ENGINEERING CHANGE NOTICE

1. ECN **637682**

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Proj.
ECN

2. ECN Category (mark one) Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. R. J. Thomas, 15510, T4-20, 373-5046 6. Project Title/No./Work Order No. 26" Vacuum, Liquid Detection 9. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-CP-SDD-013 REV 1	4. USQ Required? ☒ Yes ☐ No 7. Bldg./Sys./Fac. No. 234-5Z, 23B 10. Related ECN No(s). NONE	5. Date December 2, 1996 8. Approval Designator SQ 11. Related PO No. NONE
12a. Modification Work ☐ Yes (fill out Blk. 12b) ☒ No (NA Blks. 12b, 12c, 12d)	12b. Work Package No. NA	12c. Modification Work Complete NA Design Authority/Cog. Engineer Signature & Date	12d. Restored to Original Condition (Temp. or Standby ECN only) NA Design Authority/Cog. Engineer Signature & Date
13a. Description of Change Direct Revision to WHC-SD-CP-SDD-013 "Definition and Means of Maintaining the Process Vacuum Liquid Detection Interlock Systems Portion of the PFP Safety Envelope," as a result of changes to WHC-SD-CP-TI-108 "Plutonium Finishing Plant Safety Systems and Equipment List." The new revision deletes "Safety Class 1 & 2" designations and adds "Safety Class" and "Safety Significant" designations. 13b. Design Baseline Document? ☐ Yes ☒ No			
14a. Justification (mark one) Criteria Change ☒ Design Improvement ☐ Environmental ☐ Facility Deactivation ☐ As-found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐			
14b. Justification Details The supporting document must be revised to reflect new Safety Class designations.			
15. Distribution (include name, MSIN, and no. of copies) See Distribution Sheet		RELEASE STAMP JAN 01 1997 DATE: 2 STA: 2 HANFORD RELEASE ID: 18	

ENGINEERING CHANGE NOTICE

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1. ECN (use no. from pg. 1)

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16. Design Verification Required ☐ Yes ☒ No	17. Cost Impact <table border="1"> <tr> <th colspan="2">ENGINEERING</th><th colspan="2">CONSTRUCTION</th></tr> <tr> <td>Additional</td><td>☐ \$</td><td>Additional</td><td>☐ \$</td></tr> <tr> <td>Savings</td><td>none \$</td><td>Savings</td><td>☒ \$</td></tr> </table>	ENGINEERING		CONSTRUCTION		Additional	☐ \$	Additional	☐ \$	Savings	none \$	Savings	☒ \$	18. Schedule Impact (days) Improvement ☐ Delay none																																																																																				
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19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20. <table border="1"> <tr> <td>SDD/DD</td><td>☐</td> <td>Seismic/Stress Analysis</td><td>☐</td> <td>Tank Calibration Manual</td><td>☐</td> </tr> <tr> <td>Functional Design Criteria</td><td>☐</td> <td>Stress/Design Report</td><td>☐</td> <td>Health Physics Procedure</td><td>☐</td> </tr> <tr> <td>Operating Specification</td><td>☐</td> <td>Interface Control Drawing</td><td>☐</td> <td>Spares Multiple Unit Listing</td><td>☐</td> </tr> <tr> <td>Criticality Specification</td><td>☐</td> <td>Calibration Procedure</td><td>☐</td> <td>Test Procedures/Specification</td><td>☐</td> </tr> <tr> <td>Conceptual Design Report</td><td>☐</td> <td>Installation Procedure</td><td>☐</td> <td>Component Index</td><td>☐</td> </tr> <tr> <td>Equipment Spec.</td><td>☐</td> <td>Maintenance Procedure</td><td>☐</td> <td>ASME Coded Item</td><td>☐</td> </tr> <tr> <td>Const. Spec.</td><td>☐</td> <td>Engineering Procedure</td><td>☐</td> <td>Human Factor Consideration</td><td>☐</td> </tr> <tr> <td>Procurement Spec.</td><td>☐</td> <td>Operating Instruction</td><td>☐</td> <td>Computer Software</td><td>☐</td> </tr> <tr> <td>Vendor Information</td><td>☐</td> <td>Operating Procedure</td><td>☐</td> <td>Electric Circuit Schedule</td><td>☐</td> </tr> <tr> <td>OM Manual</td><td>☐</td> <td>Operational Safety Requirement</td><td>☐</td> <td>ICRS Procedure</td><td>☐</td> </tr> <tr> <td>FSAR/SAR</td><td>☐</td> <td>IEFD Drawing</td><td>☐</td> <td>Process Control Manual/Plan</td><td>☐</td> </tr> <tr> <td>Safety Equipment List</td><td>☐</td> <td>Cell Arrangement Drawing</td><td>☐</td> <td>Process Flow Chart</td><td>☐</td> </tr> <tr> <td>Radiation Work Permit</td><td>☐</td> <td>Essential Material Specification</td><td>☐</td> <td>Purchase Requisition</td><td>☐</td> </tr> <tr> <td>Environmental Impact Statement</td><td>☐</td> <td>Fac. Proc. Samp. Schedule</td><td>☐</td> <td>Tickler File</td><td>☐</td> </tr> <tr> <td>Environmental Report</td><td>☐</td> <td>Inspection Plan</td><td>☐</td> <td>none</td><td>☒</td> </tr> <tr> <td>Environmental Permit</td><td>☐</td> <td>Inventory Adjustment Request</td><td>☐</td> <td></td><td>☐</td> </tr> </table>			SDD/DD	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐	Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐	Operating Specification	☐	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐	Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐	Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐	Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐	Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐	Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐	Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐	OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐	FSAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐	Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐	Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐	Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐	Tickler File	☐	Environmental Report	☐	Inspection Plan	☐	none	☒	Environmental Permit	☐	Inventory Adjustment Request	☐		☐
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20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below. <table border="1"> <tr> <th>Document Number/Revision</th><th>Document Number/Revision</th><th>Document Number/Revision</th></tr> <tr> <td>none</td><td></td><td></td></tr> </table>						Document Number/Revision	Document Number/Revision	Document Number/Revision	none																																																																																									
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**UNREVIEWED SAFETY QUESTION (USQ)
SCREENING AND EVALUATION**1. Identification Number: WHC-SD-CP-
SDD-013**USQ SCREENING**

Page 1 of 2

2. Title: Definition and Means of Maintaining the Process Vacuum Liquid Detection Interlock System Portion of the PFP Safety Envelope

INSTRUCTIONS: Respond to each question and provide justification for each response. A restatement of the question does not constitute a satisfactory justification or basis. An adequate justification provides sufficient explanation such that an independent reviewer could reach the same conclusion based on the information provided [DOE 5480.21, 10.e.1].

QUESTIONS

1. Does the proposed change or occurrence represent a change to the facility or procedures as described in the Authorization Basis?

☐ N/A ☒ No ☐ Yes/Maybe

BASIS: The changes proposed in this revision reflect the change from Safety Class 1,2 and 3 designations to Safety Class and Safety Significant designations. The intent of chapter 5 of WHC-SD-CP-SAR-021 is not altered, added to or reduced by this change. ZO-060-602 is the operating procedure which defines the method for testing the integrity of the leak detection system and the frequency for performing it. This change will not impact either this procedure or the Criticality Safety Manual requirements.

2. Does the proposed change or occurrence represent conditions that have not been analyzed in the Authorization Basis?

☐ N/A ☒ No ☐ Yes/Maybe

BASIS: All aspects of the Process Liquid Detection System were addressed on the original SDD. These changes are primarily administrative.

3. Does the proposed change represent a test or experiment NOT described in the Authorization Basis that may affect the safe operation of the facility?

☐ N/A ☒ No ☐ Yes/Maybe

BASIS: There are no tests or experiments associated with this proposed change.

4. Does the proposed change or occurrence represent a change to the Technical Safety Requirements or a reduction in the margin of safety defined in the Technical Safety Requirements?

☐ N/A ☒ No ☐ Yes/Maybe

BASIS: The margin of safety is not altered by this change. The clarity of the SDD is enhanced by this change, not the intent of the SDD.

