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

LER 311 / 04 – 008 – 00
Salem Generating Station Unit 2
Facility Operating License DPR- 75
Docket No. 50-311

This Licensee Event Report entitled "Unplanned Reactor Trip Due to Main Generator Exciter Brush Failure" is being submitted pursuant to the requirements of 10CFR 50.73(a)(2)(iv)(A). The attached LER contains no commitments.

Should there be any questions regarding this matter please contact Howard Berrick at 856-339-1862.

Sincerely,

A handwritten signature in black ink, appearing to read "C. Fricker", written over the printed name.

C. Fricker
Salem Plant Manager

Attachment

HGB

C Distribution
 LER File 3.7

TE22

LICENSEE EVENT REPORT (LER)

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

Estimated burden per response to comply with this mandatory collection request: 50 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 Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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 Unplanned Reactor Trip Due to Main Generator Exciter Brush Failure
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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
09	09	2004	2004	- 008 -	00	11	8	2004	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE 1	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)									
10. POWER LEVEL 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)(vii)(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)(vii)(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 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 Howard G. Berrick, Senior Licensing Engineer	TELEPHONE NUMBER (Include Area Code) 856-339-1862
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13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
E	-	-	-	No					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On September 9, 2004 at 0106 hours Salem Unit 2 automatically tripped off line as a result of a Main Turbine Trip which initiated a Reactor Trip. The turbine tripped on Generator Differential and Loss of Field. All control rods fully inserted and all safety related systems were available and functioned as designed. The direct cause of this event was exciter brush/collector flashover. The root causes of this event were that the Generator/Exciter vendors' recommended inspections were not implemented and the lessons learned from a 1993 Hope Creek brush failure were not applied to Salem Unit 2. (Salem Unit 1 is a different Generator/Exciter). Corrective actions taken include replacing the Salem Unit 2 exciter brushes, repair to the collector ring damaged in the brush failure event, incorporation of vendor recommended inspections and guidance into plant procedures. This report is being made in accordance with 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), specifically (B)(1) reactor trip."

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
Salem Generating Station Unit 2	05000311	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 4
		2004	- 0 0 8 -	00	

17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

PLANT AND SYSTEM IDENTIFICATION

Westinghouse - Pressurized Water Reactor
Main Generator Excitation / Exciter {TL/ EXC} *

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

IDENTIFICATION OF OCCURRENCE

Event Date: September 9, 2004

Discovery Date: September 9, 2004

CONDITIONS PRIOR TO OCCURRENCE

The plant was in Mode 1 (Power Operation), at 100% power, at the time of the event. Prior to the trip, the 500kV breaker 2-10 had been removed from service. This did not contribute to the event. No other structures, systems or components were inoperable at the time of the occurrence that contributed to the event.

DESCRIPTION OF OCCURRENCE

On September 9, 2004 at 0106 hours Salem Unit 2 tripped off line as a result of a Turbine Trip, which initiated a Reactor Trip. The turbine tripped on Generator Differential and Loss of Field. The loss of the Generator Exciter {TL/ EXC} field resulted in a degraded 4kV group bus voltage condition. The 4kV bus under voltage (UV) relays picked up and timed out, resulting in a Reactor Coolant Pump (RCP) BUS UV trip, per design.

All control rods fully inserted. Auxiliary Feedwater automatically initiated, as expected, on Steam Generator Low-Low Level. Decay heat removal was available via the steam dumps to the condenser. All safety related systems were available and functioned as designed.

Prior to the trip, the 500kV breaker 2-10 had been removed from service for maintenance. Upon the Turbine/Reactor Trip, the 500 kV output breakers 1-9 and 9-10 opened as designed, and the 500 kV transmission line (5037) to Hope Creek was de-energized. Two (2) offsite power sources remained available and all three Emergency Diesel generators were operable.

A four-hour notification was made to the NRC on September 9, 2004 in accordance with 10 CFR 50.72 (b)(2)(iv)(b), for actuation of the reactor protection system. This event is also reportable pursuant to 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), specifically (B)(1) reactor trip."

