
Limit Switches	Check operation and setpoint		✓	✓
Controllers and Pendant	Check for proper operation	✓	✓	✓
Rope Guide	Check wear and tighten bolts		✓	✓
Drum	Check for rough edges on cable grooves		✓	✓
Brakes	Check adjustment and wear		✓	✓
Rope Clamps	Check tightness		✓	✓
Sheaves	Check for wear		✓	✓
Bumper	Check for damage and operation		✓	✓
Wheels	Check for wear		✓	✓
Current Collectors	Check tension and wear		✓	✓
Electrical Connections	Spot check for loose connections		✓	✓
Slip Ring Motors	Check alignment and wear		✓	✓
Nuts and Bolts	Spot check for tightness		✓	✓

RECEIVING CRANE CRN-001 GENERAL REQUIREMENTS				
Item	**Description**	**Daily**	**Monthly**	**Yearly**
Guide Rollers	Check for wear			✓
Bridge Alignment	Check for alignment			✓
Gear Boxes/Gears	Check for wear			✓
Runway	Check for alignment and rail wear			✓

<u>MCO Shipping Cask</u>

C. Not an SNF-CSB system.

<u>Transport Semi-Truck and Trailer</u>

D. Not an SNF-CSB system.

<u>MCO Cask Lifting Yoke</u>

E. Maintenance and surveillance requirements are to be performed in accordance with *DOE-RL-92-36, Hoisting and Rigging, Manual, Sections 11.7 through 11.9.*

<u>Rail Frogs RF-001A and RF-001B</u>

F. Maintenance or surveillance requirements for the Rail Frogs RF-001A and RF-001B consist of routine inspections for wear. The jib cranes used to lift the frogs must be inspected annually.

<u>Containment Tent BARR-001</u>

G. Containment Tent BARR-001 General Requirements are in accordance with the Vendor's requirements.

Portable Tent Exhaust Unit CSB-EF-005

H. Portable Tent Exhaust Unit CSB-EF-005 General Requirements are in accordance with Vendor requirements.

Portable Alpha CAM-585, Beta CAM-570, Area Radiation Monitor ARM-511

I. ARM-511 operability checks must be performed by the Radiation Protection Group in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model EC4S-X, Technical Manual, Section IV, Maintenance* and *HNF-PRO-640, Eberline EC-4 Area Radiation Monitor* as follows:

Quarterly - Source

J. ARM-511 must be calibrated at least yearly by the Pacific Northwest National Laboratories (PNNL) in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation Document, Model PM-6A Personnel Monitor Technical Manual, Section IV, Maintenance* and the applicable PNNL procedure.

K. Beta CAM-570 including vacuum pump operability checks must be performed by the Radiation Protection Group in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model AMS-3 Beta Air Monitor Technical Manual, Section 4.0, Maintenance; C-17320, 1.6.3; Hi-Q Environmental Products Document, VS-Series Pump VS-S23-0523CV, Maintenance and Operating Instructions* and *HNF-PRO-645, Eberline EMS-3 CAMs* as follows:

Daily - Operability

Weekly - Source

Monthly - Alarm Check

L. Beta CAM-570 including vacuum pump must be calibrated at least yearly by the Pacific Northwest National Laboratories (PNNL) in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model AMS-3 Beta Air Monitor Technical Manual, Section 4.0, Maintenance; C-17320, 1.6.3; Hi-Q Environmental Products Document, VS-Series Pump VS-S23-0523CV, Maintenance and Operating Instructions* and the applicable PNNL procedure.

M. Alpha CAM-585 including vacuum pump operability checks must be performed by the Radiation Protection Group in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model Alpha-5 Alpha Air Monitor Technical Manual, Section 3.0, Maintenance; C-17320, 1.6.3;Hi-Q Environmental Products Document, VS-Series Pump VS-S23-0523CV, Maintenance and Operating Instructions* and *HNF-PRO-646, Eberline Alpha-4, 5, 5A and 5AS* as follows:

Daily - Operability

Weekly - Source

Monthly - Alarm Check

N. Alpha CAM-585 including vacuum pump must be calibrated at least yearly by the Pacific Northwest National Laboratories (PNNL) in accordance with *C-17320, 1.6.3; Eberline Instrument Corporation, Model Alpha-5 Alpha Air Monitor Technical Manual, Section 3.0, Maintenance; C-17320, 1.6.3; Hi-Q Environmental Products Document, VS-Series Pump VS-S23-0523CV, Maintenance and Operating Instructions* and the applicable PNNL procedure.

Truck Vestibule Air Lock Doors

O. Truck Vestibule Inner Curtain Door (Megadoor 1000) General Requirements are listed in the table below, in accordance with *C-08371, 1.6.1; Industrial Curtain Doors - Product Data - Megadoor 1000 (Byron Epp), Section 4.0, Maintenance*:

TRUCK VESTIBULE INNER CURTAIN DOOR GENERAL REQUIREMENTS					
Item	**Description**	**Monthly**	**Yearly**	**Every 2.0 Years**	**Every 5.0 Years**
Control	Check control box is tight and for dirt inside the box. If the box is dirty on the inside, clean it and replace cover seals if necessary	✓			
Safety Edge	Ensure that the door reverses when pressing the bottom section upward by hand as the door is closing. The safety edge is not functional if the door is in the constant contact control mode and the door closes only when the close button is pressed	✓			

TRUCK VESTIBULE INNER CURTAIN DOOR GENERAL REQUIREMENTS					
Item	**Description**	**Monthly**	**Yearly**	**Every 2.0 Years**	**Every 5.0 Years**
Drop Protection	Ensure that the drop protection is working by lowering the bottom section against a support positioned at one end about 1.0 meter above the floor level. Slack the belt by cranking. Remove the support. The drop protection must now lock the bottom section. To reset the door, the hoist belt must be stretched with the aid of the crank.	✓			
Slide Guide	Check that there is no damage or irregularities resulting from collision or dimensional changes which can affect movement of the door. Slide guide must be replaced if deformed.	✓			
Bottom Section	If the rubber seal of the bottom section does not seal against the floor at both ends, then the hoist belt must be adjusted. If the seal is damaged, replace the seal.	✓			
Clamp Strips	Strips deformed as a result of collision should be realigned or replaced. Loose strips must be re-fixed without failure	✓			
Fabric	Check fabric for damage. If fabric is damaged, the fabric must be repaired immediately to prevent further damage. Repairs are conducted by gluing or welding fabric over the damaged area. If the fabric is not stretched at the side guides when the door is shut, the fabric is to be re-stretched at the bottom section	✓			
Sealing Strip	Check sealing strip for damage. If damaged, the sealing strip shall be replaced along the entire length. The strip is easy to replace when the door is almost fully opened. The new strip must be pressed carefully into the slot along the entire length with the aid of a thin blade-shaped tool.	✓			
Hoist Belt	Check if the hoist belt shows signs of wear or damage. If damaged replace the belt		✓		

TRUCK VESTIBULE INNER CURTAIN DOOR GENERAL REQUIREMENTS					
Item	**Description**	**Monthly**	**Yearly**	**Every 2.0 Years**	**Every 5.0 Years**
Safety Edge Cable	Check the safety edge cable for wear. If the outer insulation is damaged, the cable should be replaced		✓		
Brake	Check the brake function and inspect for wear and verify settings in accordance with *Section 6.0, Eurodrive Brakes*		✓		
Gear Unit	Change oil in the gear unit and inspect for wear and verify settings in accordance with *Section 7.0, Shop and Electrical Drawings*			✓	
Motor	Grease motor bearings and check for excessive dust and foreign matter from fan and cooling fans in accordance with *Section 7.0, Shop and Electrical Drawings*				✓

P. Truck Vestibule Outer Telescoping Door (Milcor) General Requirements are listed in the table below, in accordance with *C-08370, 1.6.1, 1.6.3, 1.6.4; Telescoping Doors - Milcor Telescoping Door (Byron Epp, Inc.), Maintenance and Troubleshooting*:

TRUCK VESTIBULE OUTER TELESCOPING DOOR GENERAL REQUIREMENTS	
COMPONENT	**FREQUENCY**
Check Safety Edge and Brake Functions	Initial Inspection or 100 Opening/Closing Cycles
Check Brakes, Drive and Timing Chains and Sprockets, Shafts, Gearbox Oil Level and for Leaks	2.0 Months or 3,000 Opening/Closing Cycles
Check All Bearings, Lifting Cables, Plastic Edging, Roller on Limit Switch, Chain Clutch Brake Spring, Lubricate Chain Brake	6.0 Months or 40,000 Opening/Closing Cycles
Check Header Box and Side Guide Attachments, All Mechanical Header Box Attachments, Electrical Relays, Lifting Drums	Yearly or 100,000 Opening/Closing Cycles

MCO Guide and Shield Hatch Assembly RSE-004

Q. MCO Guide and Shield Hatch Assembly RSE-004 General Requirements are in accordance with Vendor's recommendations.

Cask Receiving Shield Ring

R. There are no identified maintenance or surveillance requirements for the Cask Receiving Shield Ring.

Tent Gantry Hoist CRN-008

S. Tent Gantry Hoist CRN-008 General Requirements are Vendor requirements.

Cask Receiving Pit

T. Cask Receiving Pit General Requirements are in accordance with Vendor's recommendations.

Cask Receiving Impact Absorber IMP-004

U. Cask Receiving Impact Absorber IMP-004 General Requirements are in accordance with Vendor's recommendations.

10.5 Safety

10.5.1 *Potential Safety Hazards and Concerns:*

A. There are several safety hazards associated with the operation of the Transportation Cask Receiving System:

- Hazards associated with Receiving Crane operation include dropping or losing a load, pinch points on hooks and equipment, etc.
- Hydrogen buildup from the uranium metal reaction with water in the MCO. This could cause an explosion hazard if the hydrogen is released from the MCO into the air at concentrations between 4% and 74%.

- Potential for radiological air contamination from a leak in the MCO or MCO cask.

B. Personnel are at risk of injury and equipment damage when not properly qualified. Only properly qualified personnel should be allowed to operate the receiving crane.

C. Any time the MCO cask lid is removed, there will be "High Radiation Shine" of approximately 100 mr/hr above the MCO. Exposure must be limited in accordance with the applicable Radiation Work Procedure.

D. Receiving Crane CRN-001 is protected by several engineered safety features:

- Bridge stops and over-travel limit switches prevent the Receiving Crane CRN-001 (60 ton gantry crane) trolleys from impacting the ends of the crane rails. Over-travel limit switches cause the trolley motors to slow down and stop prior to impact with the bridge stops. The bridge stops are designed to absorb whatever momentum is left after the over-travel limit switches have engaged.

- Collision prevention switches prevent the possible collision of CRN-001 and the MHM crane, as these cranes move on intersecting rails. There are also collision prevention switches that prevent a possible collision between the CRN-001 and the Truck Vestibule inner door.

- CRN-001 shielded operator control station, with shielded viewing window, is designed to minimize the radioactive exposure to the operator from the MCO or MCO cask during MCO receiving operations.

E. The MCO Guide and Shield Hatch Assembly RSE-004are designed to provide streaming protection as a sealing and shielding device in the space between the MHM and the Cask Receiving. This protection is especially significant when the MHM is lifting the MCO from the cask in the Cask Receiving Pit.

10.5.2 *Safety Classification*: The majority of the components contained in the MCO Receiving System are classified as General Service (GS), because they are not required to prevent or mitigate an accident or to operate after an accident, and provides only a limited function in protecting the facility worker from industrial and radiological hazards. However, the Receiving Crane is classified Safety Significant (SS) in keeping with the "NRC-Equivalency" categorization as Important to Safety, Category B. The structural portion of the receiving crane and deck portion of the Cask Receiving area are designed to meet Safety Class seismic design requirements.

Receiving Crane

The Receiving Crane is designed to ASME NOG-1, Type I criteria that meet Safety Significant (SS) Safety Classification requirements. If allowed to escape from the cask environment, the radionuclide release could be sufficient to result in SS exposures. The MCO is protected by the shipping cask from damage which could result in a release exceeding SS consequences as long as the cask is not dropped from an excessive height. No other accidents with the Receiving Crane are projected to result in significant damage to SS items. However, damage from a failure of the Receiving Crane may result in the Cask Receiving, or MHM cask from performing their safety functions. No damage resulting in a SC consequences due to impact to the deck or the vault inlet structure from a falling Receiving Crane is credible.

Cask Receiving Portable Tent and Hoist

The Containment Tent BARR-001 and associated auxiliary equipment (Tent Gantry Hoist CRN-008 and Portable Tent Exhaust Unit CSB-EF-005) are classified as General Service (GS) because they are not required to prevent or mitigate an accident or to operate after an accident, and provide only a limited function in protecting the facility worker from industrial and radiological hazards. The Cask Receiving 5.0 ton hoist moves the cask lid from the cask and across the top of the MCO. No radiological releases have been projected to occur due to an MCO cask lid drop.

Cask Receiving Pit

The Cask Receiving (Pit) is classified as Safety Significant (SS) because of the safety function of providing a radiologically safe area for operators to conduct MCO receipt and storage preparation operations. Sealed MCO design and strict implementation of MCO handling procedures minimize the probability of an accident. It has been determined that the unmitigated release from a failed MCO would be the release of radionuclides at safety significant levels. The floor of the Cask Receiving pit is designed to break-away in a dropped cask accident, allowing for repair of the pit rather than resistance to the accident, which could result in damage to the adjoining deck.

10.5.3 *Quality Level*: The MCO Receiving System has Quality Level I and II features. Safety Significant (SS) components must be classed at Quality Level I to provide increased assurance that they will function as designed. Quality Level I indicates that this System has more stringent Quality requirements specified. Quality Level II indicates that functionality can be adequately assured with the off-normal level of Quality Assurance.

10.5.4 *Environmental Safety*:

A. The SNF CSB does not have any connections to a chemical sewer or other means of direct disposal of hazardous chemical waste. All hazardous wastes generated during maintenance or other activities within the facility must be safely contained at the point of generation (i.e., fluids drained into buckets, rags and other materials placed in plastic bags), and removed to some other facility having suitable means of safe hazardous material disposal.

B. The General Service (GS) HEPA Filtered HVAC System provided for use with the Containment Tent assures compliance with Washington State airborne effluent requirements during normal operations.

10.6 References

10.6.1 Drawings relating to or referenced in this document are:

DWG #	DRAWING TITLE
D-14899-01 Sheets 1-4	American Crane & Equipment Corporation, 60/10 Ton Double Girder Crane General Arrangement, Elevation
D-14899-300	American Crane & Equipment Corporation, 60/10 Ton Receiving Crane Trolley Arrangement

DWG #	DRAWING TITLE
D-14899-302	American Crane & Equipment Corporation, 60/10 Ton Receiving Crane Main Hoist Drive Arrangement
D-14899-304	American Crane & Equipment Corporation, 60/10 Ton Receiving Crane Aux. Hoist Drive Arrangement
D-14899-370	American Crane & Equipment Corporation, 60/10 Ton Receiving Crane Main Hoist Lower Block Assembly
D-14899-380	American Crane & Equipment Corporation, 60/10 Ton Receiving Crane 10 Ton Aux. Lower Block Assembly
D-14899-500	American Crane & Equipment Corporation, 60/10 Ton Receiving Crane Bridge Wheel Assembly, Idler
D-14899-501	American Crane & Equipment Corporation, 60/10 Ton Receiving Crane Bridge Wheel Assembly, Drive
EB-14899-00	American Crane & Equipment Corporation, Drawing Index
EB-14899-01 Sheet 1-10	American Crane & Equipment Corporation, System Wiring Diagram
EB-14899-02 Sheets 1-3	American Crane & Equipment Corporation, Control Panel Layout
EB-14899-03 Sheets 1-4	American Crane & Equipment Corporation, Control Logic Diagram
EB-14899-04	American Crane & Equipment Corporation, Conduit Layout
H-2-117794 Sheet 1	Architectural General Notes and Building Data
H-2-117795 Sheet 1	Architectural Floor Plan - North
H-2-117795 Sheet 3	Architectural Floor Plan - South
H-2-117797 Sheets 1-2	Architectural Exterior Elevations
H-2-117799 Sheets 1-4	Architectural Doors
H-2-117812 Sheets 1-4	Architectural Interior Elevations
H-2-120902 Sheets 1-3	Mechanical CSB MCO Service Station Layout

DWG #	DRAWING TITLE
H-2-120913, Sheets 1-2	Mechanical CSB Receiving Gantry Crane Layout
H-2-122733 Sheets 1-5	Electrical Canister Storage Building One Line Diagram (MCC-32-209, MC-32-210, Overall, Generator EG-1A, Generator EG-1B)
H-2-122740 Sheets 1-2	Electrical Canister Storage BLDG Above Ground Power Plan
H-2-122744	Electrical Canister Storage BLDG Panel Schedules
H-2-123390 Sheet 1	P&ID Legend and Symbols INSTR/HVAC/Piping
H-2-123390 Sheet 2	P&ID Instrumentation Notes
H-2-123400 Sheets 1-7	Operational Sequence Block Flow Diagram
H-2-123392	P&ID Instrument/Service Air System
H-2-123393	P&ID MCO Servicing System
H-2-129582	P&ID HVAC Operating Area CSB-AH-001
H-2-129585	P&ID HVAC Operating Area CSB-PF-002
SK-120900 Sheets 1-4	Mechanical CSB Space Allocation Plan View

10.6.2 Documents relating to or referenced in this document are:

DOC. #	DOCUMENT TITLE
N/A	Design Basis Document, Section 8, Mechanical
HNF-3553	Annex A, Canister Storage Building Safety Final Analysis Report Section A2.5.1, Baseline Operations Including Handling of Multi-Canister Overpacks
HNF-4509	Evaluation of Canister Storage Building Cask Receipt Pressure
HNF-SD-SNF-OCD-001	Spent Nuclear Fuel Project Product Specification

DOC. #	DOCUMENT TITLE
HNF-SD-SNF-SAR-002	Safety Analysis Report for the Cold Vacuum Drying Facility, Section 2.5.1.13, Multi-Canister Overpack Helium Leak Test and Preparation of Cask for Departure
DOE-RL-92-36	Hanford Site Hoisting and Rigging Manual
HNF-PRO-516	Safety Structures, Systems, and Components
N/A	SNF CSB System Safety Classification Forms, Section 96-04, MCO Receipt and Servicing
W-379-C-CSB-01730	Operation and Maintenance Data
W-379-C-CSB-08370	Telescoping Doors
W-379-C-CSB-08371	Industrial Curtain Doors
W-379-C-CSB-13030 W-379-C-CSB-13610	Containment Tent Shield Hatch Assembly
W-379-C-CSB-14310	Portable Floor Crane
W-379-C-CSB-14320	MCO Service Station Gantry Crane and Hoist
W-379-C-CSB-14503	Embedded Crane-Rail Frogs
W-379-C-CSB-15881	Air Filters (HVAC)
W-379-C-CSB-15061	Piping Material, Fabrication, Erection and Pressure Testing (Carbon Steel, Iron and nonmetallic)
W-379-C-CSB-15834	Exhaust Unit
W-379-C-CSB-15883	HEPA Filter Housing
W-379-C-CSB-15990	HVAC System Testing and Balancing
W-379-C-CSB-16150	Motors - Induction for General Service
W-379-C-CSB-16151	Motors - Induction for Radioactive Service
W-379-C-CSB-17704 W-379-C-CSB-17704B	General Instrumentation Installation and Testing
W-379-P-CSB-14620	Receiving Crane
W-379-C-CSB-17320 W-379-C-CSB-17320B	Health Protection Instrumentation (HPI)
W-379-P-CSB-17704 W-379-P-CSB-17704A W-379-P-CSB-17704B	General Instrumentation Installation and Testing

DOC. #	DOCUMENT TITLE
W-379-C-CSB-17705 W-379-C-CSB-17705B	Instrument Calibration and Checkout
W-379-P-CSB-17705 W-379-P-CSB-17705A W-379-P-CSB-17705B	Instrument Calibration and Checkout
W-379-C-CSB-17708 W-379-C-CSB-17708B	Instrument Piping Pressure Testing
W-379-C-CSB-17861 W-379-C-CSB-17861B	Local Control Panels
W-379-P-CSB-17861 W-379-P-CSB-17861B	Local Control Panels
W-379-C-CSB-17864 W-379-C-CSB-17864B	Instruments Furnished with Mechanical Equipment Canister Storage Building
W-379-P-CSB-17864 W-379-P-CSB-17864B	Instruments Furnished with Mechanical Equipment Canister Storage Building
C-08370, 1.6.1 - 1.6.6	Industrial Curtain Doors: Megadoor 1000
C-08371. 1.6.1	Telescoping Doors
C-14620, 1.6 (C-01730 and Change Order, CO-193)	Receiving Crane Operation and Maintenance Manual
Change Order, CO-193	Cask Receiving Crane (CRC) Preventative Maintenance Procedure
C-17320, 1.6.3	Eberline Instrument Corporation Document, Model EC4S-X [ARM] Technical Manual
C-17320, 1.6.3	Eberline Document: Model Alpha-5A Alpha Air Monitor Technical Manual (VI-19183 Supp. 02)
C-17320, 1.6.3	Eberline Document: Model AMS-3 Beta Air Monitor Technical Manual (VI-19183 Supp. 06)

SPENT NUCLEAR FUEL CANISTER STORAGE BUILDING

TRANSPORTATION CASK SERVICING (System #13)

SYSTEM DESIGN DESCRIPTIONS

11.0 TRANSPORTATION CASK SERVICING SYSTEM DESCRIPTION (SYSTEM #13)

11.1 Function

11.1.1 The Transportation Cask Servicing System (TCS) is designed to be used in one of three ways: Service the cask at the CSB, prepare the cask for return to the Cold Vacuum Drying Facility, or temporary cask storage. The TCS facilitates the recovery from "off-normal" MCO handling operations, such as an "off-normal" shipment from the Cold Vacuum Drying Facility, or an MCO leaking gas into the shipping cask. The TCS is able to purge generated gas (primarily hydrogen generated from the MCO) from the MCO Cask, and replace the purged gas with helium to prepare the cask for lid removal and the suspect MCO for placement in an Overpack Tube for monitoring (MCO Overpack Tube Purge System).

