



APR 04 2016

LR-N16-0074

10 CFR 50.73

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

Salem Nuclear Generating Station Unit 2
Renewed Facility Operating License No. DPR-75
NRC Docket No. 50-311

SUBJECT: LER 311/2016-002-000
Automatic Reactor Trip Due to Main Turbine Trip

In accordance with the requirements of 10 CFR 50.73(a)(2)(iv)(A), PSEG Nuclear LLC is submitting the enclosed Licensee Event Report (LER) Number 311/2016-002-000, "Automatic Reactor Trip Due to Main Turbine Trip."

Should you have any questions or comments regarding the submittal, please contact Mr. Thomas Cachaza of Regulatory Affairs at 856-339-5038.

There are no regulatory commitments contained in this letter.

Sincerely,

A handwritten signature in black ink, appearing to read "Eric Carr", with a long horizontal line extending to the right.

Eric Carr
Plant Manager
Salem Generating Station

pjd

Enclosure – LER 311/2016-002-000

cc Mr. D. Dorman, Administrator – Region 1, NRC
Mr. T. Wengert, Licensing Project Manager – Salem, NRC
Mr. P. Finney, USNRC Senior Resident Inspector, Salem (X24)
Mr. T. Cachaza, Salem Commitment Tracking Coordinator (X25)
Mr. L. Marabella, Corporate Commitment Tracking Coordinator (N21)



LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

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 FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to 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.

1. FACILITY NAME Salem Generating Station – Unit 2	2. DOCKET NUMBER 05000311	3. PAGE 1 OF 4
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4. TITLE Automatic Reactor Trip due to Main Turbine Trip

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
02	04	2016	2016	002	000	04	04	2016	FACILITY NAME	DOCKET NUMBER
										05000
										05000

9. OPERATING MODE		11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)				
1	<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)
74%	<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 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

LICENSEE CONTACT Thomas J. Cachaza, Senior Regulatory Compliance Engineer	TELEPHONE NUMBER (Include Area Code) 856 - 339 - 5038
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13. COMPLETE ONE LINE FOREACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
X	TB	RLY	G082	Y					

14. SUPPLEMENTAL REPORT EXPECTED <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR

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

On 2/4/16 at 11:21, Salem Unit 2 automatically tripped from approximately 74% power. Power had been reduced at the beginning of dayshift to support a 500 KV transmission line outage. The reactor trip was due to a Main Turbine trip caused by a Main Generator Protection signal initiated by a main generator automatic voltage regulator (AVR) volts/hertz over excitation protection relay. All emergency core cooling systems and emergency safeguards feature systems functioned as expected. As found calibration data for the generator protection logic relay were found out of specification low. An evaluation determined the cause of the generator protection relay trip was poor manufacturing quality and/or shipping damage to an adjusting rheostat.

This report is being made in accordance with 10 CFR 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)," specifically automatic actuation of the Reactor Protection System and the Auxiliary Feedwater System for this event.



**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

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 FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to 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.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
Salem Generating Station – Unit 2	05000311	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 4
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NARRATIVE

PLANT AND SYSTEM IDENTIFICATION

Westinghouse-Pressurized Water Reactor {PWR/4}

Main Generator System/Relay {TB/RLY}

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

IDENTIFICATION OF OCCURRENCE

Event Date: 02/04/2016
Discovery Date: 02/04/2016

CONDITIONS PRIOR TO OCCURRENCE

On 02/04/2016, Salem Unit 2 was operating in MODE 1. At 07:00, Salem Unit 2 commenced a load reduction at 30% per hour to approximately 73% rated thermal power (RTP) to support a 500 kV line outage. Power was stabilized at approximately 74% RTP at 07:50.

DESCRIPTION OF OCCURRENCE

On 2/4/16 at 11:21 Salem Unit 2 automatically tripped from approximately 74% power on Generator Protection, initiated by the main generator Automatic Voltage Regulator (AVR) STV1 volts/hertz relay {TB/RLY}. At 11:20:36 Overhead Annunciator (OHA) H21 – “Generator Voltage/Frequency High” was received, followed by OHA H27 – “Gen Vreg Trbl” at 11:21:19. At 11:21:25 OHA F47 – “Generator Protection” was received, coincident with the Unit 2 trip.

The STV1 relay is an over excitation protection relay. Troubleshooting identified the STV1 was the contributor to the trip, so the calibration of the relay was checked. The as-found calibration data showed that the relay was out of specification low.