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
Salem Generating Station Unit 2	05000311	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	3 OF 4
		2004	- 0 0 8 -	00	

17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

CAUSE OF OCCURRENCE

The loss of the main generator field was due to a degraded exciter. The loss of the generator field resulted in a main generator trip, which resulted in a turbine trip.

The root causes of this event were the Generator/Exciter vendor recommended inspections were not implemented when the GE generator was installed via modification in 1986, and the lessons learned from the Hope Creek Alterrex brush failure in 1993 were not applied to the Salem Unit 2 generator.

The direct cause of the occurrence is the Alterrex brush/collector flashover. Flashover is when brushes and collector ring degrade to a point that severe arcing occurs; the gap between brush and collector ring increases until the arc breaks down and the circuit opens. Inadequate monitoring of Alterrex brush condition allowed brush degradation to progress to the point of flashover. This is an organizational and programmatic cause.

A contributing cause was the frequent changing of responsibility for the Preventive Maintenance (PM) Program and frequent changing of system engineering assignments allowed for inadequacies in the Alterrex monitoring from being corrected.

PREVIOUS OCCURRENCES

Salem and Hope Creek Generating Station LERs for years 2001 through 2004 were reviewed for similar occurrences, which involved either generator/exciter failure or lack of incorporating vendor information.

LER 272/2004-003 reported a plant shutdown to comply with TS 3.6.1.1, Containment Integrity, as a result of the Service Water to Turbine Building Isolation Valve being declared inoperable. One of the contributing causes of the event was attributed to the failure to incorporate a caution note from the vendor technical manual into procedures. The corrective action associated with this event was to revise the procedure used for valve and actuator installation.

Based on the review of the above LER, the corrective actions were focused to the specific events above and would not have prevented this event from occurring.

SAFETY CONSEQUENCES AND IMPLICATIONS

This was an unplanned automatic trip with no complications. There were no nuclear, personnel, or radiological safety consequences associated with this event and there was no impact to the health and safety of the public.

The exciter brush failure / flashover caused a loss of main generator field which resulted in trip of the main generator, and a subsequent Main Turbine Trip and Reactor Trip. This condition is bounded by a loss of external electrical load and/or Turbine Trip discussed in UFSAR section 15.2.7. The main generator is classified as non-safety related and is not seismically qualified.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
Salem Generating Station Unit 2	05000311	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	4 OF 4
		2004	- 0 0 8 -	00	

17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

SAFETY CONSEQUENCES AND IMPLICATIONS (contd.)

A review of this event determined that a Safety System Functional Failure (SSFF) as defined in the Nuclear Energy Institute (NEI) 99-02 had not occurred. This event did not impact the ability of safety systems to shutdown the unit or mitigate the consequences of an accident.

CORRECTIVE ACTIONS:

1. The Unit 2 Exciter brushes were replaced and damage to the collector ring was repaired.
2. Procedures S2.OP-DL.ZZ-0005 (Q), Salem Unit 2 Secondary Plant Log, and HC.OP-DL.ZZ-0005 (Q), Hope Creek Log 5 Turbine Building Log, will be revised to require daily inspections of the exciters for arcing and degraded conditions, as recommended by the vendor.
3. Operator lesson plans associated with the Main Generator Exciters will be revised to include objectives that cover brush and slip ring inspection criteria, brush arcing and sparking, and the additional lessons learned not directly related to the failure. This training will be provided to Salem and Hope Creek Operators.
4. New weekly and monthly PM tasks will be generated for Salem Unit 2 main and Alterrex brushes (vice the previous every two months PM). The new PMs will include the recommendations from the vendor, will consider recent Operating Experience, and will mirror the main and Alterrex brush inspection guidance that currently exists in the Hope Creek inspection procedure.
5. The scope and schedule of on-going PM Optimization reviews will be reviewed to ensure the PM reviews of critical equipment includes a comparison of the PMs to the vendor recommended PMs and the differences (actual PM less than the vendor recommended PMs) are adequately justified and permanently documented.
6. Salem and Hope Creek system turnover expectations will be reviewed by Engineering for adequacy.

COMMITMENTS

This LER contains no Commitments.