11.1.2 During servicing operations at the SNF CSB, it is important to prevent a hydrogen-containing atmosphere, generated from a leaking MCO, inside the MCO Cask from becoming a flammable or explosive gas mixture. Venting and inerting the MCO Cask, by the Transportation Cask Servicing System, allows the potentially hazardous gas to be vented to the CSB HEPA filters and stack, then the MCO Cask Lid may be safely removed in preparation for MCO transport to an Overpack Storage Tube. Safety is maintained during Service operations by excluding oxygen (air) from the gas generated by the leaking MCO and contained within the MCO Cask, and diluting hydrogen to safe concentration levels before release through the building HEPA filter to the HVAC exhaust stack. These operations will allow for the removal of the MCO cask lid and retrieval of the MCO into the MHM so the MCO may be placed into an inerted, pressure-managed Overpack Storage Tube. These temporary measures maintain the safety of the MCO Cask long enough for temporary storage, or be sent back to CVDF for analysis and potential rework.

11.2 Operation

Normal Operations:

NOTE - "Normal operation" for the Transportation Cask Servicing System is defined as: Anytime the TCS is required to service (Vent and Inert) an Abnormal MCO Cask, whenever the internal cask pressure is greater than 3.0 psig.

11.2.1 When the TCS functions begin, the following conditions exist:

- MCO cask pressure was measured in accordance with *Transportation Cask Receiving (TCR) System Operation Manual* and the results indicate greater than 3.0 psig inside the cask

- Servicing of the MCO at the Cask Receiving Pit has been selected as the most appropriate method for MCO cask "off-normal" recovery.

- A transportation cask containing an MCO has been placed in the MCO cask receiving pit in accordance with *Transportation Cask Receiving (TCR) System Operation Manual*

- Containment Tent BARR-001 has been placed over the Cask Receiving Pit, and is in normal operation

- Containment Tent BARR-001 Zone II exhaust system is connected and is in normal operation.

11.2.2 The TCS is designed to vent and purge any buildup of hydrogen or other gas impurities that leak from an MCO into the MCO Cask during shipment from the Cold Vacuum Drying Facility (CVDF) to the CSB. The main concern is a buildup of hydrogen caused by a reaction between water remaining in the MCO and the metallic uranium of the reactor fuel. If the hydrogen in the MCO mixes with air to a concentration of > 4%, a fire and/or explosion hazard is possible. The TCS is used to monitor the internal pressure of an off-normal MCO cask as soon as possible after the MCO Receiving System operations have determined that an "off-normal" condition exists, that other means of "off-normal" MCO recovery (i.e., return to CVDF or temporary storage in the shipping cask) have been considered, and the placement of the MCO into an Overpack Storage Tube has been selected as the most appropriate method for "off-normal" recovery.

11.2.3 An "off-normal" condition exists anytime a high pressure condition exists inside the cask (pressure greater than 3.0 psig). A high Transportation Cask pressure indicates that the MCO within the cask has a leak or breach in the MCO, possibly due to a high hydrogen pressure buildup caused by excess water inside the MCO. A normal Transportation Cask pressure indicates that the MCO is in normal status, allowing removal of the cask lid and immediate transfer of the MCO to a Standard Storage Tube.

11.2.4 Transportation Cask Servicing is executed when the TCS is connected via a flexible steel hose to the MCO cask access port on the cask lid. The internal MCO cask pressure is checked.

11.2.5 If sampling indicates conditions acceptable for venting, the internal MCO cask atmosphere is vented through HEPA Filter FH-2 to remove radioactive contamination before being discharged into the OHVAC system exhaust duct upstream of HVAC Exhaust Fan CSB-PF-002. Because the gas purged from the MCO has been in direct contact with the fuel, fuel particles may be suspended in the MCO cask atmosphere. Venting continues until MCO cask pressure reaches atmospheric pressure. If conditions do not permit venting, a recovery plan will be developed.

11.2.6 During venting, a sample of the leaking MCO gas may be collected in a gas sample container and sent to a laboratory for analysis. At the laboratory, the gas sample will be checked for hydrogen concentration, excess water, and unexpected chemical contamination. Until the sample is analyzed at the sample laboratory, it must be assumed that the MCO contains a concentration of hydrogen that will be flammable when mixed with air.

11.2.7 While the MCO cask is being vented, helium is injected into the TCS piping system discharge to dilute the hydrogen concentration of the vented gas. This dilution prevents a flammable mixture of hydrogen from reaching the HVAC Exhaust ducts. Injection of helium into the vent gas stream is controlled proportionally to the pressure of the venting gas, to assure efficient mixing and dilution.

11.2.8 Once the MCO cask has vented to atmospheric pressure, it can be pressure purged with helium several times and vented again to atmospheric pressure. Pressurization is accomplished at slow, controlled rates to prevent unnecessary disturbance of any particulate contamination inside the MCO cask. After the MCO cask is purged, hydrogen concentration within the MCO cask will be low enough to safely remove the "off-normal" MCO to an Overpack Storage Tube for monitored storage.

11.2.9 When the MCO cask has been vented to atmospheric pressure after the pressure purge(s) and if the MCO is going to remain in the cask for an extended period of time, the MCO cask may be re-pressurized with low pressure helium to 5.0 psig to prevent air in-leakage. If the "off-normal" MCO is considered stable, it is ready for transfer to an MCO Overpack Storage Tube in accordance with the *Transportation Cask Receiving (TCR) System Operation Manual* and *MCO Handling Machine (MHM) Operation Manual.*

Emergency Operations:

11.2.10 If the following condition exists at the Cask Receiving Pit during Servicing Operations:

- A loss or interruption of 120 Vac power to the cask servicing instruments and lights while an MCO is in the Cask Receiving Pit

The MCO is placed into a safe configuration in accordance with *TCS Valve and Electrical Lineup for Operation*. This is to ensure all operating equipment (i.e., air monitoring equipment, etc.) is off and the system is placed into a safe configuration for further action. Supervision is notified of the condition, a recovery team is convened and the situation is analyzed for contingency actions. The MCO cask is pressurized to 5.0 psig (4.5 - 5.5 psig) with helium to ensure an inert atmosphere is maintained in the MCO during the duration of the power outage. The MCO cask is now considered to be in "Normal Status."

11.2.11 If any of the following conditions exist at the Cask Receiving Pit during Servicing Operations:

- Both Zone III Operating Area HVAC (OHVAC) Exhaust Fans CSB-EF-1 and CSB-EF-2 are shut down

The MCO cask is placed into a safe configuration in accordance with *TCS Valve and Electrical Lineup for Operation*. This is to ensure all operating equipment (i.e., air monitoring equipment, etc.) is off and the system is placed into a safe configuration for further action. Supervision is notified of the condition, a recovery team is convened and the situation is analyzed for contingency actions. The Operator is routed to HVAC System Emergency Procedure *Respond to Loss of HVAC System Exhaust Fans* in the *HVAC System Operation Manual*. If the affected HVAC system cannot be restarted in a short period of time, the MCO cask is pressurized to a nominal 5.0 psig with helium to ensure an inert atmosphere is maintained in the MCO until the exhaust fans are restored to operation. When exhaust fan operation is restored, the MCO cask is again considered to be in "Normal Status".

11.2.12 If any of the following conditions exist with an MCO in the Cask Receiving Pit:

- Zone II Portable Tent Exhaust Fans CSB-EF-005A and CSB-EF-005B have shut down

The Transportation Cask Servicing (TCS) System is placed into a safe configuration in accordance with *MCO Receiving System Valve and Electrical Lineup for Operation*. This is to ensure all operating equipment (i.e., air monitoring equipment, Containment Tent, etc.) is off and the system is placed into a safe configuration for further action. Supervision is notified of the condition, a recovery team is convened and the situation is analyzed for contingency actions.

11.3 Configuration

11.3.1 The Transportation Cask Servicing System (TCS) interfaces with the following systems:

A. The Normal Electrical Distribution System (NED) provides electrical power.

B. Containment Tent BARR-001 and Air Handling Unit CSB-AH-005 provide Service Pit (Zone II) ventilation and exhaust filtering for the contamination control of leaking components or accidental discharges.

C. The Operating Area HVAC System (OHVAC) provides the Zone III Operating Area ventilation and filtering for the final containment for leaking components.

D. The Distributed Control System (DCS) provides monitoring of cask vent gas temperature and pressure, and control of helium flow (via a Programmable Logic Controller) used for dilution of vented cask gas.

E. The helium supply system supplies helium to the Cask Receiving Pit at 80.0 psig and 5.0 psig for MCO cask purging, vent gas dilution and re-inerting.

F. The Analytical Laboratory provides analyses of gas samples taken during venting operations.

G. If needed, Overpack Storage Tubes are used to maintain confinement of "off-normal" MCOs; six tubes with one MCO per tube.

11.3.2 The Transportation Cask Servicing System (TCS) components are located in several areas of the SNF CSB:

A. The flexible Steel Hoses are located at the Cask Receiving Pit for use, and stored on the Tube Vent and Purge Cart.

B. HEPA Filter FH-2, the gas sample container equipment, and portions of the vent discharge piping are located in the Instrument Air Equipment Room.

C. The gas supply for the helium System is located outside the west wall of the Instrument Air Equipment Room, adjacent to the Trailer Vestibule. helium system components are located in the Instrument Air Equipment Room.

D. The refill station is located on the mid-portion of the west wall of the Operating Area near Column Number 3. This station provides helium to refill the MCO Tube Vent and Purge Cart helium gas cylinders.

11.3.3 The configuration of the TCS is shown in *H-2-123393, P&ID Transportation Cask Servicing System.*

11.4 Requirements

11.4.1 *Design Requirements*:

TCS SYSTEM	
Requirement	**Value**
Vent Subsystem	
System Design Life	40 years
Maximum Internal Temperature	400 °F
MCO Design Pressure	450 psig
MCO Maximum Shipping Pressure	20 psig
Helium Subsystem	
Helium Storage Capacity (one trailer)	2 years
Helium System Capacity (volume)	40,000 scf
Helium System Pressure	120 psig

FLEXIBLE STEEL HOSES	
Requirement	**Value**
Maximum Temperature	Cryogenic to 1250 °F
Pressure	Full Vacuum - 3190 psig

HEPA FILTER FH-2	
Requirement	**Value**
Maximum Temperature	400 °F
Maximum Pressure	150 psig
Maximum Differential Pressure (ΔP)	80 psi
Particle Removal	99.97% @ 0.3 microns

PRESSURE RELIEF VALVES PSV-102 and PSV-121	
Requirement	**Value**
PSV-102, Maximum Temperature PSV-121, Maximum Temperature	180 °F 180 °F
PSV-102, Maximum Pressure PSV-121, Maximum Pressure	150 psig 2500 psig
PSV-102, Spring Set Rating PSV-121, Spring Set Rating	150 psig 2500 psig

FLOW ORIFICES FO-101 and FO-116	
Requirement	**Value**
FO-101, Maximum Temperature FO-116, Maximum Temperature	100 °F 100 °F
FO-101, Maximum Pressure FO-116, Maximum Pressure	150 psig 2500 psig
FO-101, Maximum ΔP FO-116, Maximum ΔP	150 psid 2500 psid

PRESSURE REGULATOR VALVES PCV-103 AND PCV-104	
Requirement	**Value**
PCV-103, Flow Range PCV-104, Flow Range	0.0 - 20 scfm 0.0 - 20 scfm
PCV-103, Maximum Inlet Pressure PCV-104, Maximum Inlet Pressure	150 psig 150 psig
PCV-103, Maximum Outlet Pressure PCV-104, Maximum Outlet Pressure	5.0 psig 80 psig
PCV-103, Maximum Differential Pressure PCV-104, Maximum Differential Pressure	150 psid 165 psid
PCV-103, Maximum Temperature PCV-104, Maximum Temperature	180 °F 180 °F
PCV-103, Maximum Spring Range PCV-104, Maximum Spring Range	2.0 - 12 psig 25 - 125 psig

PRESSURE REGULATOR VALVE PCV-122	
Requirement	**Value**
Flow Range	0.0 - 20 scfm
Maximum Inlet Pressure	2500 psig
Maximum Outlet Pressure	120 psig
Maximum Differential Pressure	2500 psid
Maximum Temperature	180 °F

PRESSURE CONTROL VALVE PCV-115	
Requirement	**Value**
Maximum Flow	480 scfm
Maximum Inlet Pressure	150 psig
Maximum Outlet Pressure	5.0 psig
Maximum Differential Pressure	145 psid
Maximum Temperature	100 °F

11.4.2 *Operational Requirements*:

TCS SYSTEM	
Requirement	**Value**
General	
MCO Shipping Pressure	0.0 psig (atmospheric pressure)
Vent Subsystem	
N/A	N/A

TCS SYSTEM	
Requirement	**Value**
Helium Subsystem	
High-Pressure Helium System Pressure	80 psig (75 - 85 psig)
Low Pressure Helium System Pressure	5.0 psig (4.5 - 5.5 psig)

FLEXIBLE STEEL HOSES	
Requirement	**Value**
Maximum Temperature	Cryogenic to 1250 °F
Pressure	0.0 psig - 2500 psig

HEPA FILTER FH-2	
Requirement	**Value**
Temperature	150 °F
Pressure	2.0 psig
Flow	5.0 scfm
Clean Differential Pressure (ΔP)	7.0 inches-wg @ atmospheric pressure
Gas Composition	Up to 20% H_2, in He, N_2 or Ar
Humidity	< 20% RH

PRESSURE RELIEF VALVES PSV-102 and PSV-121	
Requirement	**Value**
PSV-102, Normal Temperature PSV-121, Normal Temperature	70 °F 70 °F
PSV-102, Normal Pressure PSV-121, Normal Pressure	150 psig 2500 psig
Gas Composition	He, N_2, or Ar

FLOW ORIFICES FO-101 and FO-116	
Requirement	**Value**
FO-101, Normal Temperature FO-116, Normal Temperature	70 °F 60 °F
FO-101, Normal Pressure FO-116, Normal Pressure	2000 psig 15 psig
FO-101, ΔP at Normal Flow FO-116, ΔP at Normal Flow	< 1000 psid 15 psid
FO-101, Normal Flow FO-116, Normal Flow	140 scfm 20 scfm
Gas Composition	He, N_2, or Ar

PRESSURE REGULATOR VALVES PCV-103 AND PCV-104	
Requirement	**Value**
PCV-103, Normal Flow PCV-104, Normal Flow	5.0 scfm 20 scfm
PCV-103, Normal Outlet Pressure PCV-104, Normal Outlet Pressure	5.0 psig 80 psig
PCV-103, Normal Temperature PCV-104, Normal Temperature	70 °F 70 °F

PRESSURE REGULATOR VALVE PCV-122	
Requirement	**Value**
Normal Flow	5.0 - 20 scfm
Normal Outlet Pressure	120 psig
Normal Temperature	70 °F

PRESSURE CONTROL VALVE PCV-115	
Requirement	**Value**
Normal Flow	360 scfm
Normal Inlet Pressure	120 psig
Normal Outlet Pressure	5.0 psig
Normal Differential Pressure	115 psid
Normal Temperature	70 °F

11.4.3 *Maintenance and Surveillance Requirements*:

TCS System Components

A. Helium Supply System inspection, testing and calibration requirements must be performed at least yearly or anytime the components show signs of excessive wear or breakdown.

B. Flexible Steel Hose inspection, testing and calibration requirements must be performed prior to use. The hoses are replaced anytime they show signs of excessive wear or breakdown.

C. Manual Valve inspection, testing and calibration requirements must be performed prior to use. The valves are replaced anytime they show signs of excessive wear or breakdown.

D. HEPA Filer FH-2 inspection, testing and calibration requirements must be performed at least yearly.

E. Sample Connection inspection, testing and calibration requirements must be performed at least annually, or anytime the connection shows signs of excessive wear or breakdown.

F. Pressure Relief Valves PSV-102 and PSV-121 inspection, testing and calibration requirements must be performed at least every 12 months, or anytime the valves show signs of excessive wear or breakdown, in accordance with *C-17663, 1.6.3; Manufacturer's O&M Manuals Pressure Relief Valves, Crosby Engineering Procedure Omni Series 900; Section 3, Maintenance.*

G. Flow Orifices FO-101 and FO-116 inspection and testing requirements must be performed anytime the orifices show signs of excessive wear or breakdown, in accordance with *Vendor Information*.

H. Pressure Regulating Valves PCV-103, PCV-104 inspection, testing and calibration requirements must be performed at least every 12 months, or anytime the valves show signs of excessive wear or breakdown, in accordance with *C-17621, 1.6.3; Self Actuated Pressure Regulators/Manufacturer's Operation & Maintenance Manual - 17 Series Back Pressure Regulator Instructions for Models 17-17 and 17-27; Adjustment, and Maintenance.*

I. Pressure Regulating Valve PCV-122 inspection, testing and calibration requirements must be performed anytime the valve show signs of excessive wear or breakdown, in accordance with *Vendor Information.*

J. Pressure Control Valve PCV-115 inspection, testing and calibration must be performed anytime the valve shows signs of excessive wear or breakdown, in accordance with the following:

- Valve Body: *C-17656, 1.6.1; Catalog Cuts Globe Type Control Valves, Fisher-Rosemount Design EZ easy-e Control Valve; Installation, and Maintenance.*

- Actuator: *C-17656, 1.6.1; Catalog Cuts Globe Type Control Valves, Fisher-Rosemount Type 657 Diaphragm Actuator Sizes 30-70 and 87; Maintenance.*

- Positioner: *C-17656, 1.6.1; Catalog Cuts Globe Type Control Valves, Fisher Controls, 3582 Series Valve Positioners, Type 3582i Valve Positioner, and 3583 Series Valve Stem Position Transmitters; Installation, and Operating Information*

- Filter Regulator: *C-17656, 1.6.1; Catalog Cuts Globe Type Control Valves, Fisher Controls, Type 67AF and 67AFR Filter Regulators; Startup and Adjustment, and Maintenance.*

<u>TCS System Instruments</u>

K. Pressure Control Instruments PIT-108, PIR-108 inspection, testing and calibration requirements must be performed at least every 12 months, or anytime the instruments show signs of excessive wear or breakdown, in accordance with *Vendor Information.*

L. Temperature Control Instruments TE-109, TIT-109 and TIR-109 inspection, testing and calibration requirements must be performed at least every 12 months, or anytime the instruments show signs of excessive wear or breakdown, in accordance with the following:

- TE-109: *Vendor Information.*

- TIT-109: *C-17601, 1.6.1; Temperature Transmitters Electronic/Catalog Cuts - Rosemount Model 3144 and 3244MV Fisher-Rosemount Models 3144 and 3244MV Smart Temperature Transmitters; Section 3, Online-Operations, and Section 4, Maintenance.*

- TIR-109: *Vendor Information.*

M. Pressure Gauges PI-103, PI-104, PDI-110, PI-123, PI-124, PI-125, PI-126, PI-127 and PI-128 inspection, testing and calibration requirements must be performed at least every 12 months, or anytime the instruments show signs of excessive wear or breakdown, in accordance with *Vendor Information.*

N. Flow Indicator FI-103 inspection, testing and calibration requirements must be performed at least every 12 months, or anytime the instruments show signs of excessive wear or breakdown, in accordance with *C-17632, 1.6.3; Manufacturer's Operation and Maintenance Manuals, Emerson Full-View Flow Meters; Section 3, Operation, Section 4, Maintenance, and Section 5, Repair.*

O. Pressure Control Instruments PT-115 and PIC-115 inspection, testing and calibration requirements must be performed at least every 12 months, or anytime the instruments show signs of excessive wear or breakdown, in accordance with *C-17617, 1.6.1; Rosemount Catalog Cuts - Pressure Transmitter Rosemount 3051, Fisher- Rosemount Model 3051 Smart Pressure Transmitter Family; Section 3, Installation, and Section 4, Troubleshooting.*

11.5 Safety

11.5.1 *Potential Safety Hazards and Concerns:*

There are several potential safety hazards associated with the operation of the Transportation Cask Servicing System (TCS):

A. Hydrogen buildup from a (uranium) metal/water reaction in the MCO:

- After an MCO is shipped, the temperature and pressure inside the MCO are expected to rise due to the decay heat from the fuel elements. The projected temperature rise inside the MCO will increase the reaction rate between the fuel elements and water remaining after cold vacuum drying, to produce additional hydrogen gas. This reaction rate doubles with each 15 - 20 °F increase in fuel and water temperature.

