

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Salem Generating Station - Unit No. 2										DOCKET NUMBER (2) 0 5 0 0 0 3 1 1										PAGE (3) 1 OF 05																																			
TITLE (4) Generator-Turbine/Reactor Trip Due To Loss Of Field On The Main Generator																																																							
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 NAMES						DOCKET NUMBER(S)																									
0			3			12			8			7			8			7			-		0		0		4		-		0		0		4			0			9			8			7			0 5 0 0 0					
OPERATING MODE (9)						1						THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 8: (Check one or more of the following) (11)																																											
POWER LEVEL (10)						1 0 0						20.402(b)						20.402(c)						20.734(c)(iv)						73.71(b)																									
												20.402(a)(1)(i)						20.402(a)(1)						20.734(c)(v)						73.71(c)																									
												20.402(a)(1)(ii)						20.402(a)(2)						20.734(c)(vi)						OTHER (Specify in Abstract below and in Text, NRC Form 308A)																									
												20.402(a)(1)(iii)						20.734(c)(1)						20.734(c)(vii)(A)																															
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LICENSEE CONTACT FOR THIS LER (12)																																																							
NAME R. K. Heller - LER Coordinator																TELEPHONE NUMBER AREA CODE 6 0 9 3 3 9 - 4 3 0 9																																							
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)																																																							
CAUSE		SYSTEM		COMPONENT		MANUFACTURER		REPORTABLE TO NRC				CAUSE		SYSTEM		COMPONENT		MANUFACTURER		REPORTABLE TO NRC																																			
SUPPLEMENTAL REPORT EXPECTED (14)																EXPECTED SUBMISSION DATE (15)				MONTH		DAY		YEAR																															
<input checked="" type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)																				1		2		3		1		8		7																									
ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)																																																							

On March 12, 1987, at 0930 hours, following a load increase to 1160 MWe and 530 MVAR, Salem Unit No. 2 experienced a Generator-Turbine/Reactor Trip. The "root cause" of this occurrence remains under investigation. The investigation results suggest that the loss of Generator excitation occurred due to a bumped transfer when the voltage regulator was shifted from auto to manual. When this occurred, Generator field current was observed to drop from 5500 amps to approximately 3000 amps. In accordance with design, the shift of the voltage regulator was initiated by the Exciter Overcurrent Protection. All of the relays potentially responsible for the occurrence were checked. No adjustments were required. All of the voltage regulator protection functions were verified. This occurrence was discussed with the Generator Vendor. A review of the system design with the Vendor is continuing. All trips for the exciter field breaker were evaluated and eliminated. New operating