ENGINEERING CHANGE NOTICE

Page 1 of 4

1. ECN 634416

Proj.
ECN

2. ECN Category (mark one) Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersedure ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. W. F. White, Cognizant Engineer, T4-20, 376-8925	4. USQ Required? ☒ Yes ☐ No	5. Date 8/19/97	
	6. Project Title/No./Work Order No. PFP Authorization Basis Support Document/K6058	7. Bldg./Sys./Fac. No. 234-5Z/236-Z/241-Z/2736-Z/2736-ZB, Sys. 99A	8. Approval Designator SQ	
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-CP-SDD-003, Rev. 4	10. Related ECN No(s). N/A	11. Related PO No. N/A	

12a. Modification Work ☐ Yes (fill out Blk. 12b) ☒ No (NA Blks. 12b, 12c, 12d)	12b. Work Package No. N/A	12c. Modification Work Complete N/A Design Authority/Cog. Engineer Signature & Date	12d. Restored to Original Condition (Temp. or Standby ECN only) N/A Design Authority/Cog. Engineer Signature & Date
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13a. Description of Change Update of supporting document	13b. Design Baseline Document? ☒ Yes ☐ No
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14a. Justification (mark one)			
Criteria Change ☐	Design Improvement ☐	Environmental ☐	Facility Deactivation ☐
As-Found ☒	Facilitate Const ☐	Const. Error/Omission ☐	Design Error/Omission ☐

14b. Justification Details
 This revision is an annual update of the SDD and supports implementation of ECN 631097 to WHC-SD-CP-OSR-010, Plutonium Finishing Plant Operational Safety Requirements, Revision 0-G.

15. Distribution (include name, MSIN, and no. of copies)
 See Distribution Sheet

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AUG 25 1997	12
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ECN (use no. from pg. 1)

634416

A-7900-013-3 (05/96) GEF096

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

1. Identification Number: ECN 634416

USQ SCREENING

Page 1 of 2

2. Title: Revise WHC-SD-CP-SDD-003, "Definition and Means of Maintaining the Criticality Detectors and Alarms Portion of the PFP Safety Envelope."

DESCRIPTION

This USQ screening is for a revision to the document HNF-SD-CP-SDD-003, "Definition and Means of Maintaining the Criticality Detectors and Alarms Portion of the PFP Safety Envelope." The following changes are made to the document:

Safety envelope equipment is designated as "safety significant" rather than "safety class 1/2" in accordance with the safety class designation in HNF-PRO-516, "Safety Structures, Systems, and Components". Safety function is not changed.

The coverage requirements in paragraph 3.1 have been abbreviated. The operability requirements in paragraph 3.3 have been expanded to address the revised OSR LCO 3.1.2 component operability requirements.

Appendix A reflects the revised OSR LCO 3.1.2 and the OSR LCO Compliance sheet.

A list of detector station locations and area of coverage is in a new Appendix C. The information formerly in Appendix C is now contained in Appendix A.

Reference is made to HNF-IP-1115, "Nuclear Criticality Alarm Manual for PFP," instead of WHC-CM-6-30, "Nuclear Criticality Alarm Manual for the 200 Areas."

The procedures for maintenance and alarm response have been changed.

Appendix B Master Component Index listing is a summary only. Individual components are now listed on Essential Drawings referenced in Appendix A.

A discussion of Transportable Criticality Alarm Systems has been added.

A figure showing the 25 rem boundary has been added.

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: WHC-SD-CP-SAR-021, Plutonium Finishing Plant Final Safety Analysis Report, Sections 5.4.2.2.11, 5.4.10.1.7, and 8.3.4.1, describe the criticality alarm system. No changes made to the system description document affect the description of the CAS as given in the above sections. Changes to the Authorization Basis contained in WHC-SD-CP-OSR-010, Plutonium Finishing Plant Operational Safety Requirements (OSR), Limiting Condition for Operation (LCO) 3.1.2 were made by ECN 631097 and approved by DOE-RL in letter 97-TPD-099 dated 7/11/97. ECN 631097 received its own USQ screening/evaluation and has been approved by the DOE, therefore this question is answered NO.

UNREVIEWED SAFETY QUESTION (USQ) SCREENING AND EVALUATION

1. Identification Number: ECN 634416

USQ SCREENING

Page 2 of 2

2. Title: Revise WHC-SD-CP-SDD-003, "Definition and Means of Maintaining the Criticality Detectors and Alarms Portion of the PFP Safety Envelope."

2. Does the proposed change or occurrence represent conditions that have not been analyzed in the Authorization Basis?
☐ N/A ☒ No ☐ Yes/Maybe

BASIS: WHC-SD-CP-SAR-021, Plutonium Finishing Plant Final Safety Analysis Report, Section 9.2.3 "Criticality" provides general discussion of PFP process related criticality accidents. In addition, Section 9.2.4A.2.11 discusses potential seismically induced criticality accidents. The criticality alarm system is not discussed in either section as it does not play any part in preventing a criticality accident, but rather is an evacuation alarm that initiates evacuation of personnel that may receive unnecessary secondary radiation exposure from a criticality event. Therefore, the change to the system description document does not represent a change to the facility or procedures as described in the Authorization Basis.