- If a leak or breach develops in the MCO while inside the shipping cask, and the space within the shipping cask becomes pressurized with hydrogen, the cask will require venting and helium purging in the Cask Receiving Pit before the cask lid is removed.

- Hydrogen concentration may increase to the point of reaching the flammability range >4% in air. If hydrogen is accidentally released from the MCO Cask during servicing and mixes with air to a concentration which falls within the flammability range in the atmosphere, then deflagration becomes possible.

- Helium is mixed with the vented MCO gas from the cask prior to discharge into the Operating Area HVAC Exhaust piping (upstream of CSB-PF-002) to ensure sufficient dilution to keep the hydrogen concentration in the exhaust gas at less than 25% of the lower explosive limit (LEL - 4% in air). Thus, the helium dilution will ensure that hydrogen in vented gas is less than 1%.

B. There is a potential for air contamination and hydrogen release from a faulty MCO, a bad connection to the Cask Receiving Pit, or damage to MCO cask connections.

C. A pressure relief valve located downstream of the helium supply source is set at 150 psig to prevent over pressurization of the MCO cask and the Cask Receiving Pit.

D. The TCS is designed to prevent damage to the system if the MCO cask temperature and pressure are near design limits when connected to the System.

E. HEPA Filter FH-2, and associated piping provide a confinement barrier which prevents the release of radionuclide particulate contamination. The HEPA filters must be challenge tested regularly to ensure that the filtering efficiency requirements are met; HEPA Filters must be changed out when the quantity of trapped particulates becomes a radiation hazard or anytime the differential pressure indicates change out.

F. Any time the MCO cask cover is removed, there is a potential for "High Radiation Shine" (>100 mR/hr) directly above the MCO. Exposure must be limited in accordance with the applicable Radiation Work Permit. Long-reach tools and the automated torque tool will be used, as necessary, to reduce exposure.

11.5.2 *Safety Classification*: The flex connector, HEPA filter, piping between the filter and the cask, and PSV-102 in the Transportation Cask Servicing System (TCS) are classified as Safety Significant (SS). The primary safety function for the TCS is to provide a means for high-pressure, "off-normal" MCO cask servicing to prevent or mitigate a radiological release. The TCS must also function to place an "off-normal" MCO cask into a known (baseline) status before cask lid removal and initial placement into an Overpack Tube. Air ingress into the MCO has the potential for a SS consequence from hydrogen deflagration, if not limited to diffusion through an opening with equivalent area of less than a 1.0-inch diameter hole. There is a very low probability of air ingress to the TCS when properly operated.

Transportation Cask Servicing System

The baseline approach to management of the hazards associated with MCO pressurization and hydrogen combustion relies on low MCO total water content (< 4.4 kg water). MCO accidents of concern for the Transportation Cask Receipt and Servicing areas are currently assumed for design purposes to have unmitigated consequences reaching SS exposure levels.

Helium Supply System

The helium Supply System is classified as General Service (GS), because it is not required to prevent or mitigate an accident or to operate after an accident, and provides only a limited function in protecting the facility worker from industrial and radiological hazards. The helium System is required to ensure that an adequate supply of purge gas is available during servicing and to maintain the inert atmosphere in the MCO cask. If an adequate supply of helium is not available, no accidents occur with Safety Class or Safety Significant (SS) consequences before an additional supply of gas can be provided. The system is designed to prevent air ingress during the time that an MCO cask is connected to the system for servicing, and to provide a positive-pressure inert atmosphere inside the MCO or MCO cask to prevent development of conditions conducive to hydrogen deflagration. This design is based on engineered safety features that prevent air (oxygen) from being delivered to the MCO cask by the helium supply during servicing. Administrative controls will also be in place to ensure the purity of the helium received.

Operating Area HVAC System

The Operating Area HVAC System is classified as General Service (GS). There are no failures of the Operating Area HVAC System with SC or SS consequences. Failure of the Operating Area HVAC may make the temperature over the deck area unacceptable for long periods of work but no significant releases can result from failure of the HVAC system.

Health Protection System

The Health Protection System is classified as General Service (GS), because it is not required to mitigate an accident, or to operate after an accident. The HP system is designed to monitor and alert personnel to hazardous radioactive conditions that could occur as a result of malfunctions or accidents. The HP system is also designed to provide a limited function in protecting facility workers from industrial and radiological hazards without any off-site consequences. The Health Protection system utilizes airborne contamination and area dose rate monitoring, and personnel contamination monitors for the facility worker.

11.5.3 *Quality Level*: The Transportation Cask Servicing System is Quality Level I. Safety Class and Safety Significant systems are designated Quality Level I to provide increased assurance that the system will function as designed. General Service Systems may also be designated Quality Level I. Quality Level I indicates that this system has more stringent quality requirements specified than may be assumed by a vendor or operator.

11.5.4 *Environmental Safety*: The SNF CSB does not have any connections to a chemical sewer or other permanently installed means of direct disposal of hazardous chemical waste. All hazardous wastes generated during maintenance or other activities within the facility must be safely contained at the point of generation (i.e., fluids drained into buckets, rags and other materials placed in plastic bags), and removed to some other facility having suitable means of safe hazardous material disposal. The General Service HEPA-filtered building HVAC System assures compliance with Washington State airborne effluent requirements during normal operations.

11.6 References

11.6.1 Drawings relating to or referenced in this document are:

DWG #	DRAWING TITLE
H-2-120902 Sheet 1-3	Mechanical CSB MCO Service Station Layout
H-2-120908 Sheet 3	Mechanical CSB MCO Service Station Details
H-2-122748 Sheet 1	Electrical Canister Storage Bldg. Communication and Fire Alarm Plan
H-2-123390 Sheet 1	P&ID Legend and Symbols INSTR/HVAC/Piping
H-2-123390 Sheet 2	P&ID Instrumentation Notes
H-2-123393	P & ID Transportation Cask Servicing System
H-2-123400 Sheets 1-7	Operational Sequence Block Flow Diagram Overview
H-2-129001	HVAC Canister Storage Bldg. Symbols & General Notes
H-2-129585	P&ID HVAC Operating Area CSB-PFH-2-A

11.6.2 Documents relating to or referenced in this document are:

DOCUMENT #	DOCUMENT TITLE
N/A	Design Basis Document, Section 8, Mechanical
N/A	Heating, Ventilation and Air Conditioning (HVAC) System Operation Manual
N/A	MCO Handling System (MHS) Operation Manual
N/A	Transportation Cask Receiving (TCR) System Operation Manual
HNF-3553	Annex A, Canister Storage Building Final Safety Analysis Report Section A2.5.1.1, Receiving Operations
N/A	SNF CSB System Safety Classification Forms, Section 96-04, MCO Receipt and Servicing
HNF-PRO-704	Hazard and Accident Analysis Process

DOCUMENT #	DOCUMENT TITLE
HNF-SD-SNF-TI-015	Spent Nuclear Fuel Project Technical Databook
W-379-C-CSB-15061	Piping Material, Fabrication, Erection and Pressure Testing
W-379-C-CSB-15161	Vibration Isolation Devices
W-379-C-CSB-15898	Canister HEPA Filter
W-379-C-CSB-16151	Motors - Induction for Radioactive Service
W-379-C-CSB-17601	Temperature Transmitters - Electronic
W-379-C-CSB-17612	Resistance Temperature Detectors
W-379-C-CSB-17617	Pressure Transmitter - Electronic
W-379-C-CSB-17621	Self Actuated Pressure Regulators
W-379-C-CSB-17626 W-379-C-CSB-17626B	Pressure Gauges
W-379-C-CSB-17632	Rotameters
W-379-C-CSB-17633 W-379-C-CSB-17633B	Pressure Relief Valves
W-379-C-CSB-17642	Orifice Plates and Restriction Orifices
W-379-C-CSB-17656	Globe Type Control Valves
W-379-C-CSB-17682	Current to Pneumatic Converters
W-379-C-CSB-17703 W-379-C-CSB-17703B	Instrument Piping Materials
W-379-C-CSB-17704 W-379-C-CSB-17704B	General Instrumentation Installation and Testing
W-379-C-CSB-17705 W-379-C-CSB-17705A W-379-C-CSB-17705B	Instrument Calibration and Checkout
W-379-C-CSB-17708 W-379-C-CSB-17708B	Instrument Piping Pressure Testing
W-379-C-CSB-17861 W-379-C-CSB-17861B	Local Control Panels
W-379-C-CSB-17864 W-379-C-CSB-17864B	Instruments Furnished with Mechanical Equipment Canister Storage Building
C-15061, 1.6.1	Product Data - Goodall Hoses

DOCUMENT #	DOCUMENT TITLE
C-15061, 1.6.1	Product Data - Snap-Tite Couplings
C-15061, 1.6.1	Product Data - Whitey Ball Valves Thompson Mechanical
C-15061, 1.6.1	Product Data and Manufacturer's Instructions - Worcester Valves Thompson Mechanical
C-15061, 1.6.1	Product Data and Manufacturer's Instructions - Vogt Valves Thompson Mechanical
C-17601, 1.6.1	Rosemount Catalog Cuts - TIT-109 - Model #3144DIESMS - Thompson Mechanical
C-17601, 1.6.1	Temperature Transmitters - Electronic/Catalog Cuts - Rosemount Model 3144 and 3244MV
C-17601, 1.6.8	Report Confirming the Construction Acceptance Test Report was Executed and the Results
C-17601, 3.3.3	Temperature Transmitters - Electronic/Construction Acceptance Test Report
C-17614B, 1.6.1	Data Sheets Describing Thermocouples (Thompson Mechanical) TE-109
C-17617, 1.6.1	Temperature Transmitters - Electronic Catalog Cuts - Pressure Transmitter Rosemount Model 3051
C-17617, 1.6.8	Pressure Transmitter-Electronic/Report Confirming the Construction Acceptance Test Procedure
C-17621, 1.6.1	Masoneilan-Dresser PCV-250; PCV-256, PCV-219-1; PCV-252; PCV-103; PCV-219-2; PCV-104 - Thompson Mechanical
C-17621, 1.6.1	Dresser-Masoneilan Catalog Cuts, 17 Series, Back Pressure Regulator - Instructions for Models 17-17 and 17-27
C-17621, 1.6.2	Masoneilan-Dresser Manufacturer's Installation Drawings and Instructions

DOCUMENT #	DOCUMENT TITLE
C-17621, 1.6.3	Self Actuated Pressure Regulators/Dresser-Masoneilan Manufacturer's Operation & Maintenance Manual - 17 Series Back Pressure Regulator Instructions for Models 17-17 and 17-27
C-17621, 1.6.3	Manufacturer's Operation and Maintenance Manuals Dresser-Masoneilan
C-17621, 1.6.3	Self Actuated Pressure Regulators/Manufacturer's Operation & Maintenance Manual - 17 Series Back Pressure Regulator Instructions for Models 17-17 and 17-27
C-17621, 1.6.4	Self Actuated Pressure Regulators/Manufacturer's Calibration Instructions Including Calibration Curves/Tables - 17 Series Pressure Reducing Regulator Models 17-1 and 17-22
C-17621, 1.6.4	Self Actuated Pressure Regulators/Manufacturer's Calibration Instructions Including Calibration Curves/Tables - 17 Series Back Pressure Reducing Regulator Instruction Models 17-1 and 17-22
C-17621, 1.6.4	Manufacturer's Calibration Instructions Including Calibration Curves/Tables - Dresser-Masoneilan
C-17621, 1.6.7	Factory Acceptance Test Procedures
C-17621, 1.6.7	Self-Actuated Pressure Regulators/Factory Acceptance Test Procedure
C-17621, 1.6.8	Self-Actuated Pressure Regulators/Report Confirming the Factory Acceptance Test Procedure was Executed and the Results
C-17626, 1.6.1	Catalog Cuts - Pressure Gauges - PDI-284, 282, 283, 270, 269, 268, 267, 260, 259, 243, 242, 110, PI-118, 114, 111, 104, 103, 252, 250

DOCUMENT #	DOCUMENT TITLE
C-17626, 1.6.8	Pressure Gauges/Report Confirming the Construction Acceptance Test Procedure was Executed and the Results
C-17632, 1.6.1	Catalog Cuts (Full-View Flow Meters)
C-17632, 1.6.2	Manufacturer's Installation Drawings and Instructions
C-17632, 1.6.3	Manufacturer's Operation and Maintenance Manuals
C-17632, 1.6.3	Manufacturer's Calibration Instructions Calibration Curves/Tables
C-17642, 1.6.1	Orifice Plates and Restriction Orifices/Sizing Calculations and Equations
C-17656, 1.6.1	Globe Type Control Valves/Catalog Cuts - Fisher-Rosemount Design EZ
C-17656, 1.6.1, 1.6.2, 1.6.3, 1.6.4, 1.6.5, 1.6.6	Globe Type Control Valves - Thompson Mechanical
C-17663, 1.6.1	Pressure Relief Valves/Catalog Cuts - Crosby Series 900 Valves: PSV-102 and PSV-249
C-17663, 1.6.1	Catalog Cuts - Crosby Series 900 Valves - Thompson Mechanical
C-17663, 1.6.2	Pressure Relief Valves/ Manufacturer's Installation Drawings Crosby Series 900 Valves PSV-102 and PSV-249
C-17663, 1.6.3	Pressure Relief Valves/Manufacturer's Operation and Maintenance Manuals - Crosby Series 900 Valves PSV-102 and PSV-249
C-17663, 1.6.4	Pressure Relief Valves/Manufacturer's Calibration Instructions Including Calibration Curves/Tables - Crosby Series 900 Valves PSV-102 and PSV-249

SPENT NUCLEAR FUEL
CANISTER STORAGE BUILDING

OVERPACK STORAGE TUBE VENT AND PURGE (System #14)

SYSTEM DESIGN DESCRIPTIONS

12.0 OVERPACK STORAGE TUBE VENT AND PURGE SYSTEM DESCRIPTION (SYSTEM #14)

12.1 Function

12.1.1 The Overpack Storage Tube Vent and Purge (OTVP) System monitors and maintains a helium environment around "off-normal" MCOs stored in Overpack Storage Tubes. The system is designed to analyze gas from within the Overpack Storage Tube, purge gas generated within the MCOs (primarily hydrogen) from the Overpack Tube through a HEPA filter to the Operating Area atmosphere, and replace the purged gas (helium).

12.2 Operation

Normal Operation (Features):

12.2.1 When OTVP System functions begin on a selected Overpack Storage Tube, the following conditions exist:

- An MCO is in "off normal" status, and has been placed into an Overpack Storage Tube in accordance with *MCO Handling System Operation Manual*
- OHVAC (Zone III) ventilation subsystem is in operation in accordance with *Heating Ventilating and Air Conditioning System Operation Manual.*

12.2.2 The OTVP System is designed to purge the Overpack Storage Tube of air, after an MCO is placed and sealed in the tube by the MCO Handling Machine (MHM). The Tube Vent & Purge Cart is used for the entire purging process. The Tube Vent & Purge Cart contains piping and instrumentation to remove air from the Overpack Storage Tube and replace the air with helium. The Cart also includes a helium supply (two gas cylinders); a flexible steel hose fitted for the Overpack Storage Tube and another flexible steel hose that provides capability for sampling MCO Standard Tubes; a CAM unit; a radioactive gas monitor; a hydrogen gas monitor with associated Alarms; a sampling connection; a HEPA filter; a gas monitor port heat exchanger; and an oxygen concentration monitor with associated Alarms. The Radioactive Gas Monitor measures the release of Krypton gas (^{85}Kr) and other fission product gases that are vented to the operating area through the HEPA filter. This Monitor will also measure other gases and volatile contaminants.

12.2.3 The Tube Vent & Purge Cart Oxygen Monitor will Alarm when the oxygen concentration in the airspace immediately around the Cart is less than 19.5%; this Alarm warns personnel of an oxygen-deficient atmosphere in the event of excess concentrations of leaking or purged gases.

Normal Operation (Major Types):

12.2.4 Overpack Storage Tube purging is divided into four major operations: Overpack Storage Tube filling, venting, venting and helium purging, and refilling:

A. Overpack Storage Tube filling is performed after the MCO is placed into the Overpack Storage Tube by the MCO Handling Machine (MHM), the Overpack Storage Tube Plug is placed and sealed, plug lock-down mechanism is latched into place and the Tube Plug seals are tested at 8 psig. The Overpack Storage Tube is filled using the normal (non-vacuum) repetitive purging process (pressurizing the tube to 35 psig (33 - 35 psig) and venting the tube through the Tube Vent & Purge Cart HEPA filter to atmospheric pressure), four (4) times, to ensure a stable and steady inert atmosphere (less than 1% residual air) inside the tube space. After the four (4) purging cycles have been completed, the tube is pressurized to 4.0 psig (3.0 - 4.0 psig).

B. Overpack Storage Tube venting is performed when an MCO inside an Overpack Storage Tube needs to be moved to a Storage Tube, other location, or when routine sampling is required. The Overpack Storage Tube is vented through Tube Vent & Purge Cart HEPA filter until atmospheric pressure is reached. This ensures that the Overpack Storage Tube is depressurized before the Overpack Storage Tube Plug is removed, to prevent potentially contaminated gas from escaping from the tube into the Operating Area. If the Overpack Storage Tube was vented for sampling, the tube must be refilled with helium.

C. Overpack Storage Tube venting and helium purging is performed anytime a sample of gas from the tube in which an MCO has been placed and previously inerted indicates $\geq$ 1.0% hydrogen. Then the Overpack Storage Tube will be vented and pressure purged (non-vacuum) four (4) times to ensure that hydrogen is properly evacuated from the Overpack Storage Tube. Overpack Storage Tube venting and purging includes final pressurization of the occupied Overpack Storage Tube with helium to 4.0 psig (3.0 - 4.0 psig). This final action is performed to ensure that a slightly positive helium pressure within the Overpack Storage Tube is maintained during outside air temperature fluctuations.

D. Overpack Storage Tube refilling is performed, as necessary, after a seasonal temperature drop (i.e. winter conditions), after routine sampling, or after slight and normal helium leakage from the Overpack Storage Tube causes the Overpack Storage Tube pressure to decrease to approximately 2.0 psig. The tube is pressurized to 4.0 psig (3.0 - 4.0 psig) to maintain the proper pressure conditions inside the Overpack Storage Tube.

Normal Operation (System Description):

12.2.5 Overpack Storage Tube venting and purging operation begins when an operator drives the Tube Vent & Purge Cart from a designated storage area to a position near the Overpack Storage Tube, and secures the Cart with wheel chocks. The Cart is prepared for operation by connecting the electrical supply to a local 480V-3Ø floor outlet, and the flexible steel hose is removed from the side rack on the Cart and connected to the Cart for purging operations. A portable Hoist, mounted on wheels that can either be towed behind the Cart or moved manually by an operator, is used to lift the Center Hatch and move it to an appropriate storage area near the tube.

12.2.6 When the MCO has been placed into an empty Overpack Storage Tube by the MCO Handling Machine (MHM) and the overpack tube plug has been placed, sealed and secured into position, the quick-connect fitting cap on the Overpack Storage Tube Plug is removed, and the cart is connected to the fitting with the flexible steel hose. The Overpack Storage Tube will remain at 0.0 psig (atmospheric pressure). This ensures that there is no pressure inside the tube for safe tube plug removal, in the event that the plug has to be removed for servicing.

12.2.7 The Tube Plug Seals are tested by connecting the tube plug seal test hose to the 1/4-inch quick-connect test fitting on the Overpack Storage Tube Plug and filling the seal space with helium to 35 psig (33 - 35 psig) for about 20 minutes. If the pressure in the seal space decays more than 0.5 psig during that period, the seals will require inspection or replacement.

12.2.8 The Overpack Storage Tube is pressurized with helium to 35 psig (33 - 35 psig). Then the tube is vented again to 0.0 psig. This cycle is repeated four (4) times. Then the Overpack Storage Tube is purged with a final helium pressure of 4.0 psig (3.0 - 4.0 psig) left in the tube. This ensures that the air (oxygen and hydrogen) is properly removed from the Overpack Storage Tube and that the tube is inerted with a slightly positive pressure inside the tube to compensate for outside air temperature fluctuations.

12.2.9 If the MCO is going to be placed into an Overpack Storage Tube, other location, or if the Overpack Storage Tube is being vented for routine sampling, the cart is connected to the Tube Plug. Then the Overpack Storage Tube local pressure indicator and the Tube Vent & Purge Cart pressure indicator are checked. If the Overpack Storage Tube Plug local pressure indicator and the Tube Vent and Purge Cart pressure indicator differ by more than 0.5 psig, both instruments are recalibrated before continuing the venting and purging operation.

