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Nuclear Business Unit

NOV 12 1999

LR-N990482

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

**LER 272/99-011-00
SALEM GENERATING STATION - UNIT 1
FACILITY OPERATING LICENSE NO. DPR-70
DOCKET NO. 50-272**

Gentlemen:

This Licensee Event Report entitled "125 VDC Control Power Circuits for 4KV Breakers Do Not Meet the Requirements of 10CFR50 Appendix R" is being submitted pursuant to the requirements of 10CFR50.73(a)(2)(ii)(B), 10CFR50.73(a)(2)(v), Salem Units 1 and 2 Technical Specification 6.9.3 and Salem Unit 2 License Condition 2.1.

Sincerely,

M. B. Bezilla
Vice President -
Operations

Attachment

BJT

C Distribution
LER File 3.7

IE22

The power is in your hands.

POB ADOR

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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TITLE (4)

125 VDC Control Power Circuits for 4KV Breakers Do Not Meet the Requirements of 10CFR50 Appendix R

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
10	28	99	99	-011	- 00	11	12	99	Salem Unit 2	05000311
									FACILITY NAME	DOCKET NUMBER
									FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	POWER LEVEL (10)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
1	45	20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
		20.2203(a)(1)	20.2203(a)(3)(i)	X 50.73(a)(2)(ii)	50.73(a)(2)(x)
		20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71
		20.2203(a)(2)(ii)	20.2203(a)(4)	50.73(a)(2)(iv)	X OTHER
		20.2203(a)(2)(iii)	50.36(c)(1)	X 50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A
		20.2203(a)(2)(iv)	50.36(c)(2)	50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Brian J. Thomas, Licensing Engineer	(856) 339-2022

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

During an ongoing review of the current Salem Post-fire Safe Shutdown Analysis, a concern was identified with the 125V DC control circuits for the 4KV circuit breakers in the post fire Alternate Shutdown (ASD) Area. In the event of a postulated fire in the ASD area, cables associated with the 4KV breaker 125 VDC control circuits could experience an external hot short on the positive side of the open/close coils. Such a short occurring in combination with multiple grounds (occurring due to postulated fire) on the negative 125 VDC circuit legs could result in energization of the closing or trip coils. This fire induced circuit failure (due to a combination of one hot short and two shorts to ground) could result in the inability to locally operate one or more 4KV breakers as required for alternate shutdown unless the hot short is removed. The multiple occurrence of this scenario could potentially cause multiple spurious operation and lead to loss of the vital buses.

The cause of this event is attributed to human error. Personnel involved with the development of the Safe Shutdown Analysis incorrectly interpreted the guidance of Generic Letter 86-10 for the evaluation of spurious operation of equipment. Immediate and long-term corrective actions are described in the detailed report.

This event is reportable in accordance with 10CFR50.73(a)(2)(ii)(B), "...a condition that was outside the design basis of the plant..." and 10CFR50.73(a)(2)(v), "...any event or condition that alone could have prevented the fulfillment of the safety function of structures that are needed to shutdown the reactor and maintain it in a safe shutdown condition..." This LER also satisfies the special reporting requirements of the Salem Unit 1 and 2 Technical Specifications Section 6.9.3 and Salem Unit 2 License Condition 2.I.

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PLANT AND SYSTEM IDENTIFICATION

Westinghouse – Pressurized Water Reactor

4160 V Breakers {EB/-}*

* Energy Industry Identification System {EIS} codes and component function identifier codes appear as (SS/CCC)

CONDITIONS PRIOR TO OCCURRENCE

At the time of discovery, Salem Unit 1 was in Mode 1 at 45% power. Unit 2 was in Mode 1 at approximately 100% power.

DESCRIPTION OF OCCURRENCE

During an ongoing review of the current Salem Post-fire Safe Shutdown Analysis, a concern was identified with the 125V DC control circuits for the 4KV circuit breakers in the post fire Alternate Shutdown (ASD) Area. ASD is implemented in the event of a fire in the Control Room, Relay Room or the ceiling of the 460V Switchgear room (ASD area). Operators implement the ASD methodology in accordance with procedures S1(2).OP-AB.CR-0002. The procedures require the 125 VDC control power for the 4KV breakers to be isolated by opening the main 125 VDC bus feeder breakers locally at the switchgear. The 4KV breakers are then manually operated at the switchgear as necessary to shed and load the 4KV buses in the event of a loss of offsite power.