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: No tests or experiments are involved with this document revision. This question is not applicable.

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 proposed change to the document takes into account the ECN 631097 revised Operational Safety Requirement (or TSR) for LCO 3.1.2 and its BASES and therefore requires no new or revised OSRs. The proposed changes clarify the requirements for staying within the safety envelope and can be considered an enhancement in the margin of safety rather than any reduction. Therefore, this question is answered NO.

USQE #1 J. P. King

(Print Name)

USQE #2

GG BERGQUIST

(Print Name)

Signature

Date:

8/11/97

Signature

Date:

8/11/97

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 CRITICALITY DETECTORS AND ALARMS PORTION OF THE PFP SAFETY ENVELOPE

W. F. White

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Abstract: The Criticality Alarm System (CAS) provides continuous detection for high radiation (criticality) events and automatically initiates an evacuation signal to affected personnel. The Safety Envelope (SE) for PFP includes the necessary equipment and the required procedures to ensure the CAS is capable of performing its intended function.

This document provides the definition and means of maintaining the SE for PFP related to the CAS. This document also identifies and provides a justification for those portions of the CAS excluded from the PFP Safety Envelope.

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1.0 INTRODUCTION

The purpose of this document is to provide the definition and means of maintaining the Safety Envelope (SE) related to the Criticality Alarm System (CAS). This document provides amplification of the Limiting Condition for Operation (LCO) described in the Plutonium Finishing Plant (PFP) Operational Safety Requirements (OSR), WHC-SD-CP-OSR-010, Rev. 0, 1994, Section 3.1.2, "Criticality Detectors and Alarms."

This document, with its appendices, provides the following:

1. System functional requirements for determining system operability (Section 3).
2. A list of annotated system block diagrams which indicate the safety envelope boundaries (Appendix A).
3. A list of the Safety Significant (SS) Safety Envelope (SE) equipment authorized for use in the Criticality Alarm System (Appendix B).
4. Functional requirements for individual SS SE components, including appropriate set-points and process parameters (Section 6 and Appendix A).
5. A list of the operational, maintenance and surveillance procedures necessary to operate and maintain the SS SE components as required by the LCO (Section 6 and Appendix A).
6. A list of detector station locations and the area of coverage for each detector station (Appendix C).

2.0 BACKGROUND

The CAS provides continuous detection for high radiation (criticality) events and automatically initiates an evacuation signal to affected personnel. The CAS also establishes the approximate time of the criticality event.

There are two methods used to detect a criticality event at PFP. A gamma detection system is the predominant method and is used throughout the facility. In addition, a neutron detection system is used in the 2736-Z Building. Criticality detection is divided into 9 zones within the PFP complex. Each zone is serviced by multiple detectors, a criticality alarm panel, backup power supply, and annunciators.

Eight of these zones (1 through 7 and 9) are intertied such that the detection of a criticality event by one criticality alarm panel initiates evacuation signals in all eight zones. Zone 8 services the 241-Z Building, which is physically separate from the rest of the facility, and is not

intertied to the other zones. Additional descriptions of the zones, criticality alarm components, and associated testing and calibration requirements are contained in HNF-IP-1115, Nuclear Criticality Alarm Manual for PFP.

3.0 SYSTEM REQUIREMENTS

3.1 COVERAGE REQUIREMENTS

WHC-CM-4-29, Section 11 requires a CAS to be installed and maintained operational for all fissionable material facilities and for fissionable material outside the core of nuclear reactor facilities. (See Appendix C for detector station locations and coverage.)

3.2 FUNCTIONAL REQUIREMENTS

The PFP Authorization Basis, WHC-SD-CP-SAR-021, and WHC-SD-CP-OSR-010,

PFP Complex 25 rem Boundaries - 1989

Figure 3-1

require that an operable criticality alarm system conforming to ANSI/ANS 8.3-1986 shall be provided to cover occupied facility areas in which the expected dose exceeds 12 rads in free air. WHC-CM-4-29, Section 11 requires that the design, location, and set-point adjustment of the CAS shall provide detection of a criticality event and automatically signal evacuation immediately. Facility areas requiring CAS coverage are determined by a criticality safety analysis review of plant configuration and operating plans. Current facility area CAS requirement boundaries are illustrated in figure 3-1.

3.3 OPERABILITY REQUIREMENTS

Minimum operability of the CAS is defined as having all areas needing detection coverage having a functional CAP for that area, and all areas needing annunciation having functional horns.

3.3.1 Criticality Alarm Panel (CAP) Operability

Minimum operability of a CAP panel is defined as having all detector stations operable, all Criticality Alarm Logic Module(s) operable, the Criticality Alarm Relay Module operable, and the Central Battery System for the CAP operable. For CAP Z7, the UPS and neutron detection system must also be operable.

3.3.2 Detector Station Operability

Minimum operability of a CAS detector station is defined as two functional detector/module pairs within one detector station (consisting of three detector/module pairs).

3.3.3 Central Battery System Operability

Minimum operability for the central battery system is defined as a battery meeting one of the following criteria.