12.2.10 After the Overpack Storage Tube Plug and Tube Vent and Purge Cart pressure indicators have been verified for accuracy, Tube Vent & Purge Cart CAM Unit CAM-596 and Hydrogen Monitor AE-351 are started, and the Overpack Storage Tube atmosphere is analyzed for hydrogen gas concentration and radiological content. Gas flow rate to the gas monitoring equipment is monitored, and if the flow rate to the CAM and Radioactive Gas Monitor drops below 0.64 cfm (18 L/min), or if the flow to the Hydrogen Monitor drops below 0.005 cfm (142 CC/min), a Low Flow Alarm will activate to alert the operator that the gas monitoring equipment may not be operating properly. The hydrogen monitor will Alarm any time the hydrogen concentration of the MCO gas exceeds 1.0% by volume. The gas temperature is cooled by passing it through an air-cooled heat exchanger; if the temperature is greater than 125 °F, a High Temperature Alarm will activate, alerting the operator that continued operation could cause thermal damage to the gas monitoring equipment.

12.2.11 Overpack Storage Tube atmosphere is vented through cartridge-type HEPA Filter F-3 to remove particulate radioactive contamination (potentially suspended in the exhaust gas due to a leak or breach in the MCO) before it is exhausted to the Operating Area atmosphere. If a gas sample is required, a sample Container is used to draw a sample. Venting continues until Overpack Storage Tube pressure reaches 0.0 psig (atmospheric pressure). The gas monitoring equipment is then shut down and isolated. If required, the MCO can now be moved.

12.2.12 If the Overpack Storage Tube is to be purged with helium, the Overpack Storage Tube is pressurized with helium to 35 psig (33 - 35 psig). Then the tube is vented to 0.0 psig. This cycle is repeated four (4) times with a final helium pressure of 4.0 psig (3.0 - 4.0 psig) left remaining in the Overpack Storage Tube. This ensures that the air (oxygen and hydrogen) is properly evacuated from the Overpack Storage Tube and that the Overpack Storage Tube is inerted with a slightly positive pressure inside the Overpack Storage Tube to compensate for outside air temperature fluctuations.

12.2.13 After the Overpack Storage Tube purging operation has been completed, the Tube Vent and Purge Cart is disconnected from the Overpack Storage Tube Plug quick-connect fitting, and the quick-connect cap is replaced.

12.2.14 The Portable Hoist is used to lift the Overpack Storage Tube Plug cover center Hatch and place it into position above the Overpack Storage Tube Plug. The Tube Vent & Purge Cart and hoist is returned to the designated storage area.

12.2.15 After the MCO has been inserted into an Overpack Storage Tube and the tube has been vented and purged with helium, the tube will be refilled to 4.0 psig (3.0 - 4.0 psig) with helium at least two times a year to compensate for normal leakage during storage, temperature fluctuations, or anytime the tube pressure drops below 2.0 psig. The Overpack Storage Tubes will be vented, purged and inerted any time the plug seals are compromised, or anytime an MCO is added or removed from the Overpack Storage Tube. MCOs will vent hydrogen from the MCO into the tubes only in an abnormal case, when moisture remaining in the MCO generates hydrogen and the MCO cover plate gaskets start leaking.

12.2.16 When an MCO must be removed from an Overpack Storage Tube for any reason, the Overpack Storage Tube will be vented. Venting the Overpack Storage Tube will assure that any off-normal pressure release from an MCO will occur safely through the Tube Vent & Purge Cart piping and HEPA filters, prior to removal of the Overpack Storage Tube Plug, and not within the MHM, preventing an unfiltered release to the Operating Area.

12.2.17 When helium cylinders on a Tube Vent and Purge Cart are empty, the Cart is brought to the Tube Vent and Purge Cart Refill Station, where the Tube Vent and Purge Cart helium Cylinders are refilled with helium from the helium Supply System.

Emergency Operation:

12.2.18 If any of the following conditions exist during Overpack Storage Tube purging:

- Gas Temperature in the Overpack Storage Tube is greater than 125 °F
- The Pressure in the Overpack Storage Tube is greater than 5.0 psig
- Hydrogen (H_2) concentration in the Overpack Storage Tube is greater than 1.0% by volume
- Obvious malfunction of monitoring equipment

The Tube Vent and Purge Cart is placed into a safe configuration in accordance with *Overpack Storage Tube Vent and Purge System Operation Manual, Valve and Electrical Lineup for Operation.* This ensures that all operating equipment (i.e., air monitoring equipment, etc.) is shut down or bypassed, and the OTVP System is placed into a safe alignment for further action. The operator is then routed to *Overpack Storage Tube Vent and Purge System Operation Manual, OTVP System Emergency Procedure: Respond to Out of Limits Conditions.* If the problem was high gas temperature, the monitors cannot be used until the gas temperature decreases. If the problem was a high temperature or hydrogen concentration (following a breached or leaking MCO), a sample of Overpack Storage Tube gas is collected in a sample Container during venting, and is sent to a sample laboratory for analysis. At the laboratory, the gas sample is checked for water, hydrogen concentration and unexpected chemical contamination. The Overpack Storage Tube is vented and pressurized to 35 psig (33 - 35 psig) four (4) times until the hydrogen concentration of the venting gas is less than 1.0%, to prevent a flammable mixture of hydrogen from reaching the Operating Area atmosphere, then finally pressurized to 4.0 psig (3.0 to 4.0 psig) in accordance with the applicable normal procedure. This minimizes the risk of fire in case of an Overpack Storage Tube Plug filtered release. The Overpack Storage Tube is now considered to be in "Normal Status".

12.2.19 If any of the following conditions exist in the Tube Vent & Purge Cart during operation:

- The Cart will not hold pressure during helium purge operations
- Obvious hissing or leaking from the Tube Vent and Purge Cart during vacuum vent or helium purge operation
- $\leq$ 19.5% Oxygen concentration in the air surrounding the Tube Vent and Purge Cart

Then the Tube Vent & Purge Cart is placed into a safe configuration in accordance with *Overpack Storage Tube Vent and Purge System Operation Manual, Valve and Electrical Lineup for Operation.* This ensures that all operating equipment (i.e., air monitoring equipment, etc.) is off and the System is placed into a safe alignment for further action. The operator is routed to *Overpack Storage Tube Vent and Purge System Operation Manual, OTVP System Emergency Procedure: Respond to Tube Vent & Purge Cart Leak.* The cart is disconnected from the Overpack Storage Tube Plug and driven to the Tube Vent and Purge Cart storage area. The failed Tube Vent and Purge Cart will be inspected and repaired by Maintenance.

12.2.20 If any of the following conditions exist in any Overpack Storage Tube Plug:

- A confirmed Overpack Storage Tube Plug seal leak has been detected by the Seal Leak Test
- An Overpack Storage Tube Plug will not hold pressure during helium purging
- An Overpack Storage Tube Plug is NOT holding pressure long enough for a scheduled purge to take place
- Obvious hissing or leaking from the Overpack Storage Tube Plug during venting or helium purging

The Overpack Storage Tube and Overpack Storage Tube Plug are placed in a safe configuration in accordance with *Overpack Storage Tube Vent and Purge System Operation Manual, OTVP System Emergency Procedure: Respond to MCO Tube Plug Leak*, prior to replacing the faulty Tube Plug. This ensures that a depressurized inert atmosphere is present in the Overpack Storage Tube before the MHM connects to the tube to replace the Plug. *MCO Handling Machine (MHM) Operation Manual, MHM System Emergency Procedure: Respond to Failure of Tube Plug Seals* is performed to replace the affected Plug with a spare, or to repair the affected Tube Plug seals. When the new or repaired Overpack Storage Tube Plug is replaced by the MHM, the seals are tested to ensure an adequate seal. When the seals are verified as good, the Overpack Storage Tube is vented and pressurized to 35 psig (33 - 35 psig) four (4) times, then finally pressurized to 4.0 psig (3.0 to 4.0 psig) in accordance with the applicable normal procedure. The Overpack Storage Tube is now considered to be in "Normal Status".

12.2.21 If any of the following conditions exist in an Tube Vent & Purge Cart:

- Loss of 480V-3Ø power to the operating Tube Vent & Purge Cart
- Power interruption to 480V-3Ø power to the local floor outlets
- The Overpack Storage Tube has just been vented to 0.0 psig (atmospheric pressure)

The Tube Vent & Purge Cart is placed into a safe configuration in accordance with *Overpack Storage Tube Vent and Purge System Operation Manual, Valve and Electrical Lineup for Operation*. This ensures that all operating equipment (i.e., air monitoring equipment, etc.) is shut down and the OTVP System is placed into a safe alignment for further action. The operator is routed to *Overpack Storage Tube Vent & Purge System Operation Manual, OTVP System Emergency Procedure: Respond to Loss of Purge Cart Power*. The affected Overpack Storage Tube is pressurized to 4.0 psig (3.0 - 4.0 psig) with helium. Although the equipment required to remove hydrogen from the Tube is not energized, air cannot enter the Tube during the length of the power outage. When power is restored, the Overpack Storage Tube is vented and pressurized to 35 psig (33 - 35 psig) four (4) times to ensure complete oxygen and hydrogen removal, then finally pressurized to 4.0 psig (3.0 to 4.0 psig) in accordance with the applicable normal procedure. The Overpack Storage Tube is now considered to be in "Normal Status".

12.2.22 If the following condition exists in the Operating Area:

- Both OHVAC Exhaust Fans CSB-EF-001 and CSB-EF-002 have shut down
- The Overpack Storage Tube has just been vented to 0.0 psig (atmospheric pressure)

The Tube Vent and Purge Cart is placed into a safe configuration in accordance with *Overpack Storage Tube Vent and Purge System Operation Manual, Valve and Electrical Lineup for Operation*. This ensures that all operating equipment (i.e., air monitoring equipment, etc.) is shut down and the OTVP System is placed into a safe alignment for further action. The operator is routed to *Overpack Storage Tube Vent and Purge System Operation Manual, OTVP System Emergency Procedure: Respond to Loss of OHVAC Ventilation*. If the OHVAC System exhaust fans cannot be restarted in a short period of time, the affected Overpack Storage Tube is pressurized to 4.0 psig (3.0 - 4.0 psig) with helium to ensure that air will not enter the tube before the exhaust fans are restored to operation. When exhaust fan operation is restored, the Overpack Storage Tube is vented and pressurized to 35 psig (33 - 35 psig) four (4) times to ensure complete oxygen and hydrogen removal, then finally pressurized to 4.0 psig (3.0 to 4.0 psig) in accordance with the applicable normal procedure. The Overpack Storage Tube is now considered to be in "Normal Status".

12.3 Configuration

12.3.1 The following Overpack Storage Tube Vent and Purge (OTVP) System interfaces with the following systems:

A. The Normal Electrical Distribution System (NED) provides 480V-3Ø electrical power for Tube Vent & Purge Cart instrument operation through floor-mounted outlets.

B. The Operating Area HVAC System (OHVAC) provides Operating Area (Zone III) ventilation and HEPA-filtered exhaust for final confinement of leaking components and vented gases.

C. The MCO Handling Machine (MHM) provides transport of the MCO from the Loadin/Loadout Area to the Overpack Storage Tube.

D. The Analysis Laboratory provides analyses for samples taken during venting operations.

12.3.2 OTVP System components are located on Tube Vent & Purge Cart VHC-1: two helium cylinders, a flexible steel hose, a CAM unit, a radioactive gas monitor, a gas monitor port heat exchanger, a hydrogen gas monitor with associated Alarms, a sampling connection, a HEPA filter, and an oxygen monitor with associated Alarms. When not in use, Tube Vent & Purge Cart is stored in the Cart storage area in the south end of the Operating Area.

12.3.3 The OTVP System is shown in Drawings H-2-123394, *P & ID MCO Tube Purging System* and H-2-120911, *Tube Vent and Purge Cart Assy, Parts List & Notes*. The Overpack Tube Plug connections are shown in Drawing H-2-120394, *Standard/Overpack Storage Tube Plug Assembly*.

12.4 Requirements

12.4.1 *Design Requirements:* Overpack Storage Tube Vent and Purge System design requirements are given in the following table:

REQUIREMENT	VALUE
Vent Subsystem	
Overpack Storage Tube Helium Storage Capacity	1 (empty) Overpack Storage Tube Volume
Design Life	6.0 years
Vent Gas Piping Design Pressure	100 psig
Design Temperature	200 °F

REQUIREMENT	VALUE
Helium Subsystem	
Helium Cylinder Design Pressure	2500 psig
High Pressure Helium Relief Pressure	75 psig
Low Pressure Helium Relief Pressure	50 psig

HYDROGEN MONITOR AE-351	
Requirement	**Value**
Hydrogen Detection	1% - 10%, in He
Accuracy	1% of full scale
Drift	< 1% of full scale in 24 hours

HEPA FILTER FH-3	
Requirement	**Value**
Design Temperature	270 °F
Design Pressure	150 psig
Maximum Differential Pressure (ΔP)	80 psid
Clean Differential Pressure (ΔP)	0.9 psid
Gas Composition	Air & Helium
Particle Removal Size	99.97% @ 0.3 microns

ANALYZER PORT HEAT EXCHANGERS HX-1	
Requirement	**Value**
Inlet Gas Temperature	175 °F
Inlet Gas Flow	1.1 acfm
Inlet Gas Pressure	35.0 psig

12.4.2 *Operational Requirements*: Overpack Storage Tube Vent and Purge System operational requirements are given in the following table:

REQUIREMENT	VALUE
General	
Minimum Zone III Confinement O_2 Concentration	19.5%
Vent Subsystem	
Operating Overpack Storage Tube Gas Temperature	150 °F
Helium Subsystem	
Helium Purge Pressure	3.0 - 4.0 psig
Minimum Helium Bottle Pressure	200 psig
Maximum Gas Temperature to CAM Unit	125 °F

HYDROGEN MONITOR AE-351	
Requirement	**Value**
N/A	N/A

HEPA FILTER FH-3	
Requirement	**Value**
Temperature	150 °F
Pressure	5.0 psig
Maximum Flow	20 scfm

ANALYZER PORT HEAT EXCHANGERS HX-1 OPERATIONAL REQUIREMENTS	
Requirement	**Value**
Outlet Gas Temperature	125 °F
Outlet Gas Pressure	5.0 psig
Outlet Gas Flow	1.0 acfm

12.4.3 *Maintenance and Surveillance Requirements*:

A. N/A

12.5 Safety

12.5.1 *Potential Safety Hazards and Concerns*:

A. It is possible during gas inerting operations that large amounts of leaking helium could cause an oxygen-deficient atmosphere near the Tube Vent & Purge Cart. The Tube Vent & Purge Cart carries an oxygen monitor that Alarms when oxygen concentration in the air around the Cart is less than 19.5%. Personnel must leave the area immediately when this Alarm is activated.

B. There are several safety hazards associated with the operation of the OTVP System that result from hydrogen buildup due to a metal reaction with water in the MCO:

- After an MCO is inserted in an Overpack Storage Tube, temperature and pressure inside the MCO may rise due to the decay heat from the contained fuel elements as well as from the increasing vault temperature in hot weather. A temperature rise inside the MCO will increase the reaction rate between the uranium metal in the fuel elements and the water remaining after cold vacuum drying, to produce additional hydrogen gas. This reaction rate doubles with each 15 - 20 °F increase in fuel and water temperature.

- Hydrogen concentration may increase to the point of reaching the flammability range > 4.0% in air. If at any time hydrogen is accidentally released from the MCO and mixes with Operating Area air to a concentration which falls within the flammability range, ignition of the hydrogen-air mixture becomes possible.

- If hydrogen pressure builds to a level high enough to leak through a breach in the MCO shell or the mechanical seal, a radiological hazard may be created through the unconfined spread of particulate contamination from fuel particles entrained in gas flow exhausting from the MCO and past the Overpack Storage Tube Plug.

C. The OTVP System is protected by several engineered safety features:

- Pressure relief valves are located downstream of the helium connection to prevent over pressurization of the Overpack Storage Tube and OTVP System.

- OTVP System piping and most of the other equipment are designed for at least 150 psig. When any specific equipment cannot be qualified for design pressure, then a root valve, relief valve, or bypass arrangement is provided.

- If hydrogen concentration in the sample stream from the Overpack Storage Tube space is greater than 25% of the lower flammability limit of hydrogen in air (i.e., 1.0% H_2 by volume), an alarm will signal that a small amount of gas from the MCO has leaked into the Overpack Storage Tube indicating a potential for a buildup of hydrogen gas inside the tube.

- Venting an Overpack Storage Tube prior to a pressure purge or removing an MCO from an Overpack Storage Tube, will relieve pressure generated by a breach or leak in the MCO, and permit the controlled (HEPA Filtered) release of radionuclide particulate to occur while the Overpack Storage Tube is connected to the Tube Vent & Purge Cart piping. This will provide a HEPA-filtered pathway for release.

- There is a High Temperature Alarm on the Tube Vent & Purge Cart CAM unit. Temperature of gas venting from an Overpack Storage Tube is measured; if the temperature is greater than 125 °F, a High Temperature Alarm is activated to warn the operator that continued operation under these conditions could cause damage to the gas analysis equipment.

D. HEPA Filter FH-3 and associated piping on the Tube Vent & Purge Cart provides the confinement barrier preventing the release of particulate contamination. The HEPA filter must be challenge (DOP) tested regularly to ensure that the filtering efficiency requirements are met. When the ΔP across the HEPA filter reaches an established setpoint, or when the quantity of particulates trapped on the filter becomes a radiation hazard, the HEPA filter must be changed out.

12.5.2 *Safety Classification*: There are two broad safety classification categories in the OTVP System:

- Components which have a high level of structural importance to the building, and provide the spent nuclear fuel confinement function are classified as Safety Class (SC).
- Components which prevent air (oxygen) ingress to the MCO or Overpack Storage Tube atmosphere during venting, purging and inerting operations, preventing the formation of flammable atmospheric concentrations of hydrogen, and providing a confinement function are classified as "Safety Significant" (SS).

Safety Class (SC) Components

Overpack Storage Tubes

Overpack Storage Tubes are classified as Safety Class (SC) due to their role in providing fixed location, and spent nuclear fuel confinement, and oxygen-ingress barrier functions. Confinement of radionuclide releases from simultaneous multiple-MCO events (e.g., triggered by a Design Basis Earthquake) is a SS function, as an uncontrolled release of radionuclide particulate contamination from an MCO would have SS consequences for the on-site worker.

The safety functions of the Overpack Storage Tubes, which must be maintained during and after a Design Basis Accident (DBA) or Natural Phenomenon Hazard (NPH) event are:

- Provide and maintain structural support and the required geometry for cooling

- Maintain an inert atmosphere around the MCOs staged within the Overpack Storage Tubes to prevent any possibility of hydrogen combustion or deflagration

- Provide a confinement barrier between the MCO and the Vault atmosphere for radionuclide particulate contamination released from MCOs.

Safety Significant (SS) Components

Overpack Storage Tube Plugs

Overpack Storage Tube Plugs are classified as Safety Class (SS) due to worker safety radiation shielding, and their potential role as primary confinement for SNF contained in off-normal MCOs. The maximum expected over-pressure in an Overpack Storage Tube resulting from hydrogen detonation is 1.5 Atm (22 psig). The consequence of an unmitigated hydrogen detonation within an Overpack Storage Tube is presently considered to lead to SS on-site exposure consequences (100 meters distance); at the site boundary there are no dose consequence in excess of limits.

The Overpack Storage Tube Plugs function as Safety Significant (SS) as they perform a radionuclide particulate contamination confinement function by acting as the upper boundary of the Overpack Storage Tube confinement, and providing radiation shielding for personnel working above an Overpack Storage Tube containing MCOs.

The Plugs also must not fail by dropping components (fractured pieces from plug) onto the "off-normal" MCO below resulting in damage and possible MCO breach causing release of radioactive particulates. Such failure, if caused by a common mode DBA and affecting the plugs, could result in SS consequences, depending upon the projected release for the MCO breach.

For design safety analysis purposes, it was determined (See HNF-3553) that leaking gases from the MCO cause the Overpack Storage Tube pressure to rise to no more than 22 psig, still well within the capacity of the plug to maintain its locked and sealed position preventing an unfiltered release to the operating area. Any deflagration outside of the Overpack Storage Tube, resulting from hydrogen inadvertently released past the plug seals, would not seriously harm the facility or occupants. This design approach meets the requirements for personnel safety, fire protection, and minimizes the spread of contamination (ALARA and waste minimization).

Overpack Storage Tube Plugs are "locked down" and can tolerate a pressure of up to about 75 psig without consequence. The Overpack Storage Tube Plugs have a double seal to provide both a physical barrier and a pressure gradient to contain particulates and maintain a positive-pressure inert atmosphere within the Overpack Storage Tube to exclude oxygen from the uranium metal remaining in the spent fuel contained in the MCO.