In the event of a postulated fire in the ASD area, cables associated with the 4KV breaker 125 VDC control circuits could experience an external hot short on the positive side of the open/close coils. Such a short occurring in combination with multiple grounds (occurring due to postulated fire) on the negative 125 VDC circuit legs could result in energization of the closing or trip coils. This effectively bypasses the isolation provided by opening the control power breaker. This fire induced circuit failure (due to a combination of one hot short and two shorts to ground) could result in the inability to locally operate one or more 4KV breakers as required for alternate shutdown unless the hot short is removed. The multiple occurrence of this scenario could potentially cause multiple spurious operation and lead to loss of the vital buses. The ASD fire areas of concern are the 460V Switchgear rooms and the Relay rooms. Fire in the Control Room Complex is not a concern since the affected cables are not routed in the control room. This condition does not satisfy the 10CFR50 Appendix R performance goal of providing necessary electrical support functions for post fire safe shutdown.

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DESCRIPTION OF OCCURRENCE (cont'd)

Fire watches were established in the Unit 1 & 2 Relay Rooms and 460V Switchgear Rooms in accordance with the fire protection program.

This event is reportable in accordance with 10CFR50.73(a)(2)(ii)(B), "...a condition that was outside the design basis of the plant..." and 10CFR50.73(a)(2)(v), "...any event or condition that alone could have prevented the fulfillment of the safety function of structures that are needed to shutdown the reactor and maintain it in a safe shutdown condition..." This LER also satisfies the special reporting requirements of the Salem Unit 1 and 2 Technical Specifications Section 6.9.3 and Salem Unit 2 License Condition 2.1.

ANALYSIS OF OCCURRENCE

Generic Letter 86-10, "Implementation of Fire Protection Requirements," dated April 24, 1986, states in response to question 5.3.1:

"Sections III.G.2 and III.L.7 of Appendix R define the circuit failure modes as hot shorts, open circuits, and shorts to ground. For consideration of spurious actuations, all possible functional failure states must be evaluated, that is, that component could be energized or de-energized by one or more of the above failure modes. Therefore, valves could fail open or closed; pumps could fail running or not running; electrical distribution breakers could fail open or closed. For three-phase AC circuits, the probability of getting a hot short on all three phases in the proper sequence to cause spurious operation of a motor is considered sufficiently low as to not require evaluation except for any cases involving Hi/Lo pressure interfaces. For ungrounded DC circuits, if it can be shown that only two hot shorts of the proper polarity without grounding could cause spurious operation, no further evaluation is necessary except for any cases involving Hi/Lo interfaces."

As stated in letter LR-N96125, "Response to NRC Letter Dated January 25, 1996, 10CFR50 Appendix R Safe Shutdown Capability," PSE&G stated the following in regards to GL 86-10 Question 5.3.1:

"...PSE&G considered this question as guidance on what types of failure modes must be considered in identifying circuits associated with spurious actuation. It identifies that three-phase AC circuits and ungrounded DC circuits do not require evaluation..."

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ANALYSIS OF OCCURRENCE (cont'd)

Since the 125 VDC system at Salem is ungrounded, the assumption was made that review of these circuits for spurious operation was not required. Local actions to remove 125 VDC control power from the breakers was deemed the only necessary action to isolate the 4KV breakers from the alternate shutdown (ASD) areas and allow local manipulation of the breakers.

On March 17, 1997, the NRC responded back to the PSE&G. In regards to GL 86-10 Question 5.3.1 the NRC stated:

“...The intent of this staff response was to ensure that licensees performed analyses of sufficient depth to determine the adverse impacts of hot shorts, shorts to ground, or open circuits on safe-shutdown-related control circuits and their associated logic...”

As stated in the above response, the NRC staff informed PSE&G that PSE&G's interpretation of GL 86-10 Question 5.3.1 was not correct and that analysis of sufficient depth needed to be performed to determine the impact of spurious operation of equipment.

CAUSE OF OCCURRENCE

The cause of this event is attributed to human error. Personnel involved with the development of the Safe Shutdown Analysis incorrectly interpreted the guidance of Generic Letter 86-10 for the evaluation of spurious operation of equipment.

PRIOR SIMILAR OCCURRENCES

A review of LERs for Salem Units 1 and 2 for the past two years identified two similar occurrences.

LER 311/99-008-00 identified that the limit switch cables for both of the service water header valves (SW22) are routed through the same fire area. In the event of hot shorts, both of the header valves could go closed resulting in isolation of service water flow to both nuclear headers. A review of other limit switch cables for external hot shorts was performed and did not identify any other concerns beyond the service water valves. Although the corrective actions of LER 311/99-008-00 did not extend beyond verifying the impact of limit switch cables of motor operated valves (MOVs) used for safe shutdown, the problem with the 125 VDC control circuits for the 4KV breakers existed prior to submittal of the above LER on July 28, 1999. Therefore, the actions from LER 311/99-008-00 would not have been able to prevent recurrence of this existing condition.

