



~~JUN 27~~ 2012

LR-N12-0154

10CFR 50.73

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, DC 20555-0001

LER 272/2012-001  
Salem Nuclear Generating Station Unit 1  
Facility Operating License No. DPR-70  
NRC Docket No. 50-272

SUBJECT: Single Train Actuation of Safety Injection Due to Failure of Solid State Protection System

The Licensee Event Report, "Single Train Actuation of Safety Injection Due to Failure of Solid State Protection System," is being submitted pursuant to the requirements of the Code of Federal Regulations, 10CFR 50.73(a)(2)(iv)(A), "Any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B)..." and under 10 CFR 50.73(a)(2)(i)(B) for conditions which were prohibited by the plant's Technical Specifications.

The attached LER contains no commitments. Should you have any questions or comments regarding the submittal, please contact David Lafleur of Salem Regulatory Assurance at 856-339-1754.

Sincerely,

A handwritten signature in black ink, appearing to read "C. Fricker".

Carl J. Fricker  
Site Vice President – Salem

Attachments (1)

JE22  
NRR

**JUN 27 2012**

cc            Mr. W. Dean, Administrator – Region 1, NRC  
              Mr. John Hughey, Licensing Project Manager – Salem, NRC  
              Mr. D. Schroeder, USNRC Senior Resident Inspector, Salem (X24)  
              Mr. P. Mulligan, Manager IV, NJBNE  
              Mr. T. Joyce, President and Chief Nuclear Officer – Nuclear  
              Mr. T. Cachaza, Salem Commitment Tracking Coordinator  
              Mr. L. Marabella, Corporate Commitment Tracking Coordinator  
              Mr. D. Lafleur, Salem Regulatory Assurance

# LICENSEE EVENT REPORT (LER)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to [infocollects.resource@nrc.gov](mailto:infocollects.resource@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

<b>1. FACILITY NAME</b> Salem Generating Station - Unit 1	<b>2. DOCKET NUMBER</b> 05000272	<b>3. PAGE</b> 1 of 5
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**4. TITLE**  
Single Train Actuation of Safety Injection Due to Failure of Solid State Protection System

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	30	2012	2012	0 0 1	0	06	27	2012		DOCKET NUMBER

<b>9. OPERATING MODE</b>  1	<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§:</b> (Check all that apply)							
<b>10. POWER LEVEL</b>  100%	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)				
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)				
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)				
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)				
	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)				
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)				
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)				
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER				
<input type="checkbox"/> 20.2203(a)(2)(vi)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A					

**12. LICENSEE CONTACT FOR THIS LER**

FACILITY NAME David Lafleur, Senior Compliance Engineer, Salem Regulatory Assurance	TELEPHONE NUMBER (Include Area Code) (856)-339-1754
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**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
X	JE	CHA	-	Y					

<b>14. SUPPLEMENTAL REPORT EXPECTED</b> <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO	<b>15. EXPECTED SUBMISSION DATE</b>	MONTH	DAY	YEAR
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**ABSTRACT** (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On April 30<sup>th</sup>, 2012, at 1003 hours. Salem Unit 1 experienced an invalid Train A Safety Injection, Reactor Trip, Main Steam Line Isolation, Emergency Diesel Generator start, Phase A Isolation, and start of the Auxiliary Feedwater Pumps.

Technical Specification 3.0.3 was entered due to both trains of Safety Injection actuation logic being blocked after actuation per system design. The plant exited Technical Specification 3.0.3 at 1428 hrs. when Train B of the Solid State Protection System was reset. The operating crew however, failed to recognize all Technical Specification Action Statements associated with inoperability of a single train of the Solid State Protection System and did not meet the requirement for entry into Mode 4. On May 1<sup>st</sup> at 0802 hours operators identified the applicable Action Statement and commenced a plant cooldown. The plant entered Mode 4 at 1739 hrs. and entered Mode 5 at 2129 hours.

The Safety Injection was caused by invalid actuation of Train A of the Solid State Protection System. The apparent cause of the failure to recognize entry into Technical Specification Action Statements was a lack of procedural adherence.

This event is being reported under 10 CFR 50.73(a)(2)(iv)(A) for actuation of the Reactor Protection and Safety Injection systems and under 10 CFR 50.73(a)(2)(i)(B) for conditions which were prohibited by the plant's Technical Specifications.