Overpack Storage Tube Plugs must be installed in every Overpack Storage Tube to provide Radiation Shielding for the Operators in the Operating Area.

Tube Vent and Purge Cart

The Tube Vent & Purge Cart is used to monitor the pressure of the Overpack Storage Tube Atmosphere, to provide a confined, filtered pathway to vent the Overpack Storage Tube atmosphere, and a helium supply pathway to establish and maintain an inert atmosphere around MCOs staged in the Overpack Storage Tubes.

The portion of the Tube Vent & Purge Cart system (including all lines, fittings and valves) between the tube plug connection and the outlet from FH-3 is SS, as it performs the SS function of ensuring that the Overpack Storage Tube atmosphere remains inert (non-flammable) by excluding air ingress during all Cart operations. This is equivalent to providing (when connected to the Overpack Storage Tube) the confinement barrier normally supplied by the Overpack Storage Tube system (that includes the plug itself). In any credible accident conditions, this confinement system will prevent any radionuclide releases from an Overpack Storage Tube from reaching either the operating area or the vault space.

The Tube Vent & Purge Cart also provides the SS functions of regularly performing Overpack Storage Tube venting, and inerting to prevent oxygen ingress into Overpack Storage Tubes during normal operations and after any Design Basis Earthquake. If the Tube Vent and Purge Cart is disabled by some event, such as a Design Basis Earthquake, the subsequent failure to perform the Tube Vent and Purge Cart functions could lead to conditions with SS consequences, from increased pressurization of releases from several Overpack Storage Tubes containing up to a total of six MCOs (one MCO for each of the 6 overpack storage tubes).

Failure of the confinement features of the Tube Vent and Purge Cart during a Design Basis Accident (DBA) could result in release of radioactivity having SS consequences if the DBA also causes radionuclides to be released from the MCO inside the Overpack Storage Tube. Release of radionuclides from off-normal MCOs would be probable due to a pre-existing leak or breach. Such a leak or breach is one possible reason for the MCO being initially placed into the Overpack Storage Tube.

Detailed accident analysis, taking into account the actual loading and hydrogen evolution history for the MCOs together with cold vacuum drying data, show that the Overpack Storage Tube Vent and Purge System has no SC functions (See HNF-3553).

Overpack Storage Tubes

Overpack Storage Tubes fulfill a SS function by providing confinement of radionuclide particulate contamination that may be released from an "off-normal" MCO event. Maintaining a barrier between Radionuclide particulates and the unfiltered Vault atmosphere is vital to assuring continued operability of the SNF CSB facility. Therefore, venting and purging release are normally through a HEPA filter on the Tube Vent and Purge Cart.

General Service (GS) Components

Overpack Storage Tube Plug Covers and Embed Covers

Overpack Storage Tube Plug Covers are classified General Service (GS) because there is no real safety function, except defense in-depth for radiation shielding.

Helium Supply System

The Helium Supply System is classified as General Service (GS), because it is not required to prevent or mitigate an accident or to operate after an accident, and provides only a limited function in protecting the facility worker from industrial and radiological hazards. However, the helium itself will be tested to confirm purity upon receipt at the CSB.

The Helium System is required to ensure that an adequate supply of purge gas is available during inerting operations and to maintain the inert atmosphere in an Overpack Storage Tube. If an adequate supply of helium is not available, no accidents occur with Safety Class or Safety Significant (SS) consequences before an additional supply of gas can be provided. The system is designed to prevent air ingress during the time that an Overpack Storage Tube is connected to the system for inerting, and to provide a positive-pressure inert atmosphere inside the tube to prevent development of conditions conducive to hydrogen deflagration. This design is based on engineered safety features that prevent air (oxygen) from being delivered to the MCO by the helium supply during purging operations.

12.5.3 *Quality Level*: The Overpack Storage Tube Vent and Purge System is Quality Level I. Safety Class and Safety Significant systems are designated Quality Level I to provide increased assurance that the system will function as designed. General Service Systems may also be designated Quality Level I. Quality Level I indicates that this system has more stringent quality requirements specified than may be assumed by a vendor or operator.

12.5.4 *Environmental Safety*: The SNF CSB does not have any connections to a chemical sewer or other permanently installed means of direct disposal of hazardous chemical waste. All hazardous wastes generated during maintenance or other activities within the facility must be safely contained at the point of generation (i.e., fluids drained into buckets, rags and other materials placed in plastic bags), and removed to some other facility having suitable means of hazardous material disposal.

12.6 References

12.6.1 Drawings relating to or referenced in this Manual are:

DRAWING #	DRAWING TITLE
H-2-119276	Structural Canister Storage BLDG Vault Oper Floor Plan
H-2-120394	Standard/Overpack Tube Plug Assembly
H-2-120911	MCO Vent and Purge Cart Assy, Parts List & Notes
H-2-121202 Sheet 4	Control Systems Canister Storage Building Storage Tubes Location Plan
H-2-122733 Sheets 3-5	Electrical Canister Storage BLDG (Overall, Generator 1A, Generator 1B) One Line Diagram
H-2-122744	Electrical Canister Storage BLDG Panel Schedules
H-2-123400 Sheet 1-7	Operational Sequence Block Flow Diagram Overview
H-2-123390 Sheet 1	P&ID Legend and Symbols INSTR/HVAC/Piping
H-2-123390 Sheet 2	P&ID Instrumentation Notes
H-2-123394	P&ID, MCO Tube Purging System
H-2-125162 Sheet 2	Piping Floor Plan Inert Line

12.6.2 Documents relating to or referenced in this Manual are:

DOC. #	DOCUMENT TITLE
N/A	Design Basis Document, Section 8, Mechanical
N/A	Backup Power System Operation Manual

DOC. #	DOCUMENT TITLE
N/A	HVAC System Operation Manual
N/A	MCO Handling System Operation Manual
N/A	MCO Servicing System Operation Manual
HNF-3553	Annex A, Canister Storage Building Final Safety Analysis Report Section A2.5.1.4, MCO Sampling/Weld Operations
HNF-PRO-704	Hazard and Accident Analysis Process
N/A	SNF CSB System Safety Classification Forms, Section 96-02, Operating Deck
SNF-2770	Cold Vacuum Drying Facility Design Basis Accident Analysis Documentation
W-379-C-CSB-11556	Electric Utility Vehicle O&M Manual
W-379-C-CSB-13051	Tube Vent & Purge Cart Assembly
W-379-C-CSB-13089	Canister/Overpack - Storage Tube Plug
W-379-C-CSB-14310	Portable Floor Crane
W-379-C-CSB-15061	Piping Material, Fabrication, Erection and Pressure Testing
W-379-C-CSB-15151	Vacuum Pumps (MCO Storage Tube)
W-379-C-CSB-15898	Canister HEPA Filters
W-379-C-CSB-16151	Motors - Induction for Radioactive Service
W-379-C-CSB-17601	Temperature Transmitters - Electronic
W-379-C-CSB-17612	Resistance Temperature Detectors
W-379-C-CSB-17617 W-379-C-CSB-17617B	Pressure Transmitter - Electronic
W-379-C-CSB-17621	Self Actuated Pressure Regulators
W-379-C-CSB-17626 W-379-C-CSB-17626B	Pressure Gauges
W-379-C-CSB-17630	Mass Flow Meters
W-379-C-CSB-17642	Orifice Plates and Restriction Orifices
W-379-C-CSB-17663 W-379-C-CSB-17663A	Pressure Relief Valves
W-379-C-CSB-17667	Pressure Switches

DOC. #	DOCUMENT TITLE
W-379-C-CSB-17669 W-379-C-CSB-17669B	Flow Switches
W-379-C-CSB-17682	Current to Pneumatic Convertors
W-379-C-CSB-17703 W-379-C-CSB-17703B	Instrument Piping Materials
W-379-C-CSB-17704 W-379-C-CSB-17704B	General Instrumentation Installation and Testing
W-379-C-CSB-17705 W-379-C-CSB-17705A W-379-C-CSB-17705B	Instrument Calibration and Checkout
W-379-C-CSB-17708 W-379-C-CSB-17708B	Instrument Piping Pressure Testing
W-379-P-CSB-17861 W-379-P-CSB-17861B W-379-P-CSB-17861C	Local Control Panels
W-379-C-CSB-17864 W-379-C-CSB-17864B	Instruments Furnished with mechanical Equipment Canister Storage Building

SPENT NUCLEAR FUEL
CANISTER STORAGE BUILDING

MCO HANDLING MACHINE
(System #15)

SYSTEM DESIGN DESCRIPTIONS

13.0 MCO HANDLING MACHINE SYSTEM DESCRIPTION (SYSTEM #15)

13.1 The MCO Handling Machine (MHM) System Design Description is being provided by another vendor. The MHM operation and maintenance is the central focus of the manual.

SPENT NUCLEAR FUEL CANISTER STORAGE BUILDING

VAULT COOLING (System #16)

SYSTEM DESIGN DESCRIPTIONS

14.0 VAULT COOLING SYSTEM DESCRIPTION (SYSTEM #16)

14.1 Function

14.1.1 The Vault Cooling System (VCS) uses passive, natural air circulation to remove the decay heat from the nuclear fuel contained in MCOs in the storage vault.

14.2 Operation

14.2.1 The storage vault is passively cooled (with no mechanical or electrical devices required to perform the cooling function) using the "stack effect" to promote ventilation flow. Air passes down through the Air Intake Structure, where its temperature and flow rate are monitored, to an inlet plenum. From the Inlet Plenum, the air flows into the enclosed volume of the vault where it absorbs heat from the Standard Storage Tubes. The heated air flows from the vault to an Exit Plenum, then out the vault Exhaust Stack, where the exhaust temperature is monitored. See drawing H-2-129581.

14.2.2 The "stack effect" is created by buoyancy forces due to elevated air temperature in the exhaust air. The "stack effect" is enhanced in the VCS by several factors: the effective stack height is 169 feet, and the Exhaust Stack has an wind deflector assembly on top which will draw a slight vacuum in the stack when the wind blows; also, the top of the Inlet Plenum opening within the vault is seven feet lower than the top of the Exhaust Plenum exit, thereby directing the heated air within the vault to preferentially expand into the Exhaust Plenum and out the Exhaust Stack. Additionally, the Intake Structure has a cruciform canopy opening to allow the wind to force air through the vault.

14.2.3 The temperatures of the Inlet Air and Exhaust Air, and the Inlet Airflow are monitored and displayed on the "Hot Spot Data" Screen of the DCS, along with manually input values for the Vault Total Heat, Maximum Canister Heat (If available at the time of shipment of the MCO from the CVDF, see *Distributed Control System Operation Manual*).

14.2.4 There are no Alarms associated with the VCS.

14.3 Configuration

14.3.1 The VCS begins at the Intake Structure, and extends through the Inlet Plenum, Storage Vault, Exhaust Plenum, and the VCS Exhaust Stack.

14.3.2 The only VCS interface is with the DCS. Instruments monitoring Intake Structure air temperature and flow rate, and Exhaust Stack air temperature feed their signals to the DCS for display on the "Hot Spot Data", "Flowrate Trends", and "Pressure / Temperature Trends" Screens.

14.3.3 The Intake Structure is located outside the west wall of the Operating Area, and the Inlet Plenum is in the west wall of the storage vault. The Exhaust Plenum is in the east wall of the storage vault, and the Exhaust Stack is located outside the east wall of the Operating Area.

14.4 Requirements

14.4.1 Vault Cooling System:

A. *Design Requirements*: The VCS must provide natural convection cooling to remove decay heat from the spent nuclear fuel within the MCOs inside the Standard Storage Tubes. The VCS must operate during and following any and all Design Basis Accidents or credible natural events.

B. *Operational Requirements*: VCS operational requirements are given in the following table:

REQUIREMENT	VALUE
MCO shell temperature	< 270 °F

C. *Maintenance and Surveillance Requirements*:

- Flow and Temperature monitoring instruments are located on the Inlet and Outlet Stacks only, and are accessible from the outside for routine or other maintenance.
- VCS Flow and Temperature readings are displayed on the "Hot Spot Data" Screen of the DCS.

14.5 Safety

14.5.1 The VCS is an entirely passive system: No mechanical or electrical equipment is required for it to perform its function. There are no identifiable hazards related to VCS operation.

14.5.2 Proper airflow though the vault is enhanced by the structural relationship between the Inlet Plenum and the Exhaust Plenum; the top of the Exhaust Plenum is 7 feet higher than the top of the Inlet Plenum.

14.5.3 *Safety Classification*: The Vault Cooling System (VCS) is classified as Safety Class (SC), including the Vault #1 Air Intake and Exhaust Structures that are an integral part of the natural convection cooling system, because it maintains the SNF temperature within established safety limits. Vault #1 structure is divided into three sections of importance: The intake, which draws outside air into the Vault, where decay heat from the SNF contained in the MCOs is carried away, and the Exhaust, which exhausts heated air from within the Vault. If Intake or Exhaust structures failed to allow continued convective cooling of the MCOs held within the Standard and Overpack Storage Tubes for an extended period, overheating could occur, which could lead to amounts of respirable radionuclides in excess of SS limits being released from the Storage Tubes to the Operating Area due to MCO failures.

Positions for Inlet and Outlet Structures for Vaults #2 and #3 are provided for future use. The Intake Structures are completed up through the reinforced-concrete deck level and the Exhaust Structures are completed to "top of concrete." All of the structures identified for future use are capped with steel plates.

Intake Stack

The Intake Stack serves as the supply air source for convective cooling of Vault #1. The Intake Structure is designed to withstand, without structural failure, all applicable Design Basis Accident (DBA) and Natural Phenomena Hazard (NPH) events. The Intake Structure is designed so that its failure does not result in the Structure falling into the CSB Superstructure and causing damage to the SC Operating Deck. Damage to the Operating Deck, if catastrophic in nature, could result in SC or Safety Significant (SS) level releases of radionuclides from damaged MCOs in the Storage Tubes, the Cask Receiving Pit, and/or in the MHM. The Intake Structure could also fail -- if not designed to prevent it -- in such a way as to block incoming airflow to the Vault; if the incoming airflow is severely restricted or curtailed, overheating of the MCOs in the Standard Storage Tubes would result, with consequences related to overheated MCO accidents.

Exhaust Stack

Buoyancy forces within the Exhaust Stack serve to drive updraft airflow through Vault #1. The Exhaust Stack is designed to remain intact, without collapsing, under all applicable DBA and NPH events. A failure of the Exhaust Stack could result in it falling into the CSB superstructure and causing damage to the SC Operating Deck. Damage to the Operating Deck, if catastrophic in nature, could result in SC or Safety Significant (SS) level releases of radionuclides from damaged MCOs in the Standard Storage Tubes, the Cask Receiving Pit, and/or in the MHM. The Exhaust Stack is designed so that it cannot fail in such a way as to completely block exhaust airflow from the Vault; if the exhaust airflow is severely restricted or curtailed, overheating of the MCOs in the Standard Storage Tubes could result. Several severely overheated MCOs could release quantities of respirable radionuclides in excess of SC threshold values. However, thermal calculations have shown that elimination of, or damage to, the Exhaust Stack which does not completely plug the outlet does not result in extreme overheating of Vault #1 within a 72 hour period following the accident.

14.5.4 *Quality Level*: The Vault Cooling System is Quality Level I, indicating that a System has more stringent Quality requirements specified. Safety Class (SC) or Safety Significant (SS) Systems or components must be Quality Level I to provide increased assurance that the System will function as designed.

14.5.5 *Environmental Safety*: The vault floor has no sumps or drains. There are no connections in the SNF CSB to a chemical sewer or other means of direct disposal of hazardous chemical waste. All hazardous wastes generated during maintenance or other activities within the facility, including areas directly above the vault, must be safely contained at the point of generation (i.e., fluids drained into buckets, rags and other materials placed in plastic bags), and removed to some other facility having suitable means of safe hazardous material disposal available.

14.6 References

14.6.1 Drawings relating to or referenced in this document are:

DWG #	DRAWING TITLE
H-2-119276	Structural Canister Storage Building Vault Oper. Floor Plan
H-2-119277	Structural Canister Storage Building Vault Mat Plan
H-2-119278	Structural Canister Storage Building Vault Cross Sections
H-2-119281 sheet 2	Structural Canister Storage Bldg Reinf @ Mat Column, & Misc Dets

DWG #	DRAWING TITLE
H-2-119300 sheets 1 - 3	Structural Canister Storage Building Exh Stack Plan & Dets
H-2-129581	P & ID Storage Vault Temperature Monitoring

14.6.2 Documents relating to or referenced in this document are:

DOCUMENT #	DOCUMENT TITLE
N/A	*Distributed Control System Operation Manual*
N/A	Design Basis Document, Section 6, *HVAC*
HNF-SD-SNF-OCD-001, Revision 1	Spent Nuclear Fuel Project Product Specification
HNF-3553, Annex A, Canister Storage Building Final Safety Analysis Report	Section A2.4.1, CSB Subsurface Structure
	Section A2.4.4, Canister Storage Building Above-Grade Structures (Intake Structure, Exhaust Stack, Operating Area Shelter, Support Building)
SNF CSB Safety Classification Forms	Section 96-05, CSB Superstructure
	Section 96-05-01, Vault Air Inlet Structure
	Section 96-05-02, Vault Air outlet Structure
HNF-PRO-516	Safety Structures, Systems, and Components
W-379-C-CSB-17612	Resistance Temperature Detectors
W-379-C-CSB-17630	Mass Flowmeters
Kurz Instruments, Inc., Drawing (GG)-0001 Sheets 1 & 2	K-BAR24-MT, SENSOR ELECT. CONFIG. TRANSMITTER ATTACHED
Kurz Instruments, Inc., Drawing (GG)-0002 Sheets 1 & 2	K-BAR 24 TRUSS ASSY, DOUBLE ENDED
Kurz Instruments, Inc., Drawing (GG)-0003 Sheet 1	MODEL 185-8, RFI, EMI, SURGE PROTECTION, 8x8x4 ENCLOSURE
Kurz Instruments, Inc., Drawing (GG)-0004 Sheets 1 & 2	MODEL 155C-2 MASS FLOW COMPUTER OUTLINE / ASSY

DOCUMENT #	DOCUMENT TITLE
Kurz Instruments, Inc., Drawing (GG)-0005 Sheet 1	OUTLINE, MOUNTING FLANGE W/SUPPORT PIN, K-BAR TRUSS
Kurz Instruments, Inc., (GG)-0006 Sheets 1 & 2	K-BAR TRUSS SET-UP SHEET
Kurz Instruments, Inc., (GG)-0007 Sheet 1	K-BAR SET-UP SHEET
Kurz Instruments, Inc., Drawing (GG)-3401 Sheets 1 - 3	CE K-BAR 24 INTERNAL / FIELD WIRING DIAGRAM
Kurz Instruments, Inc., Drawing (GG)-3402 Sheets 1 & 2	155C-2 MASS FLOW COMPUTER FIELD WIRING

SPENT NUCLEAR FUEL CANISTER STORAGE BUILDING

SECURITY (System #17)

SYSTEM DESIGN DESCRIPTIONS

15.0 SECURITY SYSTEM DESCRIPTION (SYSTEM #17)

15.1 The Security System (SS) Design Description is based on information provided by another vendor and will be provided at a later date.

SPENT NUCLEAR FUEL CANISTER STORAGE BUILDING

ROLL-UP DOORS (System #19)

SYSTEM DESIGN DESCRIPTIONS

16.0 ROLL-UP DOORS SYSTEM DESCRIPTION (SYSTEM #19)

16.1 The Roll-up Doors (RD) System Design Description is based on information provided by another vendor and will be provided at a later date.

SPENT NUCLEAR FUEL CANISTER STORAGE BUILDING

FIRE WATER PUMP HOUSE (System #20)

SYSTEM DESIGN DESCRIPTIONS

17.0 FIRE WATER PUMP HOUSE SYSTEM DESCRIPTION (SYSTEM #20)

17.1 Function

17.1.1 The Fire Water Pump House (FWPH) System is designed to supply backup Sanitary Water (SWX) to the SNF CSB Fire Protection system (the Wet Pipe Sprinkler System and Fire Department Hose Connections) and surrounding facilities, for supplemental fire suppression.

17.1.2 FWPH System supplies a backup source of fire water (Sanitary Water) anytime significant pressure fluctuations occur, system pressure decays or the water supply is unavailable from the Raw Water (RW) System. See Fire Protection (FP) System (System 3) System Design Description for additional information on the Fire Protection System and Raw Water Supply.

17.2 Operation

17.2.1 The FWPH System consists of a 440,640 gal Storage Tank (TK-500-001), a 10" Fire Water Discharge Header (FWX-10"-500-033-RF), 10 gpm/2.0 hp Heater Pump (PX-500-003), a 75,000 btu/hr, Fire Water Heater HT-500-001, a 15 gpm/3 hp Jockey Pump (PX-500-004) and two 1500 gpm, 125 hp Fire Water Pumps (PX-500-002A/B). The system is designed to provide an on-demand, alternate source of fire water to the CSB and to the Fire Water Pump House itself, anytime the raw water header is either not available or unable to keep up with the demand of the Fire Protection System. In addition to the CSB and Fire Water Pump House, the facilities protected by this system are: 2704HV, 2701HV, MO-724, MO-725, MO-730, MO-731, MO-732 and MO-733.