**UNREVIEWED SAFETY QUESTION (USQ)
SCREENING AND EVALUATION**

1. Identification Number: WHC-SD-CP-
SDD-013

USQ SCREENING

Page 2 of 2

2. Title: Definition and Means of Maintaining the Process Vacuum Liquid Detection Interlock System Portion of the PFP Safety Envelope

USQE #1 R.J. Thomas

USQE #2

11.11 NGUYENTHUU

(Print Name)

(Print Name)

R.J. Thomas

Signature

Date: 11/24/96

H. Nguyen

Signature

Date: 11/26/96

If there is a YES/MAYBE response to questions 1, 2, 3, or 4, then a USQ Evaluation must be completed.

The following guidance should be considered when completing this screening. This guidance should not be considered all-inclusive; additional factors may need to be considered depending on the nature of the proposed change.

Does the proposed change:

- 1) Modify, add, or delete a safety class function of a structure, system or component stated in the authorization basis?
- 2) Alter the design of a structure, system or component as described in the authorization basis?
- 3) Modify, add, or delete the description of operation, operating environment, or analyses of any system or component described in the authorization basis?
- 4) Modify, add, delete or conflict with any of the design bases stated in the authorization basis?
- 5) Conflict with the principle or general design criteria stated in the authorization basis?
- 6) Modify, add, or delete any plant design features described in the authorization basis?
- 7) Modify, add, or delete a flow diagram or facility drawing provided in the authorization basis?
- 8) Create the potential for new system or component interactions (e.g., seismic, electrical breaker coordination)?

Definition and Means of Maintaining the Process Vacuum Liquid Detection Interlock Systems Portion of the PFP Safety Envelope

R. J. Thomas
B&W Hanford Co., Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

EDT/ECN: 637682 UC: UC-721
Org Code: 15510 Charge Code: K6002
B&R Code: EW7003000 Total Pages: 35

Key Words: PFP, Process Vacuum System, Liquid Detection, Criticality Prevention, Safety Envelope Definition, Authorization Basis

Abstract: The Process Vacuum Liquid Detection interlock systems prevent intrusion of process liquids into the HEPA filters downstream of demisters #6 and #7 during Process Vacuum System operation. This prevents liquid intrusion into the filters which could cause a criticality. The Safety Envelope (SE) includes the equipment which detects the presence of liquids in the vacuum headers; isolates the filters; shuts down the vacuum pumps; and alarms the condition. The presence of liquid in the HC-4, HC-7, and HC-227S glovebox vacuum traps or a high level of liquid in the 236-Z Tank 50 will isolate these portions of the vacuum system from the main headers. This report identifies the equipment in the SE; operating, maintenance, and surveillance procedures needed to maintain the SE equipment; and rationale for exclusion of some equipment and testing from the SE.

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[Signature] 1/2/97
Release Approval Date

Approved for Public Release

(1) Document Number

Page 1

(2) Title

Definition and Means of Maintaining the Process Vacuum Liquid Detection Interlock Systems Portion of the PFP Safety Envelope

CHANGE CONTROL RECORD

(3) Revision

(4) Description of Change - Replace, Add, and Delete Pages

Authorized for Release

(5) Cog. Engr.

(6) Cog. Mgr. Date

(1)

(7) This is a total rewrite; therefore, revision bars have not been used to indicate changes. EDT 166686

WHC-SD-CP-SDD-013, Rev. 0. EDT 141531,
2/9/93

RS

R99

RS (2)

General update of SDD to reflect
Safety Equipment List revisions.

R=F: ECN 637682

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DEFINITION AND MEANS OF MAINTAINING THE PROCESS
VACUUM LIQUID DETECTION INTERLOCK SYSTEMS PORTION
OF THE PFP SAFETY ENVELOPE

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1.0 PURPOSE

The purpose of this document is to record the technical evaluation of the Operational Safety Requirements described in the Plutonium Finishing Plant (PFP) Operational Safety Requirements, WHC-SD-CP-OSR-010, Rev. 0, May 1994, Section 3.1.1, "Criticality Prevention System." This document also defines the Safety Envelope (SE) for the liquid detection interlock system in the Process Vacuum System. The SE is derived from information in the Plutonium Finishing Plant Final Safety Analysis Report (PFP FSAR), WHC-SD-CP-SAR-021, Rev 0, September 1995, and the Criticality Safety Analysis Report (CSAR) for the 26-inch Hg Vacuum System, WHC-SD-SQA-CSA-20159, Rev 0-A. This document, with its appendices, provides the following:

1. The system functional requirements for determining system operability (Section 3).
2. Evaluations of equipment to determine the safety envelope boundary for the system (Section 4 list of SE boundary drawings).
3. A list of the safety envelope equipment (Appendix B).
4. Functional requirements for the individual safety envelope equipment, including appropriate set points and process parameters (Section 4).
5. A list of the operational and surveillance procedures necessary to operate and maintain the system equipment within the safety envelope (Sections 5 and 6 and Appendix A).

2.0 BACKGROUND

The 26-inch process vacuum system provides high capacity vacuum service to the PFP for vacuum transfer of liquids and other high vacuum requirements. The system has two vacuum pumps, operated one at a time. High Efficiency Particulate Air (HEPA) filters are located upstream of the pumps. Because this system is used to transfer liquids, there is a potential for liquid intrusion into the HEPA filters. If this were to occur, a criticality event could occur in the filters due to the unfavorable geometry of the filters, and the presence of fissile material and moderator. The remainder of the system upstream of the HEPA filters has been designed with favorable geometry to preclude criticality events.

WHC-CM-4-29, "Nuclear Criticality Safety Manual," requires that two contingencies be provided to prevent the occurrence of an accidental criticality. In the 26-inch process vacuum system, these two contingencies take the form of an engineered barrier and administrative controls governing the use of the vacuum system for transfers.

The engineered barrier preventing liquid intrusion into the 26-inch vacuum HEPA filters is the liquid detection interlock system in each of the two headers upstream of the demisters. The 26-inch vacuum header liquid detection interlock system is designed to detect the intrusion of liquid in the vacuum headers upstream of demisters #6 and #7, which are upstream of the HEPA filters. Upon detection of liquid, the system isolates flow to the filters by closing redundant valves (two in series) located between the demisters and HEPA filters and shutting down the vacuum pumps. Because it has a criticality prevention function, i.e., provides one of the two contingencies required to prevent the possibility of criticality in the HEPA filters, the 26-inch vacuum header liquid detection interlock system is included in the safety envelope. The process vacuum system itself is non-safety class, and is not included in the safety envelope.

Administrative and procedural controls provides the other contingency preventing accidental criticality in the 26-inch vacuum system HEPA filters. Operating procedures require operators to monitor vacuum transfers for liquid intrusion into branch vacuum lines and isolate the system upon detection of liquid in these lines. Detection of liquid intrusion into the vacuum system is monitored by visual inspection of vacuum traps, monitoring weight factor changes in sending and receiving locations, and monitoring liquid level limits in sending and receiving locations. Operating procedures governing vacuum transfers are summarized in Section 5.1 of this document.

Although the engineered barrier and administrative control are sufficient to address the double contingency principle, an additional engineered barrier is provided by the liquid detection interlock systems in the branch vacuum lines with the potential to introduce large quantities of liquids into the 26-inch vacuum header. Operating procedures require these systems to be functionally tested and operable prior to operating their respective branch vacuum lines. Because these systems assist the operator in maintaining control over the vacuum system, they are also included in the safety envelope. The following branch vacuum line liquid detection interlock systems are included in the safety envelope:

- Glovebox HC-4 Vacuum Trap Liquid Detection Interlock System.
- Glovebox HC-7 Vacuum Trap Liquid Detection Interlock System.
- Glovebox HC-227S Vacuum Trap Liquid Detection Interlock System.
- Tank 50 High Liquid Level Detection Interlock System.

3.0 SYSTEM FUNCTIONAL REQUIREMENTS

The function of the process vacuum liquid detection interlock systems is to prevent criticality events by precluding the intrusion of PFP process liquids into the HEPA filters during operation of the vacuum system. This is accomplished in the vacuum headers by detection of liquids upstream of demisters #6 and #7, isolation of the filters from the upstream vacuum lines, and shutting down the operating process vacuum pump.

The liquid detection interlock systems in the branch lines (HC-4, HC-7, HC-227S, and Tank 50) prevent the accumulation of liquids in the main 26-inch vacuum header by isolating the branch vacuum lines from the main vacuum header upon detection of above normal liquid levels in Tank 50 or the presence of liquids in the glovebox vacuum traps.