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Salem Generating Station Unit 1	05000272	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER
		2012 - 0 0 1 - 00		

**NARRATIVE**

**PLANT AND SYSTEM IDENTIFICATION**

Westinghouse – Pressurized Water Reactor (PWR/4)

SYSTEM – Solid State Protection System

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

**IDENTIFICATION OF OCCURRENCE**

Event Date: April 30, 2012

Discovery Date: April 30, 2012

**CONDITIONS PRIOR TO OCCURRENCE**

Salem Unit 1 was in Operational Mode 1. No additional structures, systems or components were inoperable at the time of the discovery that contributed to the event.

**DESCRIPTION OF OCCURRENCE**

On April 30, 2012, Salem Unit 1 was operating in Mode 1 at 100% Rated Thermal Power. Instrument and Control technicians were performing a functional surveillance on turbine first-stage pressure transmitter 1PT505 {JE/PT}. Test preparations require the tripping of High Steam Line Flow bistables which make up the High Steam Line Flow coincident with either the Low Steam Line Pressure or Low-Low Tavg Safety Injection logic of the Solid State Protection System (SSPS) {JE}. At 1003 hours (hrs.), upon trip of the second bistable, a Train A Safety Injection (SI) {JE/CHA} and Reactor Trip occurred. All SI, Phase A {JM} and Containment Ventilation Isolation components actuated as expected for a single train SI. The unit experienced a Main Feedwater {SJ} Isolation, a Main Steam {SB} Isolation, and auto start of the Auxiliary Feedwater (AFW) {BA} system and Emergency Diesel Generators {EK}.

Operations entered Emergency Operations Procedure 1-EOP-TRIP-1, Reactor Trip or Safety Injection, to respond to the trip and SI. Train B of SI was manually actuated. The unit then transitioned to 1-EOP-TRIP-3, Safety Injection Termination, to terminate the SI and realign the plant to transition to Mode 3, Hot Standby conditions. Because of the failure of Train A SSPS, the Train B SI actuation logic could not be reset to secure SI components. Operations declared entry into Technical Specification (TS) 3.0.3 at 1003 hrs. based on inoperability of both trains of SSPS.

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**NARRATIVE**

Following the trip, control room personnel notified Fire Protection of fire alarms in the following areas: 11, 13 and 14 Reactor Coolant Pumps (RCPs) {AC/PFR}, South Containment Penetration, Generator Seal Oil Unit {TI}, and Turbine Generator {TB}. At 1018 hrs. an Unusual Event (UE) was declared due to having non-validated fire alarms in the Protected Area of the plant for greater than 15 minutes. The UE was terminated at 1249 hrs. when all fire alarms were determined to be invalid.

Troubleshooting of the Train A SSPS was commenced. At 1428 hrs. Operations exited TS 3.0.3 by removing SSPS Train A from service and resetting SSPS Train B SI and declaring SSPS Train B Operable.

With Unit 1 in Mode 3 and Train A of SSPS still inoperable, several Technical Specification (TS) Action Statements applied to limit plant operation. As delineated in TS Table 3.3-3, Engineered Safety System Actuation Instrumentation, shift management acknowledged entry into Functional Unit 1. b., Safety Injection, Turbine Trip and Feedwater Isolation automatic actuation logic. The applicable Action Statement 13 allows the plant 6 hours to restore Operability or be in Mode 3 within the next 6 hrs. and in Mode 5 within the following 30 hrs. Shift management did not recognize additional requirements under TS Table 3.3-3, Functional Units 4 and 8, Steam Line Isolation and Auxiliary Feedwater (AFW), which required entry into the more restrictive Action Statement 20. Action Statement 20 allows 6 hrs. to restore operability or be in Mode 3 within the next 6 hrs. and in Mode 4 within the following 6 hrs. Compliance with Action Statement 20 would have required that the unit enter Mode 4 by 0228 hrs. on May 1.

On May 1, at 0802 hrs., shift personnel recognized the TS Mode compliance error and declared entry into TS Table 3.3-3, Action Statement 20. Unit 1 commenced a cooldown entering Mode 4 at 1739 hrs. and Mode 5 at 2129 hrs.