17.2.2 Sanitary Water (SWX) is supplied to the Fire Water Storage Tank by 4-inch Sanitary Water Line SWX-4"-490-013-R.. The Fire Water Storage Tank supplies the two Fire Water Pumps for on-demand supplemental fire suppression.

17.2.3 The Fire Water Heater Pump is designed to recirculate water through the FWPH System during the winter months to prevent the backup fire water supply from freezing.

17.2.4 The Fire Water Jockey pump is designed to provide a limited backup water supply to the Raw Water Header in the event of minor pressure fluctuations and drop-offs to maintain the minimum static head pressure in the Raw Water Header.

17.2.5 The two Fire Water Pumps are designed to provide a full backup source of fire water to the Raw Water Header in the event of the loss of raw water to the Raw Water Header or fire water demand exceeds the capacity of Raw Water Header.

17.2.6 There is a remote annunciator panel currently located in the 283E Building that can provide indications and alarms generated by the FWPH System, these signals are to be monitored via the Dyncorp water surveillance computer system. There are also control panels in the pump house associated with each pump that contain controls and alarms associated with each pump.

17.3 Configuration

17.3.1 The Fire Water Pump House System interfaces with the following systems:

- Electrical Distribution (System #1)
- Remote Annunciator Panel (283E Building, 200E Area)
- Fire Protection System (System #3)
- Uninterruptible Power Supply (System #18)

17.3.2 The Electrical Distribution and Uninterrupted Power Supply Systems provide power to the electrical equipment within the FWPH System providing a backup source of water to the Fire Protection subsystem.

17.4 Requirements

17.4.1 *Design Requirements*:

FIRE WATER PUMP HOUSE SYSTEM	
Parameter	**Requirement**
Design Temperature	100 °F (piping) / – 20 °F - 150 °F (valve)
Design Pressure	150 psig (piping) / 175 psig (valve)
Design Life	40 years
System Flow	1,150 gpm @ 98 psi

FIRE WATER STORAGE TANK TK-500-001	
Requirement	**Value**
Design Capacity	440,640 gal

FIRE WATER HEATER PUMP PX-500-003	
Requirement	**Value**
Design Flow Rate	10 gpm
Total Head	53 ft

FIRE WATER HEATER HT-500-001	
Requirement	**Value**
Heating Capacity	102, 400 btu/hr
Design Temperature	150°F
Design Pressure	150 psig
Pressure Differential Across Heater	5.0 psid
Overpressure Relief	100 psig

JOCKEY PUMP PX-500-004	
Requirement	**Value**
Design Flow Rate	15 gpm
Design Pressure	150 psig
Design Flow	15 gpm
Total Head	220 ft

FIRE WATER PUMPS PX-500-002A/B	
Requirement	**Value**
Design Pressure	103 psig
Total Head	238 ft
Design Flow	1500 gpm

17.4.2 *Operational Requirements*:

FIRE WATER PUMP HOUSE SYSTEM	
REQUIREMENT	**VALUE**
Operating Pressure	85 - 125 psig
Detectors and Alarms	Full-Time Operation

FIRE WATER STORAGE TANK TK-500-001	
Requirement	**Value**
Tank Level	30 ft (426,844 gal)

FIRE WATER HEATER PUMP PX-500-003	
Requirement	**Value**
Operating Temperature	45 - 50°F
Operating Flow Rate	10 - 11 gpm
Pressure Differential Across Heater	5.0 psid

FIRE WATER HEATER HT-500-001	
Requirement	**Value**
Heating Capacity	75,000 btu/hr
Operating temperature	50 - 60 °F
Operating Pressure	85 - 125 psig
Pressure Differential Across Heater	< 5.0 psid

JOCKEY PUMP PX-500-004	
Requirement	**Value**
Operating Pressure	85 -125 psig
Operating Flow	15 - 16.5 gpm

FIRE WATER PUMPS PX-500-002A/B	
Requirement	**Value**
Operating Pressure	88 - 125 psig
Operating Flow	1500 -1650 gpm

17.4.3 *Maintenance and Surveillance Requirements*:

NOTE - All testing and inspection for the Fire Protection System is performed by the Hanford Fire Department (HFD) as required by RLID 5480.7 and DOE 5480.7A (HNF-PRO-372).

A. Manual valves in the FWPH System must be exercised and lubricated at least annually.

17.5 Safety

17.5.1 *Potential Safety Hazards and Concerns*: Hazards of the Fire Protection System include:

- High pressure water
- High velocity water flow
- Wet electrical equipment after initiation of sprinklers

Pipe failure could endanger facility personnel because of the high pressure water and high velocity water flow. Inadvertent opening of a sprinkler head by mechanical damage or a heat source other that a fire (e.g., electrical heater).

17.5.2 *Safety Classification*: The FWPH System is classified as General Service (GS), because it is not required to mitigate an accident or to operate after an accident, and provides a limited function in protecting the facility worker from the industrial and radiological hazards. The 6-inch fire water supply enters the Northwest corner of the FWPH Building, supplying water to the building Automatic Wet Pipe Sprinkler System. There are no Safety Class (SC) or Safety Significant (SS) functions associated with this system. Water leakage from the FWPH System could cause water accumulation and drainage problems. Safety Classification is based on the consequences of system failure.

17.5.3 *Quality Level*: The FWPH System is Quality Level II, which indicates that its functioning can be adequately assured with the normal level of Quality Assurance as implemented by the Operating Contractor QA Plan.

17.5.4 The soil around underground RW and FWX lines must be checked monthly for evidence of leakage, to avoid the risk of building foundation failure resulting from a washout following a break of the lines.

17.5.5 *Environmental Safety*: The FWPH does not have any connections to a chemical sewer or other means of direct disposal of hazardous chemical waste. All hazardous wastes generated during maintenance or other activities within the facility must be safely contained at the point of generation (i.e., fluids drained into buckets, rags and other materials placed in plastic bags), and removed to some other facility having suitable means of safe hazardous material disposal available, in accordance with "State Waste Discharge Permit Number ST-4508, as amended" Hanford Site.

17.6 References

17.6.1 Drawings relating to or referenced in this document are:

DWG #	DRAWING TITLE
H-2-117076	Civil Water Lines Plans & Notes
H-2-117077 sheets 1 - 3	Civil Water Lines Sections & Details

17.6.2 Documents relating to or referenced in this document are:

DOC. #	DOCUMENT TITLE
N/A	Design Basis Document, Section 2, Process Systems
HNF-PRO-351	Fire Protection System Testing/Inspection and Maintenance
HNF-PRO-372	Hanford Fire Department
HNF-SD-SNF-FHA-002	Final Fire Hazard Analysis for the Canister Storage Building
HNF-3553	Annex A, Canister Storage Building Final Safety Analysis Report, Revision 7.0, Section A2.7.1, Fire Protection Features.
N/A	Westinghouse Hanford Company HWVP Raw Water and Fire Water System Operation & Maintenance Manual, Volumes: 1 - 3
NFPA 25, 1998	Inspection, Testing and Maintenance of Water Based Fire Protection Systems
NFPA 72, 1996	National Fire Protection Code
ST-4508	Hanford Site State Waste Discharge Permit
W-379-C-CSB-15501	Automatic Wet Pipe Sprinkler System

DOC. #	DOCUMENT TITLE
W-379-C-CSB-15061	Piping Material, Fabrication, Erection and Pressure Testing (Carbon Steel, Iron and Nonmetallic)
W-379-C-CSB-17697	Smoke and Heat Detectors
W-379-C-CSB-2220	Excavation And Backfill

SPENT NUCLEAR FUEL CANISTER STORAGE BUILDING

DISTRIBUTED CONTROL SYSTEM (System # 21)

SYSTEM DESIGN DESCRIPTIONS

18.0 DISTRIBUTED CONTROL SYSTEM DESCRIPTION (SYSTEM #21)

18.1 Function

The Distributed Control System (DCS) is designed to serve as the central monitoring and control system for CSB facility conditions, systems (primarily the Health Physics monitoring system), and process (inert gas dilution of vented Cask gas from the Cask Servicing System).

The CSB DCS is designed to provide the following:

- Monitoring, conditioning, and display of selected ARM readouts
- Monitoring, display, and annunciation of selected ARM Alarms
- Monitoring, display, and annunciation of two CAM Alarms
- Monitoring, conditioning, and display of Stack α, β, and ^{129}I Monitor readouts
- Monitoring and display of Vault Inlet and Exhaust Stack temperatures
- Monitoring and display of Vault Inlet Stack Flow
- Monitoring and display of HVAC Stack flow and air temperature
- Monitoring and display of On-Line Monitor flow
- Monitoring and display of Record Sampler flow
- Monitoring, totalizing, and display of total Record Sampler flow
- Resetting the Record Sampler flow totalizer
- Monitoring, display, and annunciation of Stack High Radiation, Stack Equipment Trouble, HVAC Sump High Level, Compressor Common Trouble, and Dryer Common Trouble Alarms
- Monitoring and display of Cask Servicing System Exhaust Gas pressure and temperature
- Monitoring and display of Cask Servicing System Inert Gas Dilution Control Valve PCV-115 control air pressure
- Monitoring and display of Cask Servicing System Inert Gas Dilution Control Valve PCV-115 position
- Monitoring and display of MCO Sampling/Weld Station Exhaust Gas pressure and temperature
- Monitoring and display of MCO Sampling/Weld Station Inert Gas Dilution Control Valve PCV-721 control air pressure
- "Real-time" trending and display of elected analog facility parameters
- Historical trending and display of selected analog facility parameters
- "On-demand" report generation
- Archiving of data associated with the performance of the CSB Monitoring algorithm to the CSB-1 Workstation hard drive
- Monitoring, display, and annunciation of Alarms and messages associated with the CSB Monitoring algorithm
- Displaying and updating the correct time and date

- Monitoring the proper operation of the DCS Workstations, Programmable Logic Controller (PLC), and I/O Modules
- Display and annunciation of failure of any DCS component
- Display the operational status of the PLC, I/O modules and associated power supplies, and computer network modules and connections
- "On-demand" printing of displayed screens
- Monitoring and display of all system Alarms in the "Alarm Status" portion of most display screens and on the "Alarm Summary Display" screen
- Archiving of system operational status and status changes
- "On-demand" viewing and archiving of facility Alarm history files
- System security control through use of several levels of name & password combinations

18.2 Operation

18.2.1 Two Operator Workstations allow the monitoring of components connected to the DCS, provide control functions, and provide means for archiving mass data for safe storage.

18.2.2 A color printer in the Control Room allows for the printing of hardcopy listings of alarms, control actions, and other reports by Operator request.

18.2.3 A Programmable Logic Controller (PLC) accepts sensor inputs from field devices, and control inputs from the DCS Workstations, processes these inputs through "Ladder Logic" algorithms in the PLC processor, then generates and transmits control signals to field devices such as controllers or alarms, and back to the DCS for data recording or alarm annunciation.

18.2.4 Components in the field (instruments, actuators, sensors, etc.) are connected to the DCS at 2 Remote Termination Unit (RTU) cabinets located in Room 032 and the operations area of the CSB.

18.2.5 PLC Remote Input/Output units (PLC Remote I/Os) concentrate and transmit data to another DPU, which will then act as controller for the "DPU" represented by the PLC I/O.

18.2.6 A Data Highway links all components of the DCS together.

18.3 Configuration

18.3.1 The DCS receives electrical power from the Normal Electrical Distribution (NED) System through battery-backed Uninterruptible Power Supply (UPS) DA-33-213.

18.3.2 Operator Workstations are located in the Control Room; the PLC is located in the RTU-1 cabinet in Room 032. The RTU-2 cabinet is located in the Operating Area of the CSB. The Data Highway is located throughout the facility.

18.4 Requirements

18.4.1 *Design Requirements*: The primary design requirement of the DCS is that all components be proven, "off-the-shelf" designs with a history of reliable field operation. Other design requirements are given in the following table:

REQUIREMENT	VALUE
Design Lifespan	40 years
Hardware and Software design	Modular, easily upgradeable
Installed capacity and bandwidth	25% greater than required in initial installation

18.4.2 *Operational Requirements*: DCS operational requirements (with the system assumed to be fully loaded and operating to capacity) are given in the following table:

REQUIREMENT	VALUE
Usability of new screen display after Operator request for new display at Operator Workstation	≤ 3 seconds
Refresh rate of dynamic system information on Operator Workstation display - full system	≤ 2 seconds

18.4.3 *Maintenance and Surveillance Requirements*:

A. Hardware, Software, and System Diagnostics should be performed per Procedures periodically, as necessary.

18.5 Safety

18.5.1 *Potential Safety Hazards and Concerns*: The primary hazard associated with the DCS is the possibility of electric shock if DCS PLC/RTU cabinets are opened and internal wiring is exposed. As there are few, if any, user-serviceable parts within the DCS PLC/RTU cabinets, they should not be opened except for servicing or upgrades by qualified Instrument or Electrical personnel.

18.5.2 *Safety Classification*: The DCS is classified as General Service (GS), because it is not required to prevent or mitigate an accident or to operate after an accident, and provides a limited function in protecting the facility worker from industrial and radiological hazards. Safety Classification is based on the consequences of losing the System.

The DCS provides monitoring capabilities which facilitate the confinement of incidental radioactive contamination to the CSB Operating Area by supporting key equipment associated with the Health Physics, Heating, Ventilation, and Air Conditioning, MCO Servicing System, and Vault Cooling System. The only control associated with the DCS is control of the Helium Dilution Control Valve PCV-115 of the Cask Servicing System via the a Programmable Logic Controller (PLC) in the Remote Termination Unit (RTU). All other functions of the DCS are equipment monitoring functions; the DCS has no direct support role with respect to any Safety Class (SC) or Safety Significant (SS) equipment or their required safety functions.

18.5.3 *Quality Level*: The DCS is Quality Level II, indicating that its functioning can be adequately assured with the normal level of Quality Assurance as implemented by the Operating Contractor Quality Assurance Plan.

18.5.4 *Environmental Safety*: The SNF CSB does not have any connections to a chemical sewer or other means of direct disposal of hazardous chemical waste. All hazardous wastes generated during maintenance or other activities within the facility must be safely contained at the point of generation (i.e., fluids drained into buckets, rags and other materials placed in plastic bags), and removed to some other facility having suitable means of safe hazardous material disposal. (See Hanford Site Procedures: *HNF-PRO-451, Regulated Substance Management* and *HNF-PRO-455, Solid Waste Management*).

18.6 References

18.6.1 Drawings relating to or referenced in this document are:

DRAWING #	DRAWING TITLE
H-2-121110	Instrumentation CSB Control Room Layout
H-2-121300	Control Systems CSB Data Highway
H-2-121303	Control Systems Typical RTU Cabinet Assembly Layout
H-2-121305	Control Systems CSB RTU Location Plan

18.6.2 Documents relating to or referenced in this document are:

DOCUMENT #	DOCUMENT TITLE
HNF-PRO-704	Hazard and Accident Analysis Process
HNF-3553	Annex A, Canister Storage Building Final Safety Analysis Report, Section A2.8.4, Distributed Control System
SNF CSB Safety Classification Forms	Section 96-05-04, CSB Support Building (1997)
PLCs Plus Document	Suggested Spare Parts List for CSB DCS
PLCs Plus Document	Schedule of PLCs Plus Activities for the CSB DCS
PLCs Plus Document	PLCs Plus Work Control Procedure: Software Testing
PLCs Plus Document	Quality Assurance Project Plan for Canister Storage Building Distributed Control System
PLCs Plus Document	CSB DCS Floor Layout
PLCs Plus Document	Estimated Power Requirements of CSB DCS
PLCs Plus Document	PLCs Plus Work Control Procedure: Software Development
PLCS-CSB-SDD-001 Rev. 0	System Design Description of the Canister Storage Building (CSB) Distributed Control System (DCS), Revision 0, October 1997
PLCS-CSB-FAT-001 Rev. 0	Canister Storage Building (CSB) Distributed Control System (DCS) Factory Acceptance Test Procedure, Revision 0, September 1997

DOCUMENT #	DOCUMENT TITLE
W-379-P-CSB-17100	Distributed Control System (DCS) Specification

SPENT NUCLEAR FUEL CANISTER STORAGE BUILDING

MCO SAMPLING/WELD (System #22 AND #23)

SYSTEM DESIGN DESCRIPTIONS

19.0 MCO SAMPLING/WELD SYSTEM DESCRIPTION (SYSTEM #22 AND #23)

19.1 Function

19.1.1 The MCO Sampling/Weld (MSW) System is designed to sample Monitored MCOs and weld MCO Canister Cover Assembly on all MCOs in accordance with a pre-determined schedule.

19.1.2 Several activities take place at the MCO Sampling/Weld Station: the MCO shell temperature is checked via an infrared pyrometer; the MCO gas pressure and temperature are checked; and the MCO gas stream is sampled for hydrogen and oxygen, and for radiological gases. When the sampling is complete, the MCO gas pressure will be re-established using helium to the value measured before sampling. After sampling operations are complete, the MCO valve seal and cover plate are leak tested to confirm seal integrity.

19.1.3 The Monitored MCOs will eventually (after about two years) be transferred to one of the two Sampling/Weld Stations for the Canister Cover Assembly Welding operation. Welding will be performed by an automatic Gas Tungsten Arc Welding (GTAW) process. The specific welding equipment to be used may be determined at a later date. The welding cover gas and electrical supply systems are run to two welding machine connection locations as part of the Sampling/Weld Station work.

19.2 Operation

19.2.1 MSW System operation begins when any of the following conditions exist:

- A Monitored MCO has been resident in a Standard Storage Tube for at least one month after original receipt.
- A Monitored MCO is due to be sampled.
- A Monitored, or a Standard MCO is to be welded.

19.2.2 A maximum of six to eight MCOs will be pre-selected for sampling; these six are called Monitored MCOs. Sampling of a Monitored MCO will be done after it has been in the CSB for at least one month; each Monitored MCO will be sampled a total of four times during each of the first two years of CSB storage operation. Standard MCOs will receive a welded Canister Cover Assembly after receipt at the CSB.

19.2.3 The MSW System is designed to sample the gas from a Monitored MCO for helium, hydrogen, krypton, nitrogen, and oxygen content; to determine the ratio of hydrogen to krypton (^{85}Kr); and to weld Canister Cover Assembly to the MCOs. The major components used to sample a Monitored MCO and to weld all MCOs are:

- Two shielded Sampling/Weld Station Pits (Pits #2 and #7) with impact absorbers to prevent damage to the MCOs upon placement in the Sampling/Weld Stations, and two support utilities pits (Pits #3 and #6);
- Two 7-1/2 ton gantry cranes, one for each of the two stations with one 5.0 ton and two 1.0 ton hoists on each crane, used for positioning the Sample Hood (one Sample Hood to be shared between the two stations) or Weld Hoods (one at each station);
- Temporary shielding (temporary shielding is needed for operating personnel protection against radiation streaming during MCO transfer);
- Fixed shielding with MCO cooling capability (a cooling cap for each station to cool any high temperature MCO tops for operations personnel handling);
- A shared, permanently installed Sampling/Weld station HEPA filter/exhauster to ventilate the Hoods.
- A Sample Cart to perform sampling operations
- Welder to permanently seal the MCO Canister Cover Assembly

Additional support equipment includes an infrared pyrometer at each station to measure the MCO skin temperature for a general temperature profile; one process valve operator for MCO gas access, one Sample Cart to sample and re-inert the MCO, a sample Container to collect the proper quantity of sample gas for analysis, tools for MCO process port removal and cover plate removal/installation operations, and leak test equipment to test the MCO cover plate seals.

19.2.4 The MSW System is designed to weld MCOs immediately upon receipt and Monitored MCOs after their evaluation is completed (about two years after receipt). Welding operations may be performed by a track-mounted, orbiting weld head with closed circuit television (CCTV)and an automatic gas tungsten arc welding (GTAW) process to be provided by others.

Sampling Monitored MCOs:

19.2.5 The sampling process begins when the MCO to be monitored is carried by the MCO Handling Machine (MHM) to the Sampling/Weld Station. With Shield Halves (RSE-007/RSE-008, RSE-011/RSE-012) secured in place, the MHM first removes Center Shield Plate (PL-004, PL-005), then lowers the selected Monitored MCO into the Sampling/Weld Station Pit. As the MHM lowers the MCO, an infrared pyrometer (TE-731A or TE-731B, depending on which sampling/weld station is used) will check the MCO surface temperature. These temperature readings are recorded on the Distributed Control System (DCS) and monitored by operations personnel. The data from the pyrometer is stored on the DCS for immediate operator use to identify hot spots. Hot spots may indicate possible temperature differences with the fuel inside of a Monitored MCO.