- Battery charger float voltage greater than 25.56 volts DC.
- On a loss of AC power, AC power is restored after less than two hours and procedure 1-ZM-023 is completed satisfactorily.
- On a loss of AC power, AC power is restored after two hours but less than four hours and procedure 1-ZM-023 is completed satisfactorily. Additionally, within 48 hours of the original loss of power, procedure ZSE-99A-006 is completed satisfactorily.
- On a loss of AC power for four hours or longer, procedure ZSE-99A-006 completed satisfactorily.

The central battery system is not operable if a loss of AC power lasts for four hours or longer. Procedure ZSE-99A-006 must be completed satisfactorily before operability of the system has returned.

The central battery system is immediately not operable if the battery charger has AC power supplied and is providing DC current, but the DC voltage is 24 volts or less. The system is functional, but does not have the necessary back-up power supply. *This does not apply during performance of procedure 1-ZM-023 in recovery from a loss of AC power.*

3.3.4 Neutron Detection System Operability

Minimum operability of the neutron detection system is defined as two functional detectors for each detector station (consisting of three neutron detectors).

3.3.5 UPS Operability

Minimum operability of the CAP Z7 UPS is defined as a unit meeting one of the following:

- No more than one battery pack with it's Replace Battery indicator lit.
- On a loss of AC, estimated battery remaining greater than 60 min.

3.4 OPERATIONAL SAFETY REQUIREMENTS

The Operational Safety Requirements associated with the criticality alarm system are contained in WHC-SD-CP-OSR-010, Section 3.1.2. The requirement for this LCO is:

LCO 3.1.2 The Criticality Alarm System (CAS) shall be OPERABLE.

3.5 DESIGN REQUIREMENTS

The design requirements for the criticality alarm system are contained in WHC-CM-4-29, Section 11, Subsection 5.3, "Design Requirements". This document will not address compliance to all the design requirements. Only the components necessary to fulfill OSR requirements are addressed. The CAS is designed such that 2-out-of N (where $N \geq 3$) detectors must be tripped to initiate a criticality evacuation signal. The system contains audio and visual alarm annunciators necessary to inform affected personnel of the need to evacuate. The system also includes monitoring circuits to detect malfunction, or loss of power and will automatically switch to backup power in the event of loss of normal power.

4.0 SAFETY ENVELOPE EQUIPMENT

SS SE equipment are those components necessary to ensure the CAS is capable of performing its minimum functional requirements as specified in Section 3.0 of this document. This is in support of LCO 3.1.2.

The block diagram defining the CAS SS SE boundary is shown on drawing H-2-28883, Sheet 1, "Criticality Alarm System Block Diagram and Drawing Index." Appendix B of this document lists the CAS approved SS SE equipment.

SS SE equipment included within a typical CAS Zone are the following:

1. Criticality Detector Station(s) consisting of a minimum of three criticality alarm detectors (CADs) (either gamma or neutron).
2. Criticality Alarm Panel (CAP) containing the following:
 - One Criticality Alarm Detection Module (CADM) per CAD
 - One Criticality Alarm Logic Module (CALM) serving up to six CADMs
 - One Criticality Alarm Relay Module (CARM)
 - One Audible Signal Generator (ASG)
 - Intertie Relay(s)
3. Evacuation Annunciators:
 - Criticality Alarm Horn(s) (CAH)
 - Criticality Alarm Flasher(s) (CAF), where required
4. Backup Power:
 - Battery and Battery Charger
 - Uninterruptible Power Supply (UPS) for CAP 7 only.
5. Transportable Criticality Alarm Systems when placed in service to satisfy requirements of LCO 3.1.2.

The CAS remote monitoring system (multiplexer {MUX} units, Criticality Alarm Annunciators {CAA}, and AC power loss relays) is part of the PFP SS SE. These SSCs are not essential to preventing or alarming a nuclear criticality. They provide remote indication of Criticality Alarm System operability and work with other methods to satisfy LCO 3.1.2 and ensure continued operability of the CAS. The other methods of ensuring operability include the redundancy designed into the CAS (and included in the SS SE); the monthly, and quarterly surveillances required by LCO 3.1.2; and the once per shift CAP surveillance in procedure ZO-100-400 (or procedure ZO-100-401, when system remote monitoring is compromised).

All of the SS SE are functionally tested by Safety Envelope Surveillance (ZSE or ZSR) procedures. Also, plant procedures require two hour CAP surveillances when the CAS remote monitoring system is not functional. These procedures help to ensure the CAS remains operable at all times.

The following are annunciated to the PFP Central Alarm Station: CAD/CADM fail, alert, alarm (neutron comparators only send alarm and power fail), and CAP power fail.

The TCAS usage is limited to situations approved by the PFP Criticality Safety representative and provides temporary coverage in accordance with the WHC-SD-CP-OSR-010 LCO 3.1.2 and its associated surveillance requirements.

5.0 SAFETY ENVELOPE PROCEDURES

Procedures provide administrative control over the maintenance and calibration of the Criticality Alarm System to ensure operability of safety envelope components. Procedures also provide proper responses to alerts or alarms resulting from component failure, loss of power, or the detection of a nuclear criticality.

5.1 MAINTENANCE PROCEDURES

The procedures which satisfy the surveillance requirements for maintenance calibration and functional testing of CAS safety envelope equipment are identified in Section 6.0 of this document.