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PRIOR SIMILAR OCCURRENCES (cont'd)

LER 272/99-009-00 identified that the PORV and block valves (a high/low pressure interface) were susceptible to spurious operation due to hot shorts that would lead to a loss of RCS inventory control contrary to the requirements of 10CFR50 Appendix R. Corrective actions from LER 272/99-009-00 include a review of the safe shutdown analysis to evaluate if similar problems exist with the other high/low pressure interface functions. The problem with the 125 VDC control circuits for the 4KV breakers existed prior to submittal of the above LER on October 22, 1999. Therefore, the actions from LER 272/99-009-00 would not have been able to prevent recurrence of this existing condition.

SAFETY CONSEQUENCES AND IMPLICATIONS

For design basis accident mitigation, the 4KV vital buses are not impacted by this condition and remain operable. However, the 4KV breakers' 125 VDC control circuits do not meet the requirements of 10CFR50 Appendix R. Inadvertent shorting/grounding of 4KV circuit breaker 125 VDC control circuits could result in inadvertent opening or closing of these breakers, or inability to locally position the breakers manually. This scenario could lead to loss of vital buses.

The possibility of a fire induced loss of all 4KV breaker control is highly unlikely. The following combined circuit failures need to occur in order to cause spurious operation of the 4KV breakers:

- An external hot short from the positive lead of the adjacent power cable to the positive side of the trip/close coil conductor of the 4KV breaker 125V DC control circuit.
- A short to ground from the negative 125V DC from another grounding source.
- A short to ground from the negative side of the trip/close coil circuit associated with the 4KV breaker.

The DC control cables routed in cable tray have external insulation, with a metal tape shield, and multiple individual insulated conductors within the shield. In order for the external hot short to occur, the fire would have to burn through the 125V DC cable jacket, shield, and conductor insulation. Concurrently, the fire would also have to burn through an adjacent cable jacket, shielding, and conductor insulation and then selectively affect specific DC conductors between the two cables. This same scenario would have to occur multiple times to affect all three vital buses.

Cables routed inside the Relay cabinets in the Relay Room are separated from the external insulation and shield when the cables enter the cabinet and are not afforded as much protection. Therefore, the above scenario occurring inside these cabinets is somewhat more likely. However, it should also be noted that Relay cabinets are channelized by electrical train.

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SAFETY CONSEQUENCES AND IMPLICATIONS (cont'd)

The possibility of a fire of a magnitude that would cause such shorts and failures to occur in the alternate shutdown area is also low for the following additional reasons:

- The Relay Room is equipped with a smoke and thermal detection system. The 460V Switchgear Room is equipped with an ionization (located at the ceiling and exhaust ventilation ducts) and thermal detection system. A fire would be detected in its early stages.
- The Relay Room is equipped with automatic Halon suppression system and the 460V Switchgear Room is equipped with an automatic carbon dioxide suppression system.
- Currently the fire areas of concern are monitored by compensatory measures (fire watch) in accordance with the Fire Protection Program.
- The cables in the postulated fire area are generally constructed of safety related IEEE rated cable material that minimizes fire propagation along the cables.

If a fire were to occur in any fire area, it would be detected early due to the early detection systems and the compensatory fire watches. Necessary actions could then be taken to contain such a fire.

PSE&G concludes that the existing condition has no significant impact on the health and safety of the public. The possibility of a fire induced loss of all 4KV vital buses is highly unlikely. This assessment is based on the highly unlikely cable failure mode for the 125 VDC control circuits, and the fire protection defense in depth philosophy of detection, suppression, and manual fire fighting capability provided for the affected areas such that fires would not develop beyond the incipient stages.

A review of this condition determined that a Safety System Functional Failure (SSFF) has occurred as defined in NEI 99-02.

CORRECTIVE ACTIONS

PSE&G is currently working to complete a Fire Wrap Project as described in letter LR-N97357 dated June 6, 1997, which includes periodic updates with the NRC. This project includes overall goals and completion dates. Corrective Actions 2 and 3 are encompassed within the commitments associated with this project. Additional corrective actions include:

1. Established compensatory measures in accordance with the Fire Protection Program.

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CORRECTIVE ACTIONS (cont'd)

2. Necessary corrective actions to resolve compliance with 10CFR50 Appendix R for the 125 VDC control power circuits for the 4KV breakers will be determined and implemented using PSE&G's corrective action program. (70002349 Act 0050)
3. A review of the Safe Shutdown Analysis is being performed as part of the Fire Wrap Project as committed in letter LR-N97357 dated June 6, 1997. The 125 VDC control circuits are being re-evaluated as part of this review. (70002349 Act. 0060)
4. Personnel responsible for the SSD analysis have been made aware of the incorrect interpretation of GL 86-10 and understand the NRC's interpretation of this guidance document.