19.2.6 Once the Monitored MCO has been completely lowered into the Sampling/Weld Station, the MHM replaces the Center Shield Plate (PL-004, PL-005). The MHM interlocks do not allow the MHM to leave the MCO uncovered. After the MHM is moved away from the Sampling/Weld Station, the 7-1/2 ton Sampling/Weld Station Gantry Crane CRN-009 or CRN-010 is used to remove Trench Cover Shield (COV-005, COV-006) and Center Shield Plate (PL-004, PL-005) for access to the top of the MCO.

19.2.7 The MCO top surface temperature is measured using a hand-held pyrometer. If the MCO top surface temperature is between 115°F and 150°F, administrative controls are implemented to safely work on the MCO top. If the indicated temperature is greater than 150°F, the Sampling Station Cooling Cap HX-002 will be placed on top of the MCO The cooling cap is connected to the propylene glycol/water supply and return lines in the south trench for a coolant connection to Sampling/Weld Station Chiller CSB-CHW-001. After the MCO top has been cooled to below 115°F, the cooling cap is disconnected from the polypropylene glycol/water supply and return lines and removed from the MCO top. Personnel are not required to use protective equipment for heat (e.g., gloves) if the contacted surfaces are below 115°F.

19.2.8 Shield Halves (RSE-007/RSE-008, RSE-011/RSE-012) are removed from position using the 7-1/2 ton Sampling/Weld Station Gantry Crane CRN-009 or CRN-010. The shield halves are used to reduce the radiological streaming coming from the MCO to within ALARA limits, anytime the MCO is lowered or raised at the Sampling/Weld Station.

19.2.9 An integral bumper system on each Sampling/Weld Station Gantry Crane protects the Cranes from being struck by the MHM turret. The MHM collision prevention system will make contact with the Crane bumper and stop the MHM before it can damage the sample station equipment or the MCO.

19.2.10 Removable Guard Rails are placed and locked into position. The guard rails are used to protect against personnel falling into the open trench and the Sampling/Weld Station. A vacuum dome (to be designed later) is installed on the top of the MCO to test the integrity of the MCO mechanical seals. After the seal leak test has been performed, the vacuum dome is removed from the MCO.

19.2.11 The location of the ports on top of the MCO is noted and, if necessary, the MCO is rotated using rotation motor for Shielding RSE-005, RSE-009 so that Port #2 is conveniently located. Sample Hood BARR-002 is lowered over the MCO in the Sampling/Weld Station using one of the 1.0 ton hoists on Sampling/Weld Station Gantry Crane CRN-009 or CRN-010. Sample Hood BARR-002 is used to confine possible airborne contamination generated by an accidental release during sampling. The fact that the Port #2 is equipped with an internal HEPA filter reduces the probability that airborne contamination will escape the MCO during sampling activities.

19.2.12 Sample Cart CART-001 is connected to the local DCS and helium connections (helium gas supply hose, MCO sample/inerting hose, vent hose). The Sample Cart includes a short section of 12 inch diameter pipe that serves as a gas accumulator to assure rapid flow into the Sample Cart piping when the MCO is sampled and inerted. The Sample Cart is connected to Sample Hood HEPA Filter FH-009 outlet using a quick-disconnect, which opens a line to the MCO for sampling and inerting. The Sample Cart vent flexible hose is connected, also using a quick-disconnect, to the Sample Hood BARR-002 discharge. The BARR-002 exhaust flexible hose is connected to Sampling/Weld Station HEPA Filter/Exhauster CSB-AH-006 via crane-mounted duct work. Then CSB-AH-006 is started to establish a negative pressure relative to the operating area atmosphere (approximately -0.1 in. water on PDI-732 at a flowrate of at least 100 cfm as indicated on FI-740 or FI-741) inside Sample Hood BARR-002 to maintain air contamination control around the MCO top. BARR-002 flow and pressure are controlled with dampers MD-5, MD-8, and the adjustable hood dampers (slots at the base of the hood).

19.2.13 Once negative pressure and adequate flow have been established inside Sample Hood BARR-002, the air inside of the sampling piping is purged with helium by opening Refill Valve HE-V-163, and exhausted by opening Vent Valve MCO-V-154 for several seconds, then closing MCO-V-154. This will ensure that segment of the sampling piping is cleared of air prior to sampling the Monitored MCO. High purity helium (at least 99.95% pure) is supplied from a cylinder manifold located outside the support building to the northwest of the truck vestibule. Helium purity must be maintained at no less than 99.5% at placement into a Monitored MCO. This purity is in compliance with Office of Civilian Radioactive Waste (OCRWM) requirements that no non-approved materials (e.g., air, water vapor, or deleterious gases) are to be placed into an MCO. The delivered helium purity is ensured by purchasing and receipt paperwork.

19.2.14 The MCO valve operator is used to isolate the flow of sample gas from, and helium flow into, the MCO and is connected to the flexible hose inside the Sample Hood. The MCO valve operator is also purged with helium prior to sampling to clear any air that may be trapped upon connection to the MCO. This is accomplished by opening Surge Valve MCO-V-151 for about 10 seconds, then closing the valve and closing Refill Valve HE-V-163. Using the Sample Hood glove ports, MCO Cover Plate #2 is removed using hand tools and the MCO valve operator is then bolted into place on MCO Port #2.

19.2.15 When Sample Hood BARR-002 and Sample Cart CART-001 are fully connected and operational, a 10-minute pressure decay test is performed using 75 psig helium to check for possible leaks into the Sample Hood at the process valve operator connection to the MCO, and for leaks in the pressurized lines, fittings, and valves. This pressure test is accomplished by opening Bypass Valve HE-V-168 and the pressurizing the closed MCO process valve operator inside BARR-002. After confirming that the connection to the MCO is leak tight, the line pressure is bled back to zero (0) psig by closing the Bypass Valve HE-V-168, then opening Sample Cart Vent Valve HE-V-169, until zero (0) psig is registered on PIT-721; then HE-V-169 is closed.

19.2.16 The MCO process operator valve is opened and the pressure is read on MCO Pressure Indicating Transmitter PIT-721 and recorded on the DCS (PI-721). If the indicated pressure on PIT-721 is < 15.0 psig, then the spring-loaded toggle valve that normally isolates and protects MCO Pressure Indicator PI-736 can be momentarily opened and the MCO pressure more accurately read on this lower range PI. A minimum MCO gas pressure of approximately 2.0 psig is required in order to achieve quick temperature element warm up. Helium is added, as required, to the MCO to reach at least 2.0 psig before sampling can be performed. The sample Container (by others) is connected to the sample connection and Sample Valve MCO-V-152 is opened to allow collection of a sample into the Container. Then Surge Valve MCO-V-151 is opened to begin the MCO gas flow into the Sample Cart. Rapid flow into the Sample Cart is required in order to ensure an accurate gas sample and temperature. As the venting gas flows into the 12-inch diameter piping, the gas temperature is read and recorded (DCS) on MCO Gas Temperature Indicator TI-723. This temperature reading, together with the pressure measurement from PI-721 (DCS) are required for an accurate determination of the amount and contents of gas inside the MCO. MCO gas is collected in a sample Container at the sample connection upstream of the accumulator.

19.2.17 The MCO valve operator is used to close the process valve in Port #2 to stop gas venting from the MCO. The Sample Valve MCO-V-152 is closed and the sample Container is removed, completing sample collection. The MCO gas sample is then sent to a laboratory for analysis. The gas temperature, pressure, and sample results will be used to develop the gas composition history for each Monitored MCO over the two-year sampling period.

19.2.18 After the MCO gas sample has been obtained, the Sample Cart is vented, purged and exhausted of residual MCO gas through HEPA Filter/Exhauster CSB-AH-006 by opening Purge Valve HE-V-166 and Vent Valve MCO-V-154. Purge Valve HE-V-166 is opened before the Sample Cart is vented in order to dilute (dilution factor ≥ 65) the MCO vent gas with helium as it is discharged to the CSB-AH-006. This dilution prevents formation and venting of a potentially flammable gas mixture to CSB-AH-006. When MCO Pressure Indicator PI-736 reads zero (0) psig, Purge Valve HE-V-166 is closed and Refill Valve HE-V-163 is opened for a few seconds then closed, purging any remaining hydrogen from the vent line. Then Vent Valve MCO-V-154 is closed to prevent air ingress into the Sample Cart piping.

19.2.19 When Sample Cart piping has been purged and vented of hydrogen, the internal pressure of the Monitored MCO is then re-established to 11 psig (9.5 to 12.5 psig) by opening the Refill Valve MCO-V-163, Surge Valve MCO-V-151, and the MCO process valve. helium Regulating Valve PCV-726 will continue to fill the MCO until 11 psig (9.5 to 12.5 psig) is reached. The 11 psig (9.5 to 12.5 psig) psig MCO gas pressure is verified by opening MCO Pressure Indicator PI-736 Toggle Valve and checking PI-736 for confirmation. Then the MCO process valve and Refill Valve HE-V-163 are closed to isolate the MCO from the helium gas supply. The 11 psig (9.5 to 12.5 psig) pressure is sufficient to provide a positive pressure in the MCO during winter storage conditions.

19.2.20 If the post-sampling pressure in the Monitored MCO is greater than the as-sampled pressure of 12.5 psig, then the pressure is vented off to reach the baseline 11 psig (9.5 to 12.5 psig) residual pressure in the MCO by opening Purge Valve HE-V-166 and slowly opening Vent Valve MCO-V-154.

19.2.21 After the MCO pressure has been returned to pre-sampling pressure or re-baselined to a pressure of 11 psig (9.5 to 12.5 psig) and the MCO process valve is closed using the MCO process valve operator and torqued to about 90 ft-lbs to ensure a leak-tight MCO process valve closure, a pressure decay leak check is performed by observing the pressure drop-off on PI-736 (the spring-loaded toggle valve MCO-V-161 must be held open to do this). Then, Vent Valve MCO-V-154 is opened to depressurize the Sample Cart piping. When the pressure reading on MCO Pressure Indicator PI-736 approaches Zero (0 to 0.1) psig, Vent Valve MCO-V-154 is closed to prevent air in-leakage into the Sample Cart piping. Surge Valve MCO-V-151 is then closed to maintain an inert atmosphere inside of the Sample Cart piping after the MCO is disconnected from the Sample Cart.

19.2.22 The process valve operator is disconnected from the flexible hose/HEPA filter connection from Sample Hood BARR-002. Then the MCO process valve operator is unbolted from the MCO Port #2 and the MCO Port #2 cover plate is bolted into its sealed position. The sealed MCO #2 cover plate is leak tested (bubble and/or helium detection test) by checking for helium escaping past the cover plate. This leak test gives assurance that the process valve / cover plate assembly is leak tight and that the Monitored MCO will retain the desired internal pressure. The process valve is the primary and the cover plate is the secondary barrier against leakage through Port #2. The mechanically sealed lifting ring / MCO shield plug assembly is also tested for helium leakage before the Monitored MCO is returned to the Storage Tube.

19.2.23 The Sample Cart piping is purged one last time before disconnecting the helium supply by opening Refill Valve HE-V-163 and Surge Valve MCO-V-151 for about 10 seconds, then MCO-V-151 and HE-V-163 are closed. This ensures that the Sample Cart piping is properly inerted with helium and purged of hydrogen and remains free of air.

19.2.24 Sampling/Weld Station HEPA Filter/Exhauster CSB-AH-006 is shut down. Sample Cart CART-001 is disconnected from the local DCS and helium connections. The Sample Cart quick-disconnect hoses are disconnected from Sample Hood HEPA Filter FH-009, the Sample Hood BARR-002 discharge, and the helium supply.

19.2.25 After all of the connections to the Sample Hood BARR-002 have been disconnected, the Sample Hood is removed from the top of the MCO using one of the 1.0 ton hoists on the Sampling/Weld Station Gantry Crane CRN-009 or CRN-010. Removable Guard Rails (GR-002A/B, GR-003A/B) are unlocked and removed from position. If the Sampling/Weld Station Chiller CSB-CHW-001 has been in use, it is shut down; it may need to be disconnected from Stationary Shield RSE-006 if leaks in the supply or return piping are present. Shield Halves (RSE-007/RSE-008, RSE-011/RSE-012) are placed into position using the 5.0 ton hoist on Sampling/Weld Station Gantry Crane CRN-009 or CRN-010.

19.2.26 Center Shield Plate PL-004, PL-005 and Trench Cover Shields COV-005, COV-006 are placed into position using the 5.0 ton hoist on Sampling/Weld Station Gantry Crane CRN-009 or CRN-010.

19.2.27 The gantry crane is moved away from the pit and the MHM retrieves the sampled Monitored MCO and returns it to the proper Storage Tube location.

Welding MCOs:

19.2.28 The welding process begins when the Trench Cover Shields COV-005 is removed using the Sampling/Weld Station Gantry Crane CRN-009 or CRN-010 and the MHM removes Center Shield Plate PL-004, PL-005 and lowers the an MCO into the Sampling/Weld Station Pit. As the MHM lowers the MCO, an infrared pyrometer (TE-731A or TE-731B depending on which sampling/weld station is used) will check the MCO surface temperature. These temperature readings are recorded and tracked on the Distributed Control System (DCS). The data from the DCS can be used to identify "hot spots" on the MCO surface indicating possible temperature differences from the fuel inside of the MCO.

19.2.29 Once the MCO has been completely lowered into the Sampling/Weld Station Pit onto the previously placed impact absorber, the MHM will replace Center Shield Plate PL-004, PL-005, to clear the affected MHM interlock. After the MHM is withdrawn from the pit, the 7-1/2 ton Sampling/Weld Station Gantry Crane CRN-009 or CRN-010 will remove COV-005, COV-006 and PL-004, PL-005 for access to the top of the MCO.

19.2.30 The MCO weld surface temperature is again measured using the hand-held pyrometer. If the observed MCO weld joint region surface temperature is greater than 150°F, the Sampling/Weld Station Chiller CSB-CHW-001 for the cooling jacket in the stationary shielding is activated to bring the MCO down to less than 150°F. It should be noted that the automatic welding equipment is to be supplied under separate contract, as are the welding services. Actual weld surface temperature requirements will be established by the provider of welding equipment. Specific discussion of welder operations can be found in the *vendor's design description.*

19.2.31 Shield Halves (RSE-007/RSE-008, RSE-011, RSE-012) are removed from position using the 7-1/2 ton Sampling/Weld Station Gantry Crane CRN-009 or CRN-010. If required, Sampling/Weld Station Chiller CSB-CHW-001 is started for stationary shield cooling to bring the MCO to proper welding temperature (< 150 °F).

19.2.32 An integral bumper system on the Sampling/Weld Station Gantry Cranes protects the Cranes from being struck by the MHM turret. The MHM collision prevention system will make contact with the Crane bumper and stop the MHM before it can damage a Crane.

19.2.33 Removable Guard Rails (GR-002A/B, GR-003A/B) are placed and locked into position. The guard rails are used to protect against personnel falling into the open trench and the Sampling/Weld Station. The MCO weld surface region is inspected for dirt or radioactive contamination and cleaned if necessary. Thorough inspection is facilitated by rotation of the MCO using the rotation motor for shielding RSE-005. Then Weld Hood BARR-003, with the MCO Canister Cover Assembly and automatic weld head suspended inside, is lowered over the MCO in the Sampling/Weld Station using one of the 1.0 ton hoists on Sampling/Weld Station Gantry Crane CRN-009 or CRN-010. Weld Hood BARR-003 is used to confine weld fumes and possible airborne contamination generated by inadvertent heating of radionuclide particles that may be in the weld region.

19.2.34 The Canister Cover Assembly is lowered to rest on the top of the MCO, aligning the weld prepped edges of the two components. After inspection and cleaning is complete, final joint and tracking alignments are made. Once negative pressure has been established inside Weld Hood BARR-003, the welding machine is activated and the welding operation is started. The automatic welder is expected to make between four and eight complete passes around the MCO cover cap to complete the weld. The actual number of passes required will be determined by the equipment provided.

19.2.35 When the Canister Cover Assembly weld has been examined and declared satisfactory (successful dye-penetrant examination), the automatic weld head and the Weld Hood (BARR-003 A or BARR-003 B depending on whether Gantry Crane CRN-009 or CRN-010 is used) are removed. After the Weld Hood is removed, Sampling/Weld Station HEPA Filter/Exhauster CSB-AH-006 is shut down. The MCO welding is now complete and preparations for the retrieval of the MCO by the MHM begin.

19.2.36 The Weld Hood containing the automatic weld head is lifted from the Sampling/Weld Station Pit using one of the 1.0 ton hoists on the Sampling/Weld Station Gantry Crane CRN-009 or CRN-010. Removable Guard Rails (GR-002A/B, GR-003A/B) are unlocked and removed from position. Sampling/Weld Station Chiller CSB-CHW-001 is shut down and disconnected from Stationary Shield RSE-006, RSE-010. Then Shield Halves (RSE-007/RSE-008, RSE-011, RSE-012), Center Shield Plate PL-004, PL-005 and Trench Cover Shield COV-005, COV-006 are placed into position using the 5.0 ton Sampling/Weld Station Gantry Crane CRN-009 or CRN-010.

19.2.37 The MHM retrieves the welded MCO and returns it to its Standard Storage Tube location.

Off-Normal MCOs

19.2.38 When an MCO fails the MCO seal leak test, or if during sampling operations, an MCO is determined to be in an off-normal status, the MCO is transported using the MHM to an Overpack Storage Tube for monitoring. The Overpack Storage Tube is then inerted and monitored using the Tube Vent and Purge Cart.

19.3 Configuration

19.3.1 The MCO Sampling/Weld (MSW) System interfaces with the following systems:

A. The Normal Electrical Distribution System (NED) provides 480Y/277 V, 3-phase electrical power for Sampling/Weld Station equipment and 208Y/120V, 3-phase electrical power for Sampling/Weld Station instrument operation.

B. The Operating Area HVAC System (OHVAC) provides Operating Area (Zone III) ventilation and HEPA-filtered exhaust for final confinement of leaking components and vented gases.

C. The MCO Handling System (MHS) provides transport of the MCO from the Monitored Storage Tube to the MCO Sampling/Weld Station.

D. The Analytical Laboratory provides analyses of MCO gas samples.

E. The helium Supply System provides the helium used for sampling and welding operations (i.e., purging the Sample Cart and associated piping, diluting vented hydrogen, as back gas during cover assembly welding, etc.) and to refill the MCO after sampling operations are complete.

F. The Argon Supply System provides weld cover gas for the Welding System.

19.3.2 MSW System components are located at the MCO Sampling/Weld Station Area at the South end of the SNF-CSB. The major components used to sample or weld an MCO are: Cranes moving equipment, rotating shield for shielding during rotation, cooled stationary shielding for MCO temperature control (as needed), temporary shielding for radiation protection, cooling caps to cool high temperature MCO tops for thermal protection of operators, Sample Hood and Weld Hoods for airborne radiological control, exhaust ventilation system to remove contaminated particles and gases, an infrared pyrometer to measure the MCO shell temperature, an MCO valve operator for MCO Port #2 process valve access, a Sample Cart to sample and to provide the means of re-inerting the MCO, a sample Container to extract the proper quantity of sample gas for analysis, leak test equipment to test the MCO mechanical seals and the cover plate seals, and welding and weld testing and repair equipment.

19.3.3 The MSW System is depicted in Drawing: H-2-125250, *P&ID MCO Sampling/Weld System*.

19.4 Requirements

19.4.1 *Design Requirements*:

MCO SAMPLING/WELD STATION COMPONENTS	
Requirement	**Value**
Sample Cart CART-001	
Maximum pressure	150 psig
Maximum temperature	130 °F
Minimum Temperature	32 °F
Maximum Process Fluid Temperature	400 °F
Maximum helium Pressure	150 psig
MCO Sample Hood BARR-002	
Maximum Temperature	104 °F
Required Capture Velocity at Entry Path from Environment into the Hood	100 to 150 ft/min linear velocity
MCO Weld Hood BARR-003	
Maximum Temperature	N/A
Minimum Capture Velocity	100 to 150 feet/minute linear velocity
Sampling/Weld Station Gantry Cranes CRN-009 & CRN-010	
Maximum Temperature	104 °F
Maximum Gantry Travel Speed	35 ft/min
Maximum Lift Speed	10 ft/min
Maximum Trolley Speed (5.0 Ton Hoist)	25 ft/min
Sample Hood HEPA Filter FH-009	
Minimum Efficiency	99.97% @ 0.3 microns
Maximum Temperature	400 °F
Maximum Pressure	150 psig
Maximum Flow	33 acfm
Sampling/Weld Station Chiller CSB-CHW-001	
Cooling Capacity	57,000 Btu/hr
Sampling/Weld Station HEPA Filter/Exhauster CSB-AH-006	

MCO SAMPLING/WELD STATION COMPONENTS	
Requirement	**Value**
Minimum Capacity	500 scfm
Static Pressure	8.0 wg

19.4.2 *Operational Requirements*:

COMPONENT	
Requirement	**Value**
Sample Cart CART-001	
Normal Temperature Range	60 - 85 °F
MCO Sample Hood BARR-002	
Normal Negative Pressure Range	0.1 in. w.c.
MCO Weld Hood BARR-003	
Normal Negative Pressure Range	0.1 in. w.c.
Sample Hood HEPA Filter FH-009	
Normal Differential Pressure Range	2 psi to 2.5 psi
Sampling/Weld Station HEPA Filter/Exhauster CSB-AH-006	
Normal Differential Pressure Range	1 to 4 in. w.c.