Non-LCO maintenance procedures related to the CAS are:

- 1-ZM-008** Functional Testing of Transportable Criticality Alarm Systems (TCAS)
- 1-ZM-023** Restoring Criticality Alarm System to Normal Operation After AC Power Loss- System 99A
- ZSR-99A-002** Criticality Alarm System Sound Level Test (Refer to HNF-IP-1115, Section 6.4, "Criteria for Periodic Audibility Testing of Criticality Alarm Horns ").

This procedure provides the annual test of all the CAS horns including sound level measurements (in decibels) at specific locations within the facility. If needed, this test is performed at mid-interval.

5.2 ALARM RESPONSE PROCEDURES

Response procedures for CAS alarm signals are contained in **ZAR-017**, "Criticality Alarm System Event Responses." Actions are provided for each of the following alarm conditions:

1. CALM/CARM Alarm or Evacuation (AH-00-GAH) Signal.
2. CALM/CARM Alert.

3. Detector Failure (Yellow Indicating Light).
4. Detector Power Failure (White Indicating Light).
5. Combination of Detector/Power Failure(s).
6. Response to a TCAS Alarm.

5.3 OPERATING PROCEDURES

Operating procedure Z0-100-400, "Perform Nuclear Operations Surveillance and Responses," includes a local surveillance once each shift of each CAP to verify CAS operability.

Operating procedure Z0-100-401, "Criticality Alarm System Non-routine Surveillance," includes a local surveillance every two hours of the affected CAP(s) to verify CAS operability.

6.0 SAFETY ENVELOPE SURVEILLANCE REQUIREMENTS

The surveillance requirements in LCO 3.1.2 for the Criticality Alarm System are:

	<u>SURVEILLANCE</u>	<u>FREQUENCY</u>
SR 3.1.2.1	VERIFY OPERABILITY of each detector and detector module response to a radiation source	Monthly
SR 3.1.2.2.1	VERIFY OPERABILITY of the CAS battery systems.	Monthly
SR 3.1.2.2.2	VERIFY OPERABILITY of individual CAS battery cells and perform inspection of neutron system uninterruptible power supply.	Quarterly
SR 3.1.2.3	VERIFY actuation of Audible Signal Generator audible and visual alarms.	Quarterly
SR 3.1.2.4	VERIFY OPERABILITY of the CAS Logic and Relay Modules.	Quarterly

ZSE-99A-001 Criticality Alarm System (CAS) Check out and Audible/Visual Alarm Test

This procedure is performed quarterly to verify the CAS gamma detector visual and audible alarm systems operate as designed. The procedure verifies that each Criticality Alarm Detector Module (CADM), Criticality Alarm Logic Module (CALM), Criticality Alarm Relay Module (CARM), Audible Signal Generator (ASG) and alarm horn operate properly.

Procedure ZSE-99A-001 is performed to satisfy Surveillance Requirement 3.1.2.3.

ZSE-99A-002 Criticality Alarm System, Neutron Criticality Detector System and Alarm Operability Test

This procedure is performed monthly to verify the CAS neutron detectors respond properly to a neutron check source. The procedure is also performed quarterly to verify the CAS neutron detector visual and audible alarm systems operate as designed.

Procedure ZSE-99A-002 is performed to satisfy Surveillance Requirements 3.1.2.1 and 3.1.2.3.

ZSE-99A-006 Monthly Inspection of Criticality Alarm System Batteries

This procedure is performed monthly to verify CAS Battery Systems are capable of performing as designed by measuring the electrolyte level, specific gravity and cell voltage for the pilot cell. An additional section covers the tests performed on all battery cells quarterly and the quarterly inspection of the neutron system UPS.

Procedure ZSE-99A-006 is performed to satisfy Surveillance Requirement 3.1.2.2.1 and 3.1.2.2.2.

ZSE-99A-008 Replace Criticality Alarm Horn (CAH)

This procedure is performed, as necessary, to verify CAS horns are performing properly after repair, replacement, or installation.

Procedure ZSE-99A-008 is performed to satisfy Surveillance Requirement 3.1.2.4.

ZSE-99A-011 Criticality Alarm System Operability Test

This procedure is performed monthly to verify each CAS gamma detector responds properly to a gamma check source. This procedure also verifies the proper operation of the CAS Logic and Relay Modules.

Procedure ZSE-99A-011 is performed to satisfy Surveillance Requirements 3.1.2.1.