3.1 SAFETY ENVELOPE (SE) REQUIREMENTS AND SYSTEM OPERATION, DEMISTERS 6 & 7

CPS-Z-165-80141 requires that "Safety features, alarms, and interlocks designed to prevent liquid uptake or mitigate the effects of liquid addition shall be operable whenever the 26-inch vacuum system is in use." The vacuum header liquid detection interlock system is one of the primary features for preventing liquid uptake and must be operable. Operating procedure ZO-060-602 verifies the operability of the 26-inch vacuum system liquid detection interlock system prior to use and daily while the 26" vacuum system is operating. Procedure ZSE-23B-001 performs a semi-annually functional test of the vacuum header liquid detection interlock system.

Operability of the vacuum header liquid detection interlock system depends on the operability of two liquid detection circuits; one for each vacuum header. The two circuits are not redundant. Each one monitors a different vacuum header. Therefore, both detector circuits must be operable for the liquid detection interlock system to be operable.

The vacuum header isolation/shutdown system is not redundant, except for the two isolation valves in the vacuum header between the demisters and HEPA filters. However, with the exception of the leak detection circuits, a deenergized state results in performance of the isolation and shutdown functions. This, in conjunction with the administrative controls providing the second contingency for criticality prevention, satisfies the safety class redundancy requirements for this system.

The process vacuum liquid detection supervisory panel is located in the room 321 control room in the 234-5Z Building.

3.2 HC-4, HC-7, AND HC-227S LIQUID DETECTION INTERLOCK SYSTEMS

Criticality prevention specifications CPS-Z-165-80604, -80607, and 80602 address the vacuum trap liquid detection interlock systems for Gloveboxes HC-4, HC-7, and HC-227S, respectively and refer to CPS-Z-165-80141 for the operability requirement.

The vacuum trap liquid detection interlock system operability is verified by a weekly functional test per maintenance procedure 2222124 for the HC-227S vacuum trap. The HC-7 and HC-4 vacuum systems are currently inactive. Functional tests will be performed upon reactivation of the gloveboxes. Also, operating procedures for the vacuum systems in HC-4, HC-7, and HC-227S require the vacuum trap liquid detection interlock system to be functionally tested prior to using the vacuum system.

3.3 TANK 50 HIGH LIQUID LEVEL DETECTION INTERLOCK SYSTEM

Vacuum transfers in 236-Z, except some in Miscellaneous Treatment, Room 41, are made into Tank 49, Vacuum Tank, by applying the 26-inch vacuum to it through Tank 50, Vacuum Overflow Tank. Tank 50 is basically a large vacuum trap. It is normally operated at a liquid level of 10 to 35 percent when connected to the 26-inch vacuum system. The alarm and isolation functions are performed by the weight factor transmitter, 50-WFT-A, the weight factor alarm switch, 50-WFAS, the Tank 50 interlock relay, 50-KA, and the three way valve, 50-EMV-D. Tank 50 instrumentation is tested by the following calibration procedures:

<u>Component</u>	<u>CBRS #</u>	<u>Calibration Procedure</u>
50-WFT-A	A0061-1	PSCP-6-019
50-WFI-A	A0061-2	PSCP-4-164
50-WFAS-A	A0061-3	PSCP-6-102

4.0 SAFETY ENVELOPE EQUIPMENT

The liquid detection interlock system components necessary to prevent liquid intrusion into the 26-inch Vacuum System and 26-inch Vacuum HEPA filters fall into the following five functional groups:

- 1) 26-inch Vacuum Liquid Detection Interlock System
- 2) HC-4, Vacuum Trap Liquid Detection Interlock System
- 3) HC-7, Vacuum Trap Liquid Detection Interlock System
- 4) HC-227S, Vacuum Trap Liquid Detection Interlock System
- 5) Tank 50 High Liquid Level Detection Interlock System

4.1 VACUUM LIQUID DETECTION INTERLOCK SYSTEMS (SAFETY CLASS) EQUIPMENT

4.1.1 26-inch Vacuum Header Liquid Detection Interlock System

The following equipment is required to detect and alarm the presence of liquid in the vacuum header upstream of demisters #6 or #7, isolate the vacuum lines upstream of the HEPA filter, and shut down the operating vacuum pump.

Note: the system for the vacuum header upstream of demister #7 contains the same components as the system upstream of demister #6.

- a) Conductivity Probe CE-1LD-23B, demister #6 header, [CE-2LD-23B, demister # 7 header] detects presence of liquid and conducts a signal from probe to induction relay.
- b) Induction Relay CR-1LD1-23B [CR-2LD1-23B] opens and closes the necessary contacts to activate the vacuum line, vacuum pump, and annunciator relays.
- c) Relay CR-1K1-23B [CR-2K1-23B] activates the solenoid valve and annunciator circuit.
- d) Solenoid Valve EV-PVLDL-1 [EV-PVLDL-2] vents air from the butterfly isolation valves. Note: each solenoid valve vents air from both butterfly valves.
- e) Butterfly Valves CV-PVLDL-1 and CV-PVLDL-2 isolate vacuum line upstream of HEPA filters. Valves are in series and either butterfly valve will isolate the HEPA filters.
- f) Relay CR-1K3-23B [CR-2K3-23B] removes power from the vacuum pumps' motor controllers.
- g) Motor Controllers MC-VPP1-23B and MC-VPP2-23B open and close power circuits for vacuum pumps PVVP-1 and PVVP-2 motors respectively.
- h) Annunciator CA-1LDA-23B [CA-2LDC-23B] alarms liquid intrusion into vacuum lines upstream of demister #6 [#7].

4.1.2 26-inch Vacuum Liquid Detection Interlock System Testing and Trouble Alarms

The following equipment is required to test the 26-inch vacuum leak detection interlock system and alarm if the liquid detection circuit is inoperable.

- a) Relay CR-1LD2-23B [CR-2LD2-23B] energizes circuit trouble indicator light for test or indication of open circuit.
- b) Relay CR-1K2-23B [CR-2K2-23] activates annunciator for liquid detection circuit trouble.
- c) Switch HS-1LD-23B [HS-2LD-23B] tests liquid detection circuit trouble indicator light and annunciator.
- d) Rectifier BR-1LD-23B [BR-2LD-23B] changes 220 VAC to 220 VDC for liquid detection interlock system trouble indicator circuit.
- e) Resistor R-1LD-23B [R-2LD-23B] reduces voltage in liquid detection trouble circuit from 220 VDC to 110 VDC across relay coil.
- f) Annunciator CA-1LDB-23B [CA-2LDD-23B] alarms on liquid detection circuit trouble (open circuit).

4.2 HC-4 VACUUM TRAP LIQUID DETECTION INTERLOCK SYSTEM (SAFETY SIGNIFICANT) (INACTIVE, STANDBY STATUS)

The following equipment detects the presence of liquid in the HC-4 vacuum trap and isolates the HC-4 vacuum line from the 26-inch vacuum system.

- a) Conductivity Probe CE-4C-2 detects the presence of liquid in the vacuum trap and conducts a signal from probe to controller to activate liquid detection circuit.
- b) Conductivity Controller CC-4C-2 contains the relays and contacts necessary to operate the solenoid valve to isolate the vacuum trap from the 26-inch vacuum header.
- c) Solenoid Valve 4C-EV-2 isolates the HC-4 vacuum trap from the 26-inch vacuum header.

- d) HC-4 Conductivity Controller Test Switch and reset button are used to functionally test the vacuum trap liquid detection interlock system components, except for the liquid detection probes prior to use of the HC-4 vacuum branch.
- e) HC-4 vacuum line liquid detection circuitry does not include a unique annunciator.

4.3 HC-7 VACUUM TRAP LIQUID DETECTION INTERLOCK SYSTEM (SAFETY SIGNIFICANT) (INACTIVE, STANDBY STATUS)

The following equipment detects and alarms the presence of liquid in the HC-7 vacuum trap and isolates the HC-7 vacuum line from the 26-inch vacuum system.

- a) Conductivity Probe CE-7C-1 detects the presence of liquid in the vacuum trap and conducts a signal from probe to controller to activate liquid detection circuit.
- b) Conductivity Controller CC-7C-1 contains the relays and contacts necessary to operate the solenoid valve and the liquid detection annunciator.
- c) Solenoid valve EV-7C-27 operates the air cylinder for MOV valve to isolate the vacuum trap from the 26-inch vacuum header.
- d) MOV Valve MOV-7C-43 isolates the HC-7 vacuum line from the 26-inch vacuum system
- e) Annunciator HLAL-7C-1 alarms alerting the operator to the presence of liquid in the HC-7 vacuum trap.
- f) HC-7 Conductivity Controller Test Switch and reset button are used to functionally test the vacuum trap liquid detection interlock system components, except for the liquid detection probes prior to use of the HC-7 vacuum branch.