19.4.3 *Maintenance and Surveillance Requirements*:

A. Sampling/Weld equipment will be maintained and tested as follows:

- Sample cart/hood both are maintained in accordance with applicable vendor information
- All instruments calibrated annually
- Hoses inspected regularly for kinks, damage

B. The Sampling/Weld Station equipment will be used on a temporary basis and will not require a lot of preventative maintenance or testing. This system will be used for only 6 to 8 MCOs, for short term use only. The sampling will take place over the first two years for those MCOs, then the system will no longer be required.

19.5 Safety

19.5.1 *Potential Safety Hazards and Concerns*:

A. Because helium and argon, are used in the vicinity of the Sample Cart, it is possible that an oxygen-deficient atmosphere could exist near the Sample Cart. Dangerous levels of inert gases are not expected to accumulate because of the HVAC systems of the building and the Weld Hood and Sample Hood. Leak checks are also performed. However, to provide ensured personnel safety, a portable oxygen monitor that alarms when oxygen concentration in the air around the MCO Sample Cart is less than 19.5%, must be used during sampling operations to ensure personnel safety. If this alarm is activated, all personnel must be immediately evacuated from the area.

B. The MSW System is protected by several engineered safety features:

- Sample Hood BARR-002 is designed to confine and protect operating personnel from any MCO gases that might escape during sampling operations due to leakage or poor fitting connections.
- Weld Hood BARR-003 is designed to confine weld fumes and possible airborne contamination generated by inadvertent heating of stray radionuclide particles that may be in the weld region.
- Shield Halves (RSE-007/RSE-008, RSE-011, RSE-012), Center Shield Plate PL-004, PL-005 and Trench Cover Shield COV-005, COV-006 are used to reduce the radiological streaming coming from the MCO to within ALARA limits, when the MCO is lowered or raised at the Sampling/Weld Station.
- A Pressure relief valve is located downstream of the MCO vent gas connection to prevent over pressurization of the MSW System.
- The Safety Significant PSVs and Rupture Disk PSE-1 in the helium gas supply system provide over-pressure protection to prevent over-pressurization of the MCO.
- MSW System piping and most of the equipment are designed for at least 150 psig. Any specific equipment which cannot be qualified for 150 psig design pressure is protected by a root valve, relief valve, or bypass arrangement.

- Stationary Shield RSE-006 and Sampling Station Cooling Cap HX-002 are designed to cool the MCO by removing heat from the MCO body and top. This is accomplished by pumping coolant (propylene glycol) from Sampling/Weld Station Chiller CSB-CHW-001 through this equipment.

- An automatic purge control valve opens a 120 psig supply of helium into the Sample Cart outlet to the exhauster to ensure that the hydrogen concentration in the exit gas stream does not exceed 1.0%. This is achieved through pressure measurement and proportional control of the helium dilution stream. This type control ensures sufficient dilution in the vented gas stream to keep the exhaust gas below the hydrogen flammability limits.

C. Sample Hood HEPA Filter FH-009 provides the confinement barrier preventing the release of particulate contamination. The HEPA filter must be challenge tested (DOP) periodically to ensure that the filtering efficiency requirements are met. When the differential pressure across the HEPA filter reaches an established set point, or when the quantity of particulates trapped on the filter becomes a radiation hazard, the HEPA filter must be changed out.

D. When the temporary shielding at the Sampling/Weld station is not in place, the MCO cannot be removed. The permanent shielding surrounding the MCO is capable of limiting the radiation from the MCO to acceptable levels within the immediate area. Radiation from the top of the MCO is expected to be low enough (approximately 10 mrem/hr) that extra protection of worker hands and arms is not anticipated to be needed. However, every MCO will be checked by a Radiation Control Technician prior to beginning of sampling or welding operations and appropriate protective measures taken. There may be localized "hot spots" where less than desirable shielding exists. One hot spot maybe the annular space between the MCO and the permanently installed Sampling/Weld Station shielding; the other hot spot may be the MCO process port #2 when the cover plate is removed for sampling. The radiation fields here could be approximately 50 mrem/hr on contact until the MCO process valve operator is installed. The radiation field associated with the annular space between the MCO and the shielding could also be as much as 50 mrem/hr. Exposure must be limited in accordance with the applicable Radiation Work Permit. Long-reach tools will be used whenever possible to reduce exposure.

19.5.2 *Safety Classification*: There are two broad safety classification categories applicable to the MSW System:

- Components which prevent high pressure (approximately 2000 psig) helium from being inadvertently admitted into the MCO and causing MCO failure are classified as Safety Significant (SS). Rupture Disk PSE-1 located in the helium supply line to the Sampling/Weld Station is classified as SS for this protective function. PSV-720 near HEPA Filter FH-009 and PSV-728 at the helium let-down station near PCV-733 are classified as General Service.

- Components which prevent air (oxygen) ingress to the MCO atmosphere during sampling, venting, purging, and inerting operations, preventing the formation of flammable atmospheric concentrations of hydrogen are classified as Safety Significant (SS), if a vacuum condition exists in the MCO. Efficient CVD operations are expected to be shown to preclude this "vacuum" possibility by formal safety analysis. DESH analyses have shown that an MCO with a leak area equivalent to a 1-inch diameter hole cannot develop a flammable atmosphere unless it is placed under vacuum. Components which provide a confinement function are also classified as SS (See HNF-PRO-704).

- Components that provide cooling, positioning, sampling and utilities (electrical power and helium) are General Service (GS).

The MCO Sampling/Weld Station is designed to receive and sample Monitored MCOs and weld all MCOs. The MCOs will be transported to the Sampling/Weld Station by the MHM. Monitored MCOs are received for the purpose of sampling the gas inside (for lab analysis) and measuring: gas pressure, gas temperature, MCO skin temperature and, gas composition. The Sampling/Weld Station has the capability to refill the MCO with helium to ensure a positive pressure during storage. The Sampling/Weld Station must be able to perform its safety function during normal and accident conditions. The seismic restraints and lower shield support columns are designed for a SC (0.35 G) seismic spectra and are classified as SS. Any features required to maintain the confinement barrier for the MCO during the sampling and pressure checking are Safety Significant (SS).

The only identified MCO accidents at the Sampling/Weld Station with the potential for Safety Significant consequences are MCO shear, which is protected against by features of the MHM and the Sampling/Weld Station Gantry bumper system, and gross overpressurization of the MCO, protected against by the SS Rupture Disk PSE-1. The Sampling/Weld Station area steel reinforced concrete and adjacent walls and roof structure are contiguous with the operating deck and the operating shelter and are designed to SC seismic criteria to protect the MCOs in the Standard and Overpack Storage Tubes. Sampling/Weld Station features that could be challenged and whose failure could lead to MCO damage are designed to the SC (0.35 G) seismic spectra and are classified as SS.

The features of the Sampling/Weld Station that protect the MCO from damage if dropped, or prevent objects heavy enough to damage an MCO from being dropped onto the MCO, are classified as SS. This classification is in keeping with the guidance of HNF-PRO-704 for Structures Systems and Components (SSCs) the failure of which could result in unacceptable radioactive releases or fatality to a nearby worker.

Safety classification for specific Sampling/Weld Station SSCs are as follows:

- Shielding (portable and fixed), the Sampling/Weld Station Center Shield plate, the tubular container, shear ring and pin, and impact absorber are classified as SS to protect personnel from radiation exposure from the MCO.

- Features which constitute a confinement barrier for the MCO during sampling and pressure checking provide for continuity of primary confinement. Those features are classified as safety significant because no credible consequences of greater than SS level would occur as a result of their absence. Included in this category are HEPA Filter FH-009, the Sample Hood , and the hood exhauster ducting to the HEPA Filter.

- Features which provide MCO sampling capability and helium re-pressurization of the MCO are classified as GS.

- Utilities for the Sampling/Weld Station are classified as GS. This includes electrical supply and helium.

- Features that prevent MCO damage are designated as SS. Damage to an MCO is defined as any surface or internal changes severe enough to prevent MCO process functions, exceed load limits specified in the MCO performance specs, or cause failure of confinement or criticality. Overpressurization of the MCO (pressure > 150 psig) through inadvertent charging with high pressure helium (2000 psig) is prevented by the Rupture Disk PSE-1.

- The lower shield support columns are designed to DBE criteria (0.35 G), equivalent to SC, for continuity of SNF CSB structural design.

MCO Sampling/Weld Station Gantry Cranes

The MCO Sampling/Weld Station Gantry Cranes (two similar cranes) are classified as General Service (GS) because all of the major functions during sampling and welding operations are conducted with the MCO inside the Sampling/Weld Station Pit where the MCO is from impact by dropped or failed items. The only time the MCO is moved out of the Pit is when the MHM is used to transport the MCO. Therefore the MCO is protected from having objects dropped on it during sampling and welding that could result in greater than SS consequences. The Gantry Crane is designed to not collapse and impact the MCO in a seismic event. None of the equipment and functions of the Cranes are SS. For example, relatively lightweight supplemental lighting attached to the Cranes is considered GS because it could drop without damaging the MCO or causing other SS features suspended from the Crane to fail.

An integral bumper system on the Sampling/Weld Station Gantry Cranes protects the Cranes from being struck by the MHM turret. The MHM collision prevention system will make contact with the Crane bumper and stop the MHM before it can damage a Crane.

Each Sampling/Weld Station Gantry Crane (CRN-009 or CRN-010) is a 7-1/2 ton capacity gantry crane with a 5.0 ton main hoist and two 1.0 ton hoists (on an auxiliary rail). The 5.0 ton hoist will be used to lift and move the all shields from the Sampling/Weld Station Pits. The cranes are also used as mobile support for the exhaust hood and ducts with a flexible track connection bridging to the wall. The 1.0 ton hoists will be used to lift and position the pit cover assembly, portable shielding, Weld Hoods and Sample Hood.

The safety requirements for the movement of the MCO are covered by the safety classification section of *MCO Handling Machine System Operation Manual* (the MHM O&M manual, prepared by others). Once the MCO is placed in the Sampling/Weld Station Pit and the Center Shield Plate is replaced, the MCO is protected from damage from falling objects which could result in a release exceeding SS or SC consequences. The Sampling/Weld Station Gantry Cranes are designed not to fail due to the DBE and fall into the Sampling/Weld Station Pits causing damage to the MCO or failure of any of the Safety Significant items provided for sampling and welding activities.

MCO Sample and MCO Weld Hoods

The MCO Sample Hood is classified as Safety Significant in its role to provide confinement. The Weld Hoods are classified General Service (GS) because they are designed to maintain a confinement barrier around the MCO top during sampling and welding operations, and under certain design basis events that could allow hydrogen detonation from a broken sample line, and a release of contaminants with SS consequences, or loss of confinement of tramp radionuclides near the weld zone that may be released due to the heat of welding.

With the MCO process valve open for sampling, there exists a direct path to the internal regions of the MCO via the MCO internal HEPA filter. Process credit can be taken for the MCO internal HEPA, but no safety credit is allowed. This means that the actual release of contamination from the MCO is likely to be very small, and the Sampling Station HEPA, FH-009, is not expected to become contaminated rapidly. It also means that FH-009 provides a barrier to prevent contamination spread from the MCO into and through the Sample Cart during normal operations. The MCO process valve (the valve inside port #2) is designed to re-seat automatically to protect from such an incident when the CVD-type MCO valve operator is removed. Leak checking of the connection of the CVD-type process valve operator with the MCO assures any contamination escaping from the MCO upon sampling will be directed through FH-009 where it will be removed from the gas stream, except a small volume released as the valve operator is disconnected.

The function of the Sample Hood is to provide confinement of any release of the MCO's internal atmosphere thereby preventing a release into the CSB operating area atmosphere when the MCO process valve operator is removed, to confine the exhaust from the Sample Cart, and to provide a seismically secure mounting location for the HEPA filter FH-009. Confinement is accomplished by maintaining a negative pressure within each hood that ensures any air flow will be from the operating area into the hood.

HEPA filter FH-009 is challenge (DOP) testable in-place through use of the special flex hose provided and the associated filter test port included on the Sample Cart. Challenge (DOP) testing is performed by operating the Sampling/Weld Station exhaust system (CSB-AH-006) with DOP admitted to the inlet side of CSB-FH-009 and discharged from there into the Sample Cart. The DOP sample is taken from the test port on the Cart. Challenge (DOP) testing of CSB-FH-009 takes place when the filter is not connected (through the flexible hose and piping) to the MCO. Air exhausts from each hood to the HEPA filter unit CSB-AH-006.

The function of the Weld Hood is to provide confinement of any radionuclide release resulting from MCO welding activities and to remove gases and metal vapors arising from welding away from personnel.

MCO Sample Cart

The Sample Cart is classified General Service (GS) because there are no anticipated accidents in the Sampling/Weld Station involving the Cart that are expected to have SS or greater consequences. This is because no analyzed accidents due to a DBE or air ingress have been identified that would have SS or SC consequences. The Cart is not relied upon to provide or guarantee performance of any SS or SC functions.

The Sample Cart will be used during all MCO sampling operations and is designed to provide a mobile storage location for the components required to: 1) determine MCO internal pressure, 2) sample the MCO internal atmosphere (for lab analysis), and 3) refill the MCO with helium following the sampling operations to ensure a positive pressure (nominally at 11 psig (9.5 to 12.5 psig) during MCO storage. The MCOs are received from either their storage tubes or directly from the CSB receiving area. The MCOs will be transported to the Sampling/Weld Station by the MHM.

The only identified MCO accident with potential Safety Class consequences is an MCO shear and over pressurization to catastrophic MCO failure, which is protected by features of the MHM and the Sampling/Weld Station Gantry bumper system. The Sampling/Weld Station area steel reinforced concrete and adjacent walls and roof structure are contiguous with the operating deck and the operating shelter and have been designed to SC seismic criteria to protect the MCOs at the Sampling/Weld Station.

There are no anticipated accidents in the Sampling/Weld Station involving the Sample Cart that are expected to have SS or greater consequences. The features of the Sample Cart that maintain the inert piping pressure boundary and protect the piping from over pressurization are classified as GS. Those features that protect the MCO from over pressurization to greater than 150 psig from external gas (helium) are classified as (SS Rupture Disk PSE-1). PIT-721 is GS in its role to monitor the external gas pressure to which the MCO is exposed.

19.5.3 *Quality Level*: The MCO Sampling/Weld System is Quality Level I. Safety Class and Safety Significant systems must be designated Quality Level I to provide increased assurance that the system will function as designed. General Service Systems may also be designated Quality Level I. Quality Level I indicates that this system has more stringent quality requirements specified than may be assumed by a vendor or operator.

19.5.4 *Environmental Safety*: The SNF CSB does not have any connections to a chemical sewer or other means of direct disposal of hazardous chemical waste. All hazardous wastes generated during maintenance or other activities within the facility must be safely contained at the point of generation (i.e., fluids drained into buckets, rags and other materials placed in plastic bags), and removed to some other facility having suitable means of hazardous material disposal.

19.6 References

19.6.1 Drawings relating to or referenced in this document are:

DWG #	DRAWING TITLE
H-2-116004, Sht. 3	CSB Drawing Index
H-2-117795	CSB Architectural Floor Plan South
H-2-119336	Structural Hot Conditioning Annex Floor Plan
H-2-119337	Structural Hot Conditioning Annex Sections and Details
H-2-119450, Sht. 1	Structural MCO Sampling/Weld Station Concrete Pad
H-2-119450 Sht. 2	Structural MCO Sampling/Weld Station Argon Gas Station
H-2-120950, Sht. 1	Mechanical MCO Sampling/Weld Station Floor Plan
H-2-120950, Shts. 2-4	Mechanical MCO Sampling/Weld Station Section
H-2-120951	Mechanical MCO Sampling/Weld Station Gantry Crane
H-2-120952, Shts. 1-3	Mechanical MCO Sampling/Weld Station Pits 3 & 6 Modifications
H-2-120953, Shts. 1-2	Mechanical MCO Sampling/Weld Station Sample Hood
H-2-120954, Shts. 1-3	Mechanical MCO Sampling/Weld Station Steps and Covers Installation

DWG #	DRAWING TITLE
H-2-120955	Mechanical MCO Sampling/Weld Station Shielding Components
H-2-120956, Shts 1-3	Mechanical MCO Sampling/Weld Station Handrails Installation and Details
H-2-120957	Mechanical MCO Sampling/Weld Station Gantry Crane Powertrack
H-2-120958	Mechanical MCO Sampling/Weld Station Sample Cart Assembly
H-2-120959, Shts 1-2	Mechanical MCO Sampling/Weld Station Sample Cart Piping Arrangement
H-2-120960, Shts. 1-2	Mechanical MCO Sampling/Weld Station Installation
H-2-120962, Shts. 1-2	Mechanical MCO Sampling/Weld Station Temporary Shielding
H-2-120963	Mechanical MCO Sampling/Weld Station Rotation Drive Assembly
H-2-120964	Mechanical MCO Sampling/Weld Station Pyrometer Installation
H-2-120965, Shts. 1-2	Mechanical MCO Sampling/Weld Station Stationary Shield
H-2-120966	Mechanical MCO Sampling/Weld Station Rotating Shield
H-2-120969, Shts 1-2	Mechanical MCO Sampling/Weld Station Idler Gear Box
H-2-120970	Mechanical MCO Sampling/Weld Station Shield Support
H-2-120971	Mechanical MCO Sampling/Weld Station Leveling Plate
H-2-120972	Mechanical MCO Sampling/Weld Station Cooling Cap
H-2-120973	Mechanical MCO Sampling/Weld Station Weld Hood
H-2-121240	Instrumentation MCO Sampling/Weld Station Loop Diagrams
H-2-122733, Sht. 2	Electrical Canister Storage BLDG One Line Diagram MC-32-210
H-2-122740, Sht. 2	Above Ground Power Plan
H-2-122740, Sht. 5	Above Ground Power Plan

DWG #	DRAWING TITLE
H-2-122742, Sht. 2	Lighting and Receptacle Plan
H-2-122744, Sht. 1	Electrical Canister Storage BLDG Panel Schedules
H-2-122950	Electrical MCO Sampling/Weld Station Pits #2 & #7 Installation
H-2-123390, Sheet 1	P&ID Legend and Symbols INSTR/HVAC/Piping
H-2-123390, Sht. 2	P&ID Instrumentation Notes
H-2-123397	P&ID MCO Sampling System
H-2-123400, Shts. 1-7	Operational Sequence Block Flow Diagram Overview (Rev. H, dated 7/17/98)
H-2-125162, Sht. 2	Piping Floor Plan Inert Line
H-2-125164, Sht. 1	Piping Operating/Support Areas Compressed Air/MCO Vent Sections and Details
H-2-129423	Support Area Equipment Schedules
H-2-129450, Shts. 1-6	HVAC MCO Sampling/Weld Station Floor Plan and Details
H-2-129455	HVAC MCO Sampling/Weld Station Flow Diagrams

19.6.2 Documents relating to or referenced in this document are:

DOC. #	DOCUMENT TITLE
HNF-PRO-704	Hazard and Accident Analysis Process
HNF-3553	Annex A, Canister Storage Building Final Safety Analysis Report, Section A2.5.1.4, MCO Sampling/Weld Operations
W-379-P-CSB-13052	Sample Cart
W-379-C-CSB-13093	MCO Sampling/Weld Station - Shielding and Rotary Drive Fabrication
W-379-C-CSB-13094	MCO Sampling Station Shielding and Rotary Drive Installation

DOC. #	DOCUMENT TITLE
W-379-P-CSB-14321	MCO Sampling/Weld Station Gantry Crane and Hoist
W-379-C-CSB-15061	Piping Material, Fabrication, Erection and Pressure Testing
W-379-C-CSB-15680	Air-Cooled Chiller Unit
W-379-C-CSB-15835	Sampling/Weld Station Exhaust Unit
W-379-C-CSB-15840	Ductwork and Accessories
W-379-P-CSB-15845	MCO Sample Hood
W-379-P-CSB-15846	MCO Weld Hood
W-379-P-CSB-15898	Canister HEPA Filter
W-379-P-CSB-16110	Electrical Materials and Devices
W-379-P-CSB-16111	Conduit/Cable Schedule (Attachments A & B)
W-379-C-CSB-17601	Temperature Transmitters - Electronic
W-379-C-CSB-17602	Temperature Transmitters - Pyrometers
W-379-C-CSB-17614B	Thermocouples & Thermowells
W-379-C-CSB-17617	Pressure Instruments
W-379-C-CSB-17621	Self Actuated Pressure Regulator
W-379-P-CSB-17626	Pressure Gauges
W-379-C-CSB-17642	Restriction Orifice
W-379-C-CSB-17656	Control Valves
W-379-C-CSB-17663B	Pressure Safety (Relief) Valves

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