7.0 REFERENCES

- ANSI/ANS 8.3 American National Standard, "Criticality Accident Alarm System," 1986
- WHC-CM-4-29 Nuclear Criticality Safety Manual
- HNF-IP-1115 Nuclear Criticality Alarm Manual PFP
- WHC-SD-CP-SAR-021 Plutonium Finishing Plant Final Safety Analysis Report, Rev. 0, 1995
- WHC-SD-CP-OSR-010 Plutonium Finishing Plant Operational Safety Requirements, Rev. 0, 1994

APPENDIX A

OSR LCO COMPLIANCE SHEET		
APPLICABLE OSR LCO (WHC-SD-CP-OSR-010 Section 3.0):		
3.1.2 Criticality Detectors and Alarms		
LCO 3.1.2 The Criticality Alarm System (CAS) shall be OPERABLE.		
APPLICABILITY: ALL MODES		
ACTIONS:		
CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Single detector or detector module inoperable for any detector station.	A.1 Stop fissile material (greater than 15 grams) movements in the affected area. Enter MODE 2, Limited Plutonium Handling Operations in the affected area.	4 Hours
	AND A.2 Repair or replace failed detector or detector module.	48 Hours
B. REQUIRED ACTION A.2 and associated COMPLETION TIME not met.	B.1 Enter CONDITION 1, CAP inoperable.	Immediately

OSR LCO COMPLIANCE SHEET			
APPLICABLE OSR LCO (WHC-SD-CP-OSR-010 Section 3.0):			
3.1.2 Criticality Detectors and Alarms			
C. A Criticality Alarm System Evacuation Horn or Visual Alarm inoperable.	C.1	Stop fissile material (greater than 15 grams) movement in facility areas requiring a CAS. Enter MODE 2, Limited Plutonium Handling Operations in facility areas requiring a CAS.	Immediately
		<u>AND</u>	
	C.1.1	Implement repairs according to an approved work plan.	
		<u>OR</u>	
	C.2	Stop fissile material (greater than 15 grams) movements in facility areas requiring a CAS. Enter MODE 2, Limited Plutonium Handling Operations in facility areas requiring a CAS.	Immediately
		<u>AND</u>	
	C.2.1	Prohibit entry into the area(s) affected by horn or visual alarm inoperability.	
		<u>AND</u>	
	C.2.2	Develop and implement a RECOVERY PLAN to ensure fissile material (greater than 15 grams) movement is prohibited in the facility areas when personnel are present in the area(s) affected by horn or visual alarm inoperability. Fissile material (greater than 15 grams) movement in areas not containing the inoperable horn or visual alarm may resume upon implementation of the RECOVERY PLAN.	

DEFINITION AND MEANS OF MAINTAINING THE
CRITICALITY DETECTORS AND ALARMS 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):		
3.1.2 Criticality Detectors and Alarms		
D. A CAP battery charger is inoperable (loss of incoming AC power or charger for batteries).	D.1 Restore battery charger to OPERABLE.	2 Hours
	<u>OR</u>	
	D.2 Restore battery charger to OPERABLE.	4 Hours
	<u>AND</u>	
	D.2.1 Start Equalize Recharge of affected batteries.	48 Hours
	<u>OR</u>	
	D.3 Enter CONDITION C, Criticality Alarm System Evacuation Horn or Visual Alarm inoperable.	4 Hours
	<u>AND</u>	
	D.3.1 Enter CONDITION I, CAP inoperable.	
E. Required Action D.2.1 and associated COMPLETION TIME not met (equalize recharge not started within 48 hours after power loss of greater than 2 hours).	E.1 Enter CONDITION C, Criticality Alarm System Evacuation Horn or Visual Alarm inoperable.	Immediately
	<u>AND</u>	
	E.1.1 Enter CONDITION I, CAP inoperable.	
F. A CAP battery is inoperable.	F.1 Enter CONDITION C, Criticality Alarm System Evacuation Horn or Visual Alarm inoperable.	Immediately
	<u>AND</u>	
	F.1.1 Enter CONDITION I, CAP inoperable.	
G. In-coming AC power to neutron detection Uninterruptable Power Supply (UPS) has been lost.	G.1 Restore AC power.	4 Hours
	<u>OR</u>	
	G.2 Enter CONDITION I, CAP inoperable for the 2736-Z Vaults.	4 Hours
H. Neutron detection system UPS is inoperable or indicates less than 60 minutes battery time left while without AC power.	H.1 Enter CONDITION I, CAP inoperable for the 2736-Z Vaults.	Immediately

DEFINITION AND MEANS OF MAINTAINING THE
CRITICALITY DETECTORS AND ALARMS PORTION
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OSR LCO COMPLIANCE SHEET		
APPLICABLE OSR LCO (WHC-SD-CP-OSR-010 Section 3.0):		
3.1.2 Criticality Detectors and Alarms		
<p>I. A Criticality Alarm Panel (CAP) is inoperable (can not adequately detect a criticality or initiate an alarm).</p>	<p>I.1 Stop fissile material (greater than 15 grams) movements in the affected process area(s). Enter MODE 2, Limited Plutonium Handling Operations in the affected area(s).</p>	Immediately
	<p><u>OR</u></p>	
	<p>I.2 Stop fissile material (greater than 15 grams) movements in the affected process area(s). Enter MODE 2, Limited Plutonium Handling Operations in the affected process area(s).</p>	Immediately
	<p><u>AND</u></p> <p>I.2.1 Install transportable criticality alarm system (TCAS) in accordance with plant procedures to allow limited fissile material movement.</p> <p>-----NOTE-----</p> <p>I.2 fissile material movement stoppage is not required for planned maintenance outages where a TCAS is staged in advance to cover the affected area.</p>	