4.4 HC-227S VACUUM TRAP LIQUID DETECTION INTERLOCK SYSTEM (SAFETY SIGNIFICANT)

The following equipment detects and alarms the presence of liquid in the HC-227S vacuum trap and isolates the HC-227S vacuum trap from the 26-inch vacuum header.

- a) Conductivity Probe CE-R detects the presence of liquid in the vacuum trap and conducts a signal from probe to controller to activate liquid detection circuit.

- b) Conductivity Controller CC-R contains the relays and contacts necessary to operate the solenoid valve to isolate the vacuum trap from the 26-inch vacuum system and the liquid detection annunciator to alert the operator to the presence of liquid in the HC-227S vacuum header.
- c) Solenoid valve EV-R isolates the HC-227S vacuum trap from the 26-inch vacuum header.
- d) Annunciator CA-R alarms alerting the operator to the presence of liquid in the HC-227S vacuum trap.
- e) HC-227S Conductivity Controller Test Switch and reset button are used to functionally test the vacuum trap liquid detection interlock system components, except for the liquid detection probes prior to use of the HC-227S vacuum branch.

4.5 TANK 50 HIGH LIQUID LEVEL DETECTION INTERLOCK SYSTEM (SAFETY SIGNIFICANT)

The following components detect and alarm if the Tank 50 WF exceeds 63 percent, isolate the tank from the 26-inch vacuum header and vent the tank to the process vent system.

- a) Weight factor transmitter 50-WFT-A converts the pneumatic differential pressure signal to an electronic signal sent to the weight factor indicator and weight factor alarm switch.
- b) Weight factor alarm switch 50-WFAS-A actuates the Panel Board B-6 Annunciator 38, Tank 50 High WF and Tank 50 interlock relay.
- c) Interlock relay 50-KA actuates the three-way valve to change position.
- d) Three-way valve 50-EMV-D on actuation (loss of power from 50-KA) changes position from vacuum position to vent position if the 26-inch vacuum system is being used.
- e) High weight factor annunciator (50-IL-A) illuminates and annunciates on activation from the weight factor alarm switch.

4.6 NON-SE COMPONENTS

4.6.1 26-inch Vacuum Liquid Detection Interlock System

Indicator lights L-1LD-23B and L-2LD-23B are not included in the safety envelope; they are used for testing of the system but are not monitored or required to function in order for the liquid detection interlock system to be operable.

Failure (open short) of all electrical wiring and passive hardware, except for the wiring connecting the conductivity probes to the induction relay, would result in the isolation and shutdown of the vacuum system. Therefore, this wiring and associated hardware (terminal boards, connectors) are not included in the safety envelope.

4.6.2 Tank 50 High Liquid Level Detection Interlock System

The Tank 50 weight factor liquid level indicator (50-WFI-A) is not included in the safety envelope because it is not required for the system to respond properly to the presence of high liquid level in Tank 50.

5.0 SAFETY ENVELOPE PROCEDURES

CPS-Z-165-80141, Criticality Prevention Specification 26-inch Hg Vacuum System, requires that "safety features, alarms, and interlocks designed to prevent liquid uptake or mitigate the effects of liquid addition shall be operable whenever the 26-inch vacuum system is in use." The procedures which address the prevention of liquid uptake into the vacuum system and the operability of the liquid detection interlock systems are contained in the following sections.

5.1 SE OPERATING PROCEDURES

5.1.1 26-inch Vacuum Liquid Detection Interlock System Procedures

ZO-060-602, Operate 26 in. Process Vacuum, provides instructions for start up and operation of the Process Vacuum System. It is included in the SE because it determines the operability of the liquid detection interlock system before start up and during operation of the Process Vacuum system. The portions of ZO-060-602 which are included in the SE and pertain to operability are as follows:

Section 6.2. Preliminary Test and Sample Requirements - requires that both leak detection alarm/test circuits be successfully tested before startup of either vacuum pump.

Section 6.10. Process Vacuum System Surveillance - requires that both leak detection alarm/test circuits be successfully tested once per shift during operation of the Process Vacuum System. If the test is not successful, the procedure requires that the Process Vacuum System be shut down.

5.1.2 HC-4 Vacuum Trap Liquid Detection Interlock System Procedures

Operating procedures associated with HC-4 are currently inactive, or canceled and no operations are allowed in this Glovebox. The following inactive procedures will be walked down and verified to include the requirements to monitor vacuum transfers for liquid intrusion and to functionally test the liquid detection interlock system prior to using the HC-4 vacuum branch.

- ZO-190-001, Dispose of Miscellaneous Process Solutions
- ZO-190-016, Evacuate Transfer Lines from HC-4
- ZO-190-019, Transfer Solution from Glovebox HC-227S to Glovebox HC-4

5.1.3 HC-7 Vacuum Trap Liquid Detection Interlock System Procedures

Operating procedures associated with HC-7 are currently inactive, or canceled and no operations are allowed in this Glovebox. The following inactive procedures will be walked down and verified to include the requirements to monitor vacuum transfers for liquid intrusion and to include the requirement to functionally test the liquid detection interlock system prior to using the HC-7 vacuum branch.

- ZO-190-001, Dispose of Miscellaneous Process Solutions
- ZO-190-016, Evacuate Transfer Lines from HC-4
- ZO-190-026, Perform HC-7 Vacuum Trap Test
- ZO-190-304, Start Up Glovebox HC-7 and HC-9B
- ZO-190-309, Operate Filtrate Handling Systems
- ZO-190-312, Perform Steady State Operation of RMC
- ZO-190-327, Shutdown Hood HC-7 and HC-9B Operations
- ZO-190-331, Flush Nitrate Systems

5.1.4 HC-227S Vacuum Trap Liquid Detection Interlock System Procedures

The following operating procedures for the HC-227S vacuum system require operators to periodically monitor the HC-227S vacuum trap and shutdown transfer operations if liquid is observed. These operations also require functional testing of the HC-227S vacuum trap liquid detection interlock system prior to operating the vacuum branch to ensure operability.

ZO-188-011, Load Out Plutonium Nitrate from Hood
HC-227-T
ZO-188-012, Flush Glovebox HC-227-S
ZO-188-014, Blend and Sample in Glovebox HC-227S
ZO-188-015, Load-In solution from PR Cans
ZO-188-900, Perform Emergency Shutdown Room 227

5.1.5 Tank 50 High Liquid Level Detection Interlock System Procedures

Procedure ZO-180-101 (inactive), Operate PRF 26-inch vacuum System, provides instructions to startup, operate, and shutdown the PRF 26-inch vacuum system. The procedure specifies liquid level limits and corrective actions in both TK-49, Vacuum Tank, and TK-50, Vacuum Overflow Tank, to prevent overflow of TK-49 to TK-50 and from TK-50 to the 26-inch vacuum system piping.

5.2 SE ALARM RESPONSE PROCEDURES

5.2.1 26-inch Vacuum Liquid Detection Interlock System Alarm Response

ZO-060-814, "Alarm Responses for Panel L Alarms," is included in the SE because it identifies the actions which need to be taken if alarms associated with the liquid detection interlock system are actuated. Attachments 2, 3, 4 and 5, Respond to Panel L Alarms, identifies the actions to be taken for the annunciators (alarms) as follows:

Annunciator 1, 26-inch Vac. #1 Moisture Detection; requires the operator to verify shut down or immediately shut down the Process Vacuum System. This response assures system shut down if liquid is detected in the vacuum lines upstream of demister #6.

Annunciator 2, Liquid Detector No. 1 Trouble; requires the operator to shut down or verify shut down of the Process Vacuum System. This response assures that the Process Vacuum System is not operating if the operability of the liquid detector in the vacuum line up stream of demister #6 is not verified.

Annunciator 3, 26-inch Vac. #2 Moisture Detection; requires the operator to verify shut down or immediately shut down the Process Vacuum System. This response assures shut down if liquid is detected in the vacuum lines upstream of demister #7.