In the time period just prior to the Unit 2 trip, the generator was operating at approximately 26.1 KV, which corresponds to a 2.175 V/Hz sensed at the STV1 relay. The as found pick up for the STV1 relay was at 2.17 V/Hz, so the plant was operating above the relay's pick up set point. Once the set point was exceeded, the H21 OHA alarm was received in the Control Room. After the time delay of 45 seconds had elapsed, the trip relay picked up, starting the sequence of tripping the AVR on an external trip and dropping the generator field, causing the turbine trip on generator protection. The turbine trip resulted in a reactor scram.

The Unit 2 AVR was replaced during the 2R21 refueling outage in Fall 2015. The STV1 was original plant design. A new relay was purchased, calibrated, and installed at the time of the AVR replacement.



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A four-hour NRC Event Notification (EN) was required by 10 CFR 50.72(b)(2)(iv)(B) for actuation of the reactor protection system (RPS) when the reactor is critical and an eight-hour NRC EN was required by 10 CFR 50.72(b)(3)(iv)(A) for a valid actuation of the auxiliary feedwater system. EN 51708 was completed at 13:33 on 02/04/2016. This LER is being submitted pursuant to the requirements of 10CFR50.73 (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)."

CAUSE OF EVENT

The generator trip, and subsequent automatic reactor trip, was initiated by the main generator automatic voltage regulator (AVR) STV1 volts/hertz over excitation protection relay. This relay tripped at a volts/hertz level less than the design set point (104.5% vs. 110%) during voltage manipulations to support a line outage. Failure analysis identified the cause of the trip as damage to the R14 rheostat on the STV1 relay card. This damage is attributable to either poor manufacturing quality or inadequate shipping and handling. This rheostat directly controls the set point at which the STV relay will trip for over excitation protection. This defect caused the relay to trip prior to its design value. The STV-1 relay could not be adjusted to within the manufacturer's acceptance criteria (+/-1%) with the failed R14 rheostat.

This relay was installed during the 2R21 refueling outage (Fall 2015), during the AVR upgrade project. The new relay was tested prior to installation. Due to a less rigorous testing procedure (compared with the manufacturer's requirements) the opportunity to identify the relay damage at that time was missed. The manufacturer's acceptance testing requires verifying the V/Hz pickup is within 1% of the dial setting on the relay for dial setting marked positions. The pre-installation test only verified the pickup value was within 4% of dial setting.

SAFETY CONSEQUENCES AND IMPLICATIONS

The generator protection schemes serve as asset protection for the generator, main power transformers, and main turbine. The generator over excitation protection scheme is accomplished by four GE STV relays set to protect two zones of protection. Two of the four relays are set to trip at 110% and the other two at 118% of generator voltage. During an over excitation condition when the generator voltage is over 110% or 118%, an external trip is sent to the voltage regulator which ultimately results in a generator trip. There is a backup relay for every protection setting in order to prevent inadvertent damage to the generator or transformers in the event that there is an undetected failed relay during an over-voltage condition. When the GE Alterrex voltage regulator was replaced with the ABB Unitrol automatic voltage regulator, the existing generator over excitation protection scheme (i.e., original design) was maintained and the same settings were used based on the over excitation relays coordination analysis. The generator protection trip occurred at a value below that required to ensure no generator damage.



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There were no safety consequences as a result of this event. All emergency core cooling systems (ECCS) and emergency safeguard feature (ESF) systems functioned as expected. No equipment was damaged as a result of the event. The plant was stabilized in Mode 3 with decay heat removal via the main steam dump valves and auxiliary feed water system. Condenser vacuum remained available for decay heat removal.

SAFETY SYSTEM FUNCTIONAL FAILURE

A review of this event determined that a safety system functional failure (SSFF) did not occur as defined in NEI 99-02, Regulatory Assessment Performance Indicator Guidelines.

PREVIOUS EVENTS

A review of previous events identified one that occurred in December 2012 which was caused by relay set point drift. This event was reported in LER 272/2012-005.

CORRECTIVE ACTIONS

1. The STV1 relay was replaced with a new, calibrated relay prior to Unit 2 restart.
2. Salem Unit 1 STV relays will be tested per the manufacture’s acceptance test concurrent with the AVR replacement in the Spring 2016 refueling outage.

COMMITMENTS

There are no regulatory commitments contained in this LER.