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OSR LCO COMPLIANCE SHEET	
APPLICABLE OSR LCO (WHC-SD-CP-OSR-010 Section 3.0):	
3.1.2 Criticality Detectors and Alarms	
SURVEILLANCE REQUIREMENTS:	
SURVEILLANCE	FREQUENCY
SR 3.1.2.1 VERIFY OPERABILITY of each detector and detector module response to a radiation check source.	Monthly
SR 3.1.2.2.1 VERIFY OPERABILITY of the CAS battery systems.	Monthly
SR 3.1.2.2.2 VERIFY OPERABILITY of individual CAS battery cells and uninterruptable power supply systems.	Quarterly
SR 3.1.2.3 VERIFY actuation of Audible Sound Generator audible and visual alarms.	Quarterly
SR 3.1.2.4 VERIFY OPERABILITY of the CAS Logic and Relay Modules.	Quarterly
APPLICABLE ACCIDENT ANALYSES (FSAR CH 9) SECTION/TITLE:	
9.2 ACCIDENTS	
9.2.3 Criticality	
9.2.4 Seismic Event	
9.2.4.11 Accident Scenarios-Criticality	
APPLICABLE PLANT/PROCESS DESIGN/OPERATION DESCRIPTION(S) [FSAR CHAPTER/SECTION]:	
5.0 PROCESS SYSTEMS	
5.4 SERVICE AND UTILITY SYSTEMS	
5.4.2 Electrical	
5.4.2.2 Safety Considerations and Controls.	
5.4.2.2.11 CAS.	
5.4.10 Safety Communications and Alarms	
5.4.10.1 Major Components and Operating Characteristics.	
5.4.10.1.7 CAS.	
8.0 RADIATION PROTECTION	
8.3 RADIATION PROTECTION DESIGN FEATURES	
8.3.4 Area Radiation and Airborne Radioactivity Monitoring Instrumentation	
8.3.4.1 Criticality Monitoring System	
BOUNDARY IDENTIFICATION DRAWINGS:	
H-2-28883, sheet 1, CRITICALITY ALARM SYSTEM BLOCK DIAGRAM AND DRAWING INDEX	

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OSR LCO COMPLIANCE SHEET

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

3.1.2 Criticality Detectors and Alarms

ESSENTIAL SYSTEM DRAWINGS:

H-2-28083, sheet 9, NUCLEAR CRITICALITY ALARM SYSTEM [Bldg 2736-2, 2736-2A]
H-2-28883, sheet 2, CRITICALITY ALARM SYSTEM BLOCK DIAGRAM AND DRAWING INDEX
H-2-28885, sheet 7, CRITICALITY ALARM SYSTEM FOUNDATION & TUNNEL [Bldg 234-5Z]
H-2-28885, sheet 8, CRITICALITY ALARM SYSTEM FIRST FLOOR [Bldg 234-5Z]
H-2-28885, sheet 9, CRITICALITY ALARM SYSTEM DUCT LEVEL [Bldg 234-5Z]
H-2-28885, sheet 10, CRITICALITY ALARM SYSTEM SECOND FLOOR [Bldg 234-5Z]
H-2-28885, sheet 11, CRITICALITY ALARM SYSTEM ROOF [Bldg 234-5Z]
H-2-28888, sheet 2, CRITICALITY ALARM SYSTEM FLOOR PLAN [Bldg 236-2]
H-2-80143, sheet 2, CRITICALITY ALARM SYSTEM [Bldg 2721-2, 2736-2B]
H-2-91823, sheet 6, CRITICALITY ALARM SYSTEM FLOOR PLAN [Bldg 241-2]

IMPLEMENTING PROCEDURES/COMPLIANCE VERIFICATION

OPERATING: ZO-100-400, "Perform Nuclear Operations Surveillance and Responses"
ZO-100-401, "Criticality Alarm System Non-routine Surveillance "
ZAR-017, "Criticality Alarm System Event Responses"

LABORATORY: NONE

HEALTH PHYSICS: NONE

OPERATING SPECIFICATION(S): NONE

ADMINISTRATIVE:

WHC-CM-4-29, Nuclear Criticality Safety Manual
HNF-IP-1115, Nuclear Criticality Alarm Manual for PFP

MAINTENANCE:

NON-LCO

1-ZM-023, "Restoring Criticality Alarm System to Normal Operation After AC Power Loss- System 99A"
1-ZM-008, "Functional Testing of Transportable Criticality Alarm Systems"
ZSR-99A-002, "Criticality Alarm System Sound Level Test"