Annunciator 4, Liquid Detector No. 2 Trouble; requires the operator to shut down or verify shut down of the Process Vacuum System. This response assures that the Process Vacuum System is not operating if the operability of the liquid detector in the vacuum line up stream of demister #7 is not verified.

5.2.2 HC-4 Vacuum Trap Liquid Detection Interlock System Alarm Response

Operating procedures associated with HC-4 are currently inactive and no operations are allowed in this Glovebox. The following procedures will be walked down and corrected as necessary to include the response to liquid in the vacuum trap prior to using the HC-4 vacuum branch.

- ZO-190-001, Dispose of Miscellaneous Process Solutions
- ZO-190-016, Evacuate Transfer Lines from HC-4
- ZO-190-019, Transfer Solution from Glovebox HC-227S to Glovebox HC-4

5.2.3 HC-7 Vacuum Trap Liquid Detection Interlock System Alarm Response

Operating procedures associated with HC-7 are currently inactive and no operations are allowed in this Glovebox. The following procedures will be walked down and corrected as necessary to include the liquid detection alarm responses prior to using the HC-7 vacuum branch.

ZO-190-001, Dispose of Miscellaneous Process Solutions
ZO-190-016, Evacuate Transfer Lines from HC-4
ZO-190-026, Perform HC-7 Vacuum Trap Test
ZO-190-304, Start Up Glovebox HC-7 and HC-9B
ZO-190-309, Operate Filtrate Handling Systems
ZO-190-312, Perform Steady State Operation of RMC
ZO-190-327, Shutdown Hood HC-7 and HC-9B Operations
ZO-190-331, Flush Nitrate Systems

5.2.4 HC-227S Vacuum Trap Liquid Detection Interlock System Alarm Response

The following operating procedures for using the HC-227S vacuum system contain the response actions to a liquid detection interlock system alarm.

ZO-188-011, Load Out Plutonium Nitrate from Hood
HC-227-T
ZO-188-012, Flush Glovebox HC-227-S
ZO-188-014, Blend and Sample in Glovebox HC-227S
ZO-188-015, Load-In solution from PR Cans
ZO-188-900, Perform Emergency Shutdown Room 227

5.2.5 Tank 50 High Liquid Level Alarm Response

Procedure ZO-180-800, Alarm Responses for PRF Alarm Panels, Attachment 9, specifies required actions upon receiving the Tank 50 High weight factor alarm. The tank 50 high weight factor annunciator is red indicating an OSR/Safety Related alarm. Procedure ZO-100-400, Perform Nuclear Operations Surveillance, requires periodic testing of panel board annunciators.

5.3 SE MAINTENANCE PROCEDURES

5.3.1 26-inch Vacuum Liquid Detection Interlock System Maintenance Procedures

Maintenance procedure ZSE-23B-001 satisfies the LCO Surveillance Requirement (SR 3.1.1.1.2) to perform semi-annual functional testing of the liquid detection interlock system. This procedure ensures that the entire liquid detection system downstream of the detector probes operates as designed.

**5.3.2 HC-4 Vacuum Trap Liquid Detection Interlock System
Maintenance Procedures**

Maintenance Procedure No. 2Z22124, Functional Testing of HC-4, HC-7 and 227S Vacuum Trap Isolation and Alarms, addresses the maintenance requirements for the HC-4 vacuum trap.

**5.3.3 HC-7 Vacuum Trap Liquid Detection Interlock System
Maintenance Procedures**

Maintenance Procedure No. 2Z22124 addresses the maintenance requirements for the HC-7 vacuum trap.

**5.3.4 HC-227S Vacuum Trap Liquid Detection Interlock System
Maintenance Procedures**

Maintenance Procedure No. 2Z22124 addresses the maintenance requirements for the HC-227S vacuum trap.

**5.3.5 Tank 50 High Liquid Level Detection Interlock System
Maintenance Procedures**

ZCP-6-020, Foxboro Pressure Transmitter Calibration, Tank 50 Automatic Isolation, calibration and functional testing address the maintenance requirements for Tank 50 Weight Factor System. 2Z-96-02066/I, (PM/S) TK 49/50 instrument calibration. PM&S #2Z-490 thru 2Z-496.

6.0 SAFETY ENVELOPE SURVEILLANCE REQUIREMENTS

Only two Surveillance Requirements (SR) are specified in WHC-SD-CP-OSR-010 for any of the vacuum transfer liquid detection systems. These SRs require verifying the operability of the 26-inch vacuum liquid detection interlock system prior to use and daily during operation and a semi-annual functional test of the same system. There are no OSR Surveillance Requirements for the HC-4, HC-7 or HC-227S vacuum trap liquid detection interlock systems or for the Tank 50 high liquid level detection interlock system.

The operability requirement for the 26-inch vacuum liquid detection interlock system is met by implementation of both ZO-060-602 and ZSE-23B-001.

Operating procedure ZO-060-602, "Operate 26 in. Process Vacuum," requires that the leak detector circuit alarm be tested prior to operation of the Process Vacuum System and shiftily during operation of the system. The test assures that trouble with the liquid detection circuit alarm will be identified allowing operators to shut down the Process Vacuum System, thereby implementing the criticality prevention specification.

Functional testing of the liquid detection interlock system is performed once every six months by ZSE-23B-001. The functional test verifies the proper operation of the liquid detection interlock system from the conductivity probes to the alarms, isolation valves, and vacuum pumps. A six month interval is sufficient for the functional test due to the daily test of the detection circuit alarm and the design of the liquid detection interlock system which performs its isolation and shut down function when deenergized down stream of the induction relays (see section 4.3).

The only portions of the liquid detection interlock system not physically checked by the surveillance tests are the electrodes (XE-1LDA-23B, 1LDB, 2LDA, and 2LDB). However, this is not considered to significantly impact verification of the operability of the system for two reasons. First, the electrodes are passive items. They are 1" S.S. bolts which complete the liquid detection circuit in the presence of liquid. Second, these bolts are attached to two plugs in each conductivity probe. The plugs alone would complete the circuit in the presence of liquid.

7.0 SAFETY ENVELOPE SYSTEM OPERABILITY VERIFICATION

There are no OSR Surveillance Requirements for the HC-4, HC-7 or HC-227S vacuum trap liquid detection interlock systems or for the Tank 50 high liquid level detection interlock system. However, proper operation of these branch line systems helps to ensure large quantities of liquid are not introduced into the 26-inch vacuum header. Therefore, these systems are included in the safety envelope and the procedures used to verify their operability are described below.

7.1 HC-4 AND HC-7 VACUUM TRAPS LIQUID DETECTION INTERLOCK SYSTEMS OPERABILITY VERIFICATION

The operability of the liquid detection interlock systems for the vacuum traps in Gloveboxes HC-4 and HC-7 is verified by maintenance procedure 2222124, Functional Testing of HC-4, HC-7 and 227S Vacuum Trap Isolation and Alarms.

Operating procedures requiring the testing of the liquid detection interlock systems prior to use will be in place prior to operating the HC-4 and HC-7 vacuum traps.

7.2 HC-227S VACUUM TRAP LIQUID DETECTION INTERLOCK SYSTEM OPERABILITY VERIFICATION

The operability of the liquid detection interlock systems for the vacuum traps in Glovebox HC-227S is verified by the operating procedures which require testing of the liquid detection interlock systems prior to use and by maintenance procedure 2Z22124, Functional Testing of HC-4, HC-7 and 227S Vacuum Trap Isolation and Alarms.

7.3 TANK 50 HIGH LIQUID LEVEL DETECTION INTERLOCK SYSTEM OPERABILITY VERIFICATION

The operability of the Tank 50 High Liquid Level Detection Interlock System is verified by operating procedure Z0-180-101, (Inactive) Operate PRF 26-inch Vacuum System, which provides instructions to startup, operate, and shutdown the PRF 26-inch vacuum system. This procedure specifies liquid level limits and requires operators to note the liquid level indicated by the liquid level detection interlock system. This ensures the system is operating prior to using the Tank 50 vacuum branch. ZCP-6-020, Foxboro Pressure Transmitter Calibration and 2Z-96-02066/1, (PM/S) TK 49/50 instrument calibration. PM&S #2Z-490 thru 2Z-496. Tank 50 Automatic Isolation, calibration and functional testing address the maintenance requirements for Tank 50 Weight Factor System.