**CAUSE OF OCCURRENCE**

The SI actuation was caused by a failure of SSPS Train A logic. Troubleshooting and testing did not identify a definitive cause for the failure as the inadvertent SI signal could not be replicated. Potential causes were evaluated using a Failure Mode Cause Tree analysis. All major fault trees were investigated and possible causes were refuted or repaired. Potential signals that could cause the trip signal to be generated were confirmed absent and relays used as part of the 1PT505 functional test were exercised with no voltage perturbations or abnormal results received. All circuit cards in question were replaced. Additionally, all new style SSPS circuit cards were removed and replaced with the old style circuit cards in both SSPS trains. Note that five new style SSPS circuit cards were installed in SSPS Trains A and B in previous refueling outages. The five new style circuit cards consisted of three Safeguard Driver cards, 1 UV Driver card and 1 Tester card.

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High noise on the A407 Universal Logic card and an intermittent E-1 Error LED on the Undervoltage Driver card were noted. The apparent cause of the inadvertent SI was identified as induced noise on the SSPS 15 volt logic circuit. A review of applicable Operating Experience revealed that newer model SSPS driver cards may be sensitive to signal noise.

The apparent cause of the failure to identify all applicable TS and Mode change requirements was due to inadequate procedural adherence. The applicable entries into TS Action Statements were identified in the I&C procedure used for blocking the SSPS Train A system logic but were not briefed to the Control Room Supervisor and were not tracked. The Reactor Operator working with I&C did not enter the LCOs called for in the procedure at the time since TS 3.0.3 was more limiting and was in effect. No follow-up to apply these TS requirements occurred once Train B was reset and the I&C procedure LCO entries were effectively in use.

**PREVIOUS OCCURRENCES**

Salem Unit 2 LER 2007-003-001 reported a reactor trip on low-low level in a Steam Generator (SG) {SG} due to a spurious Feedwater isolation signal. The Feedwater isolation was generated by a faulty SSPS output driver card. The failed circuit card was due to a defective solder joint.

Salem Unit 1 LER 272/2010-004 reported a failure to recognize TS 3.0.4.b requirements for a risk assessment based on a Chiller being inoperable. The failure was due to inattention to detail when reviewing procedural controls for movement of irradiated fuel to a Dry Cask Storage Facility.

**SAFETY CONSEQUENCES AND IMPLICATIONS**

The health and safety of the public was not impacted by this event. Spurious actuation of SI while at power is a Condition 2 Event analyzed in section 15.2.14 of the plant UFSAR. All equipment responded as required and described for a spurious SI actuation in the safety analysis. Spurious Safety Injection with or without an immediate Reactor Trip presents no hazard to the integrity of the RCS, no cladding damage, no release of fission products and thus no safety hazard.

SSPS is comprised of two fully redundant trains that ensure its required safety function is met if one train is inoperable or malfunctions. Though the allowable time for the plant to be in Mode 3 was exceeded under TS Action Statement 20, Train B SSPS was Operable and capable of performing its intended SI actuation function. Both the Main Steam Isolation Valves (MSIVs) {SB/ISV} and the AFW system were Operable and capable of performing their design functions of steam line isolation and providing feedwater flow to the Steam Generators (SG) {SJ} when actuated on an SSPS generated signal. The MSIVs and the AFW system were also capable of manual control after the Train B SI signal was reset.

A review of this event determined that a Safety System Functional Failure (SSFF) as defined in NEI 99-02, Regulatory Assessment Performance Indicator Guideline, did not occur.

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**CORRECTIVE ACTIONS**

1. The four universal logic circuit cards which potentially could have caused the SI/Reactor Trip were replaced.
2. The five new style SSPS circuit cards were replaced on both SSPS trains for Salem Unit 1. New style SSPS circuit cards had not been installed in Unit 2 and thus did not need card replacement.
3. The A407 Universal Logic card was replaced and the induced noise on the SSPS 15 volt logic system was verified to be corrected.
4. The applicable SSPS cards will be sent to Westinghouse for additional testing.
5. A stand alone Shift Technical Advisor was assigned throughout the forced outage to monitor and ensure that proper control room crew oversight and back-up was provided for identification of TS compliance issues.
6. An evaluation is in progress to determine lessons learned and to identify follow-up actions for the failure to identify all applicable TS Action Statements when exiting TS 3.0.3.

**COMMITMENTS**

No commitments are made in this LER.