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OSR LCO COMPLIANCE SHEET			
APPLICABLE OSR LCO (WNC-SD-CP-OSR-010 Section 3.0):			
3.1.2 Criticality Detectors and Alarms			
SURVEILLANCE REQUIREMENTS	PROCEDURE NUMBER	DESCRIPTION	PROCEDURE FREQUENCY
SR 3.1.2.1	ZSE-99A-011, "Criticality Alarm System Operability Test"	Verifies gamma detectors respond properly to a check source.	Monthly
	ZSE-99A-002, "Neutron Criticality Detector System and Alarm Operability Test"	Verifies neutron detectors respond properly to a check source.	Monthly
SR 3.1.2.2.1	ZSE-99A-006, "Monthly/Quarterly Inspection of Criticality Alarm System Batteries and UPS"	Verifies battery operability.	Monthly
SR 3.1.2.2.2	ZSE-99A-006, "Monthly/Quarterly Inspection of Criticality Alarm System Batteries and UPS"	Verifies battery operability.	Quarterly
SR 3.1.2.3	ZSE-99A-001, "Criticality Alarm System (CAS) Check out and Audible/Visual Alarm Test"	Verifies CAPs and alarm horn operability.	Quarterly
	ZSE-99A-002, "Neutron Criticality Detector System and Alarm Functional Test"	Verifies neutron detector visual and audible alarm operability.	Quarterly
SR 3.1.2.4	ZSE-99A-001, "Criticality Alarm System (CAS) Check out and Audible/Visual Alarm Test"	Verifies proper operation of CAS Logic and Relay Modules.	Quarterly
	ZSE-99A-002, "Neutron Criticality Detector System and Alarm Functional Test"	Verifies proper operation of CAS CAP Z-7 Neutron Comparator Panel Logic.	Quarterly
	ZSE-99A-008, "Replace Criticality Alarm Horn (CAH)"	Verifies proper operation of CAS horns.	As needed for inoperability.
Other: None			
NOTES/COMMENTS: None			

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**APPENDIX B
MASTER COMPONENT INDEX LISTING**

The Master Component Index Number for each item in the Criticality Alarm System is shown on the referenced Essential Drawings. The following is an amalgamation of approved components for the CAS.

Component	Manufacturer - Part and Model Number(s)
AC Power Relay	¹ Allen Bradley - # 700-C200-A1
ASG	Fabricated per H-2-72419
Battery	Exide Power Systems - 12 or 3 CC-5, 24 VDC, 100 A
Battery Charger	Exide Power Systems - Model SCRF 24-1-40-E, 24 VDC, 40 A
CAD/CADM	Nuclear Measurement Corporation - GA2-TMO
CAF	North American - Model ST-1250/Blue
CAH	Federal Signal Corporation - Model 300GC, 24 VAC/DC <u>or</u> Model 302GC, 24 VAC/DC and ² Selectone Connector Board Model 300CK
CALM	Fabricated per H-2-91180
CAP 27 Relay Module	Fabricated per H-2-99518, sheet 8
CAP 27 UPS	Matrix - Model 5000 with 4 battery packs
CARM	Fabricated per H-2-91180
Inhibit Switch Module	Fabricated per H-2-99522
Inhibit Switch	³ Square D - Class 9001, Type LRSA-2K1 with Type LA-1 Contact Blocks
Intertie Relay Module	Fabricated per H-2-89709
Master Intertie Reset Switch	Square D - Model #9001-KR-1RW13
Master Intertie Relays	⁴ Potter-Brumfield - Model KRP11DG-24, 24 VDC, DPDT Relay
Neutron Detector	Fabricated per H-3-29983 (Battelle Northwest Laboratory)
Neutron Source Holder	Fabricated per H-2-28814
Gamma Source Holder	Fabricated per H-2-28752

¹ Allen-Bradley is a registered trademark of the Allen-Bradley Company Inc., Milwaukee, WI.

² Selectone is a trademark of Federal Sign and Signal Corporation

³ Square D is a registered trademark of the Square D Company, Palatine, IL

⁴ Potter-Brumfield is a registered trademark of Potter & Brumfield Inc., Princeton, IN

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**APPENDIX C
CAS Detector Location and Coverage**

DETECTOR	DETECTOR LOCATION	AREAS COVERED
<u>CAP-Z1 Corridor No. 2</u>		
CAD-Z1-1A 1B 1C	Room 221-A	Rooms 221,A,B,C,D North half of Room 225 Duct Level Col 4-7, C-F 2nd Floor Chem Makeup Area, Col 4-7
CAD-Z1-2A 2B 2C	Corridor No. 5 Column 4E	Corridor 5, Col 1-12, Analytical Labs NW portion Duct Level, Col 4-7, E-G
CAD-Z1-3A 3B 3C	Duct Level Column 1E	Duct Level over Ana.Labs, Analytical Labs NE Portion, 2nd Floor Col C-G, 1-4
CAD-Z1-4A 4B 4C	Corridor 242-Z	Analytical Labs
CAD-Z1-5A 5B 5C	Corridor 4B by Room 139	Analytical Labs, Duct Level above Analytical Labs.
CAD-Z1-6A 6B 6C	Vault 192A South Wall	Vault 192A
<u>CAP-Z2 Corridor No. 2</u>		
CAD-Z2-1A 1B 1C	Room 232-A Column 11D	Portion of C-Line, Col 11-12 Duct Level, same location A-Line, col 8-14, C-D
CAD-Z2-2A 2B 2C	Corridor No. 5 Column 8E	Corridor 5, Col 4-16, C-Line Col 8-12, D- E, Duct Level over C-Line, Col 8-11, 2nd floor, north half of filter rooms Col 8- 11
CAD-Z2-3A 3B 3C	Room 166	Instrument shops, South half of Rooms 170 & 171
CAD-Z2-4A 4B 4C	Room 308 Column 7F	Second Floor, col 1-7, 3-J over analytical labs Filter rooms on East side
<u>CAP-Z3 Corridor No. 2</u>		
CAD-Z3-1A 1B 1C	Corridor 14-A	Elevator Shaft Areas in front of elevator shaft
CAD-Z3-2A 2B 2C	Room 235-B, Column 14D, Mezzanine Level	Room 235B, col 12-16, C-D Room 230B, col 13-15, D-E Duct Level, col 13-15, D-E
CAD-Z3-3A 3B 3C	Room 179 East Wall	Room 179 and 172 Duct Level, Col. 15-19, F-G
CAD-Z3-4A 4B 4C	Vault 221C	Vaults 221-B,C,& D, 225 and Duct Level, Col., 4-8, C-D