8.0 REFERENCES

CPS-Z-165-80141, REV. B-0, 12/23/91, "Criticality Prevention Specification; Plutonium Finishing Plant; PFP Facilities, 234-5Z Building, 200 West Area; 26-inch Hg. Vacuum System"

CPS-Z-165-80602, REV. C-2, 04/11/89, "Criticality Prevention Specification; Plutonium Finishing Plant; PFP Facilities, 234-5Z Building, 200 West Area; Glovebox HC-227S: Plutonium Nitrate Preparation"

CPS-Z-165-80604, REV. B-2, 04/11/89, "Criticality Prevention Specification; Plutonium Finishing Plant; PFP Facilities, 234-5Z Building, 200 West Area; Glovebox HC-4: Solution Storage"

CPS-Z-165-80607, REV. B-2, 04/11/89, "Criticality Prevention Specification; Plutonium Finishing Plant; PFP Facilities, 234-5Z Building, 200 West Area; Glovebox HC-7: Feed Preparation"

WHC-CM-4-29, Release 3, 9/10/92, "Nuclear Criticality Safety Manual"

WHC-SD-CP-OSR-010, REV. 0, May 1994, "Plutonium Finishing Plant Operational Safety Requirements"

WHC-SD-SAR-021, REV. 0, September 1995, "Plutonium Finishing Plant Final Safety Analysis Report"

WHC-SD-SQA-CSA-20159, REV. 0-A, 9/17/92, CSER 78-013, "Criticality Safety Analysis Report For RHO-MA-165, Criticality Prevention Specification 80.14-1; 26-Inch Hg Vacuum System"

WHC-SD-SQA-CSA-20160, REV. 0, 1/18/90, "Addendum to CSER 78-013"

WHC-SD-SQA-CSA-20337, REV. 0, 5/17/91, "Addendum 2 to CSER 78-013: Demister Legs in the Plutonium Finishing Plant"

APPENDIX A - PROCESS VACUUM LIQUID DETECTION INTERLOCK SYSTEMS SE DATA SHEET

OSR LCO COMPLIANCE SHEET

APPLICABLE OSR LCO (WHC-SD-CP-OSR-010 Section 3.0):

3.1.1 Criticality Prevention System

3.1.1 Criticality Prevention System

LCO 3.1.1.1 The 26-Inch Process Vacuum Liquid Detection Interlock System shall be OPERABLE whenever the 26-Inch Process Vacuum System is operating.

LCO 3.1.1.2 Glovebox Criticality Drains shall be OPERABLE (unobstructed) in the following locations:

234-52 Gloveboxes

HC-4	HC-9B
HC-6	HC-227S
HC-7	HA-23S
HC-227T	

Pu Process Support Laboratories Gloveboxes

188-1
179-10
179-12

Engineering Laboratory Glovebox

522 (Room 152)

236-2 Gloveboxes

MT-5	1st Floor East Cell Access
MT-6	1st Floor West Cell Access
4th Floor Column	2nd Floor East Cell Access
5th Floor Column	2nd Floor West Cell Access
6th Floor Column	

LCO 3.1.1.3 The following criticality safety features shall be in place.

- Glovebox Sump Discs in gloveboxes HC-7, HC-9B
- Glovebox Floor Filler Plates in glovebox HC-6
- Raschig Rings in Room 166 Sump

APPLICABILITY: 3.1.1.1 All MODES
3.1.1.2 All MODES
3.1.1.3 All MODES

OSR LCO COMPLIANCE SHEET		
APPLICABLE OSR LCO (WHC-SD-CP-OSR-010 Section 3.0):		
3.1.1 Criticality Prevention System		
ACTIONS:		
CONDITION	ACTION	COMPLETION TIME
A. Process Vacuum Liquid Detection Interlock System is inoperable.	A.1 Shut down 26-Inch Process Vacuum System	Immediately
	AND A.2 Enter MODE 2, Limited Plutonium Handling Operations. Prohibit all liquid transfers using 26" vacuum system.	Immediately
B. Criticality Drain is inoperable.	B.1 Suspend operations in affected glovebox.	Immediately
	AND -----NOTE----- If a criticality drain is inoperable due to an obstruction which can be easily and quickly cleared (e.g., debris temporarily blocking the drain entrance, item inappropriately placed on top of drain bag), the cognizant shift manager shall be notified IMMEDIATELY and the obstruction may be cleared with his concurrence. In such instances, the Required Action statement B.2 shall be considered as having been entered. Appropriate notifications and documentation shall be completed. -----	Immediately
C. Criticality safety feature required by LCO 3.1.1.3 is not present.	B.2 Restore Criticality Drain to OPERABLE condition in accordance with RECOVERY PLAN.	Immediately
	C.1 Suspend operations in affected glovebox(es).	Immediately
	AND C.2 Restore criticality safety features in accordance with RECOVERY PLAN.	Immediately

DEFINITION AND MEANS OF MAINTAINING THE PROCESS
VACUUM LIQUID DETECTION INTERLOCK SYSTEMS PORTION
OF THE PFP SAFETY ENVELOPE

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OSR LCO COMPLIANCE SHEET		
APPLICABLE OSR LCO (WHC-SD-CP-OSR-010 Section 3.0):		
3.1.1 Criticality Prevention System		
SURVEILLANCE REQUIREMENTS:		
SURVEILLANCE		FREQUENCY
SR	3.1.1.1.1 VERIFY OPERABILITY of the Process Vacuum Liquid Detection Interlock System supervisory circuit.	Once within 24 hours prior to startup of the 26-Inch Process Vacuum System AND Daily thereafter while the 26-Inch Process Vacuum System is operating
SR	3.1.1.1.2 Perform a FUNCTIONAL TEST of the Process Vacuum Liquid Detection Interlock System.	Semi-annually
SR	3.1.1.2.1 VERIFY OPERABILITY of the Criticality Drains.	Monthly
SR	3.1.1.3.1 VERIFY presence of the criticality safety features required by LCO 3.1.1.3.	Monthly
APPLICABLE ACCIDENT ANALYSES FSAR (WHC-SD-CP-SAR-021, CHAPTER 9) SECTION/TITLE:		
9.2 ACCIDENTS		
9.2.3 CRITICALITY		
APPLICABLE PLANT/PROCESS DESIGN/OPERATION DESCRIPTION(S) [FSAR CHAPTER/ SECTION]:		
4.0 PRINCIPAL DESIGN CRITERIA		
4.3 SAFETY PROTECTION SYSTEMS		
4.3.4 Nuclear Criticality Safety		
5.0 PLANT DESIGN		
5.4 SERVICE AND UTILITY SYSTEMS		
5.4.5 Vacuum Systems		
5.4.5.1 Major Components and Operating Characteristics		
5.4.5.1.1 Process Vacuum System, 26-in. Mercury		

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OSR LCO COMPLIANCE SHEET

APPLICABLE OSR LCO (WHC-SD-CP-OSR-010 Section 3.0):

3.1.1 Criticality Prevention System

BOUNDARY IDENTIFICATION DRAWINGS:

H-2-28087, Sht 3	26" Vacuum System Leak Detector Installation
H-2-28540,	Liquid Detection System 26" Hg Vacuum System
H-2-93504, Sht 1-3, 5, 6	EFD RMC Line
H-2-19405, Sht 1,	HC-6 Equipment Arrangement, ECN 500050
H-2-95607,	IEFD Glovebox HC-60
H-2-28013, Sht 1 & 3,	Process Engineering Flow Diagram Misc Treat Room MT-5 and MT-6
H-2-27135, Sht 1-4,	Criticality Drains Gloveboxes HC-7, HC-6, HC-227S, HC-227T, HC-4, HC-5B, HA-235, HC-9B, HC-1, HC-60, and ECNs 621512, 623378, 191519
H-2-28822, Sht 1-3,	Criticality Drains Screens Gloveboxes HC-6, HC-7, HC-227S, HC-227T, HC-9B, MW-2, EW-2
H-2-27145,	236-Z Gallery Glovebox Criticality Drain
H-2-26865,	Misc. Treatment Room Inter Glovebox Criticality Drain
H-2-28934, Sht 1-2,	Installation Criticality Drain Screen HC-1, HC-5, MT-5, MT-6
H-2-25598,	Room 166, HC-6, Raschig Rings
H-2-24640, Sht 1-2,	HC-7 and HC-9B Sump Filler Plates
H-2-28983,	Criticality & D-4 Drains GB 10 & 12 Room 179-B
H-2-26802,	Equipment Arrangement GB522 Room 152
H-2-28536,	Assembly - Glovebox 188-1

SYSTEM DRAWINGS:

H-2-29814 Sht 1-2	26" Vacuum Piping & Instrument Engineering Flow Diagram
H-2-93504, Sht 1-3, 5, 6	EFD RMC Line
H-2-95607	IEFD Glovebox HC-60
H-2-28013 Sht 1 & 3	Process Engineering Flow Diagram Misc Treat Room MT-5 and MT-6
H-2-27135 Sht 1-4	Criticality Drains Gloveboxes HC-7, HC-6, HC-227S, HC-227T, HC-4, HC-5B, HA-235, HC-9B, HC-1, HC-60, and ECNs 621512, 623378, 191519
H-2-28822 Sht 1-3	Criticality Drains Screens Gloveboxes HC-6, HC-7, HC-227S, HC-
H-2-27145	236-Z Gallery Glovebox Criticality Drain
H-2-26865	Misc. Treatment Room Inter Glovebox Criticality Drain
H-2-28934, Sht 1-2	Installation Criticality Drain Screen HC-1, HC-5, MT-5, MT-6
H-2-25598	Room 166, HC-6, Raschig Rings
H-2-24640 Sht 1-2	HC-7 and HC-9B Sump Filler Plates
H-2-28983	Criticality & D-4 Drains GB 10 & 12 Room 179B
H-2-26802	Equipment Arrangement GB522 Room 152
H-2-28985	Criticality Drains and Screens GB 10 and 12 Room 179-B
H-2-28536	Assembly - Glovebox 188-1
H-2-28584 Sht 1-2	Criticality Drains & Screens GB 1 Room 188-1

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OSR LCO COMPLIANCE SHEET	
APPLICABLE OSR LCO (WHC-SD-CP-OSR-010 Section 3.0):	
3.1.1 Criticality Prevention System	
IMPLEMENTING PROCEDURES/COMPLIANCE VERIFICATION	
OPERATING:	
ZO-060-602	Operate 26 in. Process Vacuum
ZO-060-814	Alarm Responses for Panel L Alarms
LABORATORY: NONE	
HEALTH PHYSICS: NONE	
OPERATING SPECIFICATION(S): NONE	
ADMINISTRATIVE: WHC-CN-5-8, PFP Administration Manual, Section 3.3, "Criticality Safety"	
MAINTENANCE: NONE	

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OSR LCO COMPLIANCE SHEET			
APPLICABLE OSR LCO (WHC-SD-CP-OSR-010 Section 3.0):			
3.1.1 Criticality Prevention System			
SURVEILLANCE REQUIREMENT	PROCEDURE NUMBER	DESCRIPTION	FREQUENCY
SR 3.1.1.1.1	ZO-060-602	Perform an OPERABILITY check of the Process Vacuum Liquid Detection Interlock System supervisory circuit.	Once within 24 hours prior to startup of the 26-Inch Process Vacuum System <u>AND</u> Required to be performed shiftly thereafter, while the 26-Inch Process Vacuum System is operating
SR 3.1.1.1.2	ZSE-238-001	Semi-annual 26" Vacuum Liquid Detectors Functional Test	Semi-annually
SR 3.1.1.2.1	See WHC-SD-CP-SDD-008		Monthly
SR 3.1.1.3.1	See WHC-SD-CP-SDD-008		Monthly
OTHER:			
ZO-060-624 Process Vacuum Pumps, Routine Startup Switching and Shutdown			
NOTES/COMMENTS:			
PREPARED BY:			

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APPENDIX B - MASTER COMPONENT INDEX INPUT LIST: PROCESS VACUUM LIQUID DETECTION INTERLOCK SYSTEMS SAFETY CLASS			
APPLICABLE LCO: 3.1.1.1			
PROCESS VACUUM LIQUID DETECTION INTERLOCK SYSTEM SE EQUIPMENT/COMPONENT LIST			
MASTER COMPONENT INDEX NUMBER	FUNCTIONAL DESCRIPTION	MANUFACTURER PART/MODEL NUMBER	DRAWING NUMBER
BR-1LD-23B	Rectifier changes 220 VAC to 220 VDC for liquid detection trouble indicator circuit for liquid detection interlock system in header upstream of demister #6	International Rectifier # 18082A/Stores # 16-1345-200	H-2-28087, sht 2
BR-2LD-23B	Rectifier (2): changes 220 VAC to 220 VDC for liquid detection trouble indicator circuit for liquid detection interlock system in header upstream of demister #7	International Rectifier # 18082A/Stores # 16-1345-200	H-2-28087, sht 2
CA-1LDA-23B	Annunciator alarms liquid intrusion into vacuum lines upstream of demisters #6	Ronan # X2-1029	H-2-28087, sht 2
CA-1LDB-23B	Annunciator alarms liquid detection circuit trouble (open circuit) for liquid detection interlock system in vacuum header upstream of demister #6	Ronan # X2-1029	H-2-28087, sht 2
CA-2LDC-23B	Annunciator alarms liquid intrusion into vacuum lines upstream of demister #7	Ronan # X2-1029	H-2-28087, sht 2
CA-2LDD-23B	Annunciator alarms liquid detection circuit trouble (open circuit) for liquid detection interlock system in vacuum header upstream of demister #7	Ronan # X2-1029	H-2-28087, sht 2
CE-1LD-23B	Conductivity Probe, demister #6 header, detects presence of liquid and conducts a signal from probe to induction relay.	B/W Controls Type E-2; W/2 # 1264	H-2-28540, H-2-96418, sht 3
CE-2LD-23B	Conductivity Probe, demister #7 header, detects presence of liquid and conducts a signal from probe to induction relay.	B/W Controls Type E-2; W/2 # 1264	H-2-28540, H-2-96418, sht 3

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**APPENDIX B - MASTER COMPONENT INDEX INPUT LIST: PROCESS VACUUM LIQUID DETECTION
INTERLOCK SYSTEMS
SAFETY CLASS**

APPLICABLE LCO: 3.1.1.1

**PROCESS VACUUM LIQUID DETECTION INTERLOCK SYSTEM
SE EQUIPMENT/COMPONENT LIST**

MASTER COMPONENT INDEX NUMBER	FUNCTIONAL DESCRIPTION	MANUFACTURER PART/MODEL NUMBER	DRAWING NUMBER
CR-1K1-23B	Relay- activates liquid detection annunciator CA-1LDA-23B and deenergizes solenoid valve EV-1LD-23B	Potter & Brumfield # KRP14P120	H-2-28087, sht 2
CR-1K2-23B	Relay- activates annunciator for liquid detection circuit trouble CA-1LDB-23B	Potter & Brumfield # KRP14P120	H-2-28087, sht 2
CR-1K3-23B	Relay removes power from vacuum pump motor controllers MC-VPP1-23B and MC-VPP2-23B; each relay removes power from both controllers	Potter & Brumfield KPR11AG120	H-2-28087, sht 2 H-2-28737, sht 1
CR-2K1-23B	Relay- activates liquid detection annunciator CA-2LDC-23B and deenergizes solenoid valve EV-2LD-23B	Potter & Brumfield # KRP14P120	H-2-28087, sht 2
CR-2K2-23B	Relay- activates liquid detection circuit trouble annunciator CA-2LDD-23B	Potter & Brumfield # KRP14P120	H-2-28087, sht 2
CR-2K3-23B	Relay removes power from vacuum pump motor controllers MC-VPP1-23B and MC-VPP2-23B; each relay removes power from both controllers	Potter & Brumfield KPR11AG120	H-2-28087, sht 2 H-2-28737, sht 1
CR-1LD1-23B	Induction Relay- activates liquid detection circuit by deenergizing relays CR-1K1-23B and CR-1K3-23B and illuminates circuit trouble indicator light L-1LD-23B	B/W Controls Type "D"/1500-D-L1-S7-OC-X	H-2-28087, sht 2
CR-1LD2-23B	Relay- deenergizes relay CR-1K2-23B energizes circuit trouble indicator light L-1LD-23B	Potter & Brumfield # KCP11	H-2-28087, sht 2
CR-2LD1-23B	Induction Relay- activates liquid detection circuit by deenergizing relays CR-2K1-23B and CR-2K3-23B and illuminates circuit trouble indicator light L-2LD-23B	B/W Controls Type "D"/1500-D-L1-S7-OC-X	H-2-28087, sht 2

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INTERLOCK SYSTEMS
SAFETY CLASS**

APPLICABLE LCO: 3.1.1.1

**PROCESS VACUUM LIQUID DETECTION INTERLOCK SYSTEM
SE EQUIPMENT/COMPONENT LIST**

MASTER COMPONENT INDEX NUMBER	FUNCTIONAL DESCRIPTION	MANUFACTURER PART/MODEL NUMBER	DRAWING NUMBER
CR-2LD2-238	Relay- deenergizes relay CR-2K2-238, energizes circuit trouble indicator light L-2LD-238	Potter & Brumfield # KCP11	H-2-28087, sht 2
EV-PVLDL-1	Solenoid Valve vents air from butterfly valves CV-PVLDL-1, CV-PVLDL-2; each solenoid vents air from both butterfly valves	ASCO CAT # 8300C72	H-2-28540, H-2-96418, sht 2
EV-PVLDL-2	Solenoid Valve vents air from butterfly valves CV-PVLDL-1, CV-PVLDL-2; each solenoid vents air from both butterfly valves	ASCO CAT # 8300C72	H-2-28540, H-2-96418, sht 2
CV-PVLDL-1	Butterfly Valve isolates vacuum line upstream of HEPA filters	Fisher Controls Model 9500 TFE	H-2-28540, H-2-96418, sht 2
CV-PVLDL-2	Butterfly Valve isolates vacuum line upstream of HEPA filters	Fisher Controls Model 9500 TFE	H-2-28540, H-2-96418, sht 2
HS-1LD-238	Switch- tests liquid detection circuit trouble indicator light L-1LD-238 and annunciator CA-1LDB-238	GE CR2940, VA202B	H-2-28087, sht 2
HS-2LD-238	Switch tests liquid detection circuit trouble indicator light L-2LD-238 and annunciator CA-2LDB-238	GE CR2940, VA202B	H-2-28087, sht 2
L-1LD-238	Indicator Light- Indicates liquid intrusion in vacuum lines upstream of demister #6 and trouble with liquid detection circuit (open circuit) for alarm and test of liquid detection circuit NON-SAFETY ENVELOPE	GE CR2290, VC212C2	H-2-28087, sht 2
L-2LD-238	Indicator Light- Indicates liquid intrusion in vacuum lines upstream of demister #7 and trouble with liquid detection circuit (open circuit) for alarm and test of liquid detection circuit NON-SAFETY ENVELOPE	GE CR2290, VC212C2	H-2-28087, sht 2

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INTERLOCK SYSTEMS
SAFETY CLASS**

APPLICABLE LCO: 3.1.1.1

**PROCESS VACUUM LIQUID DETECTION INTERLOCK SYSTEM
SE EQUIPMENT/COMPONENT LIST**

MASTER COMPONENT INDEX NUMBER	FUNCTIONAL DESCRIPTION	MANUFACTURER PART/MODEL NUMBER	DRAWING NUMBER
MC-VPP1-23B	Motor Controller opens and closes power circuits for vacuum pump PVVP-1 motor	Cutler-Hammer T8D	H-2-28737, sht 1
MC-VPP2-23B	Motor Controller opens and closes power circuits for vacuum pump PVVP-2 motor	Cutler-Hammer T8D	H-2-28737, sht 1
R-1LD-23B	Resistor reduces voltage in liquid detection trouble circuit from 220 VDC to 110 VDC across relay coil CR-1LD2-23B	N/A 47K Ohms, 1 watt	H-2-28087, sht 2
R-2LD-23B	Resistor reduces voltage in liquid detection trouble circuit from 220 VDC to 110 VDC across relay coil CR-2LD2-23B	N/A 47K Ohms, 1 watt	H-2-28087, sht 2

APPENDIX B - MASTER COMPONENT INDEX INPUT LIST:
Glovebox HC-4 Vacuum Trap Liquid Detection Interlock System

APPLICABLE LCO: NONE

SE SYSTEM EQUIPMENT/COMPONENT LIST
SAFETY SIGNIFICANT

MASTER COMPONENT INDEX NUMBER	FUNCTIONAL DESCRIPTION	MANUFACTURER PART/MODEL NUMBER	DRAWING NUMBER
CC-4C-2	HC-4 Vacuum Trap Conductivity Controller	Warrick Controls, Series 2	H-2-93504, sht 1
CE-4C-2	HC-4 Vacuum Trap Conductivity Element	Warrick Controls, 3NIC	H-2-93504, sht 1
4C-EV-2	HC-4 Vacuum Trap Conductivity Isolation Valve	Asco, 120v Solenoid	H-2-93504, sht 1
Test Button (HC-4)	HC-4 Conductivity Controller Test Button		
Reset Button (HC-4)	HC-4 Conductivity Controller Reset Button		

APPENDIX B - MASTER COMPONENT INDEX INPUT LIST:
Glovebox HC-7 Vacuum Trap Liquid Detection Interlock System

APPLICABLE LCO: NONE

SE SYSTEM EQUIPMENT/COMPONENT LIST

SAFETY SIGNIFICANT

MASTER COMPONENT INDEX NUMBER	FUNCTIONAL DESCRIPTION	MANUFACTURER PART/MODEL NUMBER	DRAWING NUMBER
HLAL-7C-1	HC-7 Vacuum Trap Conductivity Alarm	Warrick, Controls bell	H-2-93504, sht 3
CC-7C-1	HC-7 Vacuum Trap Conductivity Controller	Warrick Controls, Series 2	H-2-93504, sht 3
CE-7C-1	HC-7 Vacuum Trap Conductivity Element	Warrick Controls, 3NIC	H-2-93504, sht 3
EV-7C-27	HC-7 Vacuum Trap Conductivity Isolation Valve	Asco, 120v Solenoid	H-2-93504, sht 4
MOV-7C-43	Isolates the HC-7 vacuum line from the 26-inch vacuum system		H-2-93504, sht 4
Test Button (HC-7)	HC-7 Conductivity Controller Test Button		
Reset Button (HC-7)	HC-7 Conductivity Controller Reset Button		

APPENDIX B - MASTER COMPONENT INDEX INPUT LIST:
Glovebox HC-227S Vacuum Trap Liquid Detection Interlock System

APPLICABLE LCO: NONE

SE SYSTEM EQUIPMENT/COMPONENT LIST

SAFETY SIGNIFICANT

MASTER COMPONENT INDEX NUMBER	FUNCTIONAL DESCRIPTION	MANUFACTURER PART/MODEL NUMBER	DRAWING NUMBER
CA-R	HC-227S Vacuum Trap Conductivity Alarm	Warrick, Controls bell	H-2-93504 sht 2
CC-R	HC-227S Vacuum Trap Conductivity Controller	Warrick Controls, Series 2	H-2-93504 sht 2
CE-R	HC-227S Vacuum Trap Conductivity Element	Warrick Controls, 3NIC	H-2-93504 sht 2
EV-R	HC-227S Vacuum Trap Isolation Valve	Asco, 120v Solenoid	H-2-93504 sht 2
Test Button (HC-227S)	HC-227S Conductivity Controller Test Button		
Reset Button (HC-227S)	HC-227S Conductivity Controller Reset Button		

APPENDIX B - MASTER COMPONENT INDEX INPUT LIST:
Tank 50 High Liquid Level Detection Interlock System

APPLICABLE LCO: NONE

SE SYSTEM EQUIPMENT/COMPONENT LIST
SAFETY SIGNIFICANT

MASTER COMPONENT INDEX NUMBER	FUNCTIONAL DESCRIPTION	MANUFACTURER PART/MODEL NUMBER	DRAWING NUMBER
50-WFT-A	TK-50 Weight Factor Transmitter	Foxboro, E13/613	H-2-27977, sht 1
50-WFAS-A	TK-50 High Level Alarm Switch	Foxboro, M63	H-2-29790, sht 1
50-IL-A	TK-50 High Level Annunciator	Ronan, 2200350	H-2-29790, sht 1
50-KA	TK-50 Interlock Relay	Ronan, 99999	H-2-29790, sht 1
50-EMV-D	TK-50 Three Way Valve		H-2-27977, sht 1 H-2-29790, sht 1

DISTRIBUTION SHEET

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		Date December 2, 1996
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Definition and Means of Maintaining the Process Vacuum Liquid Detection Interlock System Portion of the PFP Safety Envelope		ECN No. 637682

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