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DETECTOR	DETECTOR LOCATION	AREAS COVERED
CAD-23-5A 5B 5C	Corridor 10 by Room 182	Rooms 182, 183, 187, 188 and 190, Duct Level, Col. 14-18, E-F
CAD-23-6A 6B 6C	Corridor 6	Vault 174, 175 and 230C Duct Level, Col. 14-18, E-F
<u>CAP-24 Corridor No. 13</u>		
CAD-24-1A 1B 1C	Room 236, east wall, Column 18D3	Rm 236 & RADTU area Rm 230 A&B, Rm 179B NE portion of Chem Lab area Duct Level over Rm 236
CAD-24-2A 2B 2C	Room 236 SW Corner Column 23D3	Room 236 & RADTU area West side loading docks Duct Level over Rm 236
CAD-24-3A 3B 3C	Room 264 Duct Level Column 19C	Duct Level, Rm 264 Rm 235B & RADTU 2nd Fl, Fan Rm
CAD-24-4A 4B 4C	Corridor #3 by filter Room 320	West filter Rms, Col 13-23, A-G, Duct Level, Rm 264 Column 19D, Room 236
CAD-24-5A 5B 5C	Vault 192B North Wall	Vault 192B
CAD-24-6A 6B 6C	Vault 192C South Wall	Vault 192C
<u>CAP 2-5 236-Z Control Room</u>		
CAD-25-1A 1B 1C	236-Z Room 43	South half of 4th Floor
CAD-25-2A 2B 2C	236-Z Room 41	North half of 4th Floor
CAD-25-3A 3B 3C	236-Z Stairwell #2 Landing between 4th and 5th floor	Stairway from 3rd to 6th Fl.
CAD-25-4A 4B 4C	236-Z Room 50	Rm 50 & stairway outside Rm 50, Rm 60
CAD-25-5A 5B 5C	Third floor Elevator shaft	All of elevator shafts
CAD-25-6A 6B 6C	Third floor maintenance cell	Maintenance Hood, Upper half of Hot Cell
CAD-25-7A 7B 7C	Filter Room 26 West wall	Filter Room, Corridor outside Filter Rm

CAP-26 236-Z Control Room

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DETECTOR	DETECTOR LOCATION	AREAS COVERED
CAD-26-1A 1B 1C	Room 13 North wall	Bag out room Lower half of hot cell
CAD-26-2A 2B 2C	First floor Corridor 14 First-East	Corridor 14 Maintenance Shop
CAD-26-3A 3B 3C	Room 19 South wall	PR can unloading room
CAD-26-4A 4B 4C	Stairway No. 1 Between first and Second floor	Stairway from 1st to 3rd Floor
CAD-26-5A 5B 5C	Second floor Corridor No. 20 North Wall	Corridor 20
CAD-26-6A 6B 6C	Second floor West, West wall, midway	Corridor 21
CAD-26-7A 7B 7C	Stairway No. 2 Landing between second and third floor	Stairwell from 1st. to 3rd. Floor
<u>CAP-27 2736-2A North Room</u>		
CAD-27-5A 5B 5C	2736-Z Corridor East Wall	2736-Z Corridor
<u>NEUTRON DETECTOR 2736-2A South Wall, North Room</u>		
CAD-27-N1A N1B N1C	Vault No. 1 Ceiling	Vault No. 1
CAD-27-N2A N2B N2C	Vault No. 2 Ceiling	Vault No. 2
CAD-27-N3A N3B N3C	Vault No. 3 Ceiling	Vault No. 3
CAD-27-N4A N4B N4C	Vault No. 4 Ceiling	Vault No. 4
<u>CAP 29 2736-2B Room 638</u>		
CAD-29-1A 1B 1C	Room 642 South Wall	Room 642
CAD-29-2A 2B 2C	Room 641 West Wall	Room 641
CAD-29-3A 3B 3C	Room 638 North Wall	Room 638
CAD-29-4A 4B 4C	Room 636 West Wall	Room 636

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DETECTOR	DETECTOR LOCATION	AREAS COVERED
CAD-Z9-5A 5B 5C	Room 637 North Wall	Room 637
<u>CAP-Z8 241-Z North East Corner</u>		
CAD-Z8-1A 1B 1C	Between Tanks D4 & D5	Tanks D4-D5
CAD-Z8-2A 2B 2C	Between Tanks D7 & D8	Tanks D7-D8

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To PLUTONIUM FINISHING PLANT (PFP) FACILITY	From PFP ENGINEERING	Page 1 of 1 Date <u>8/18/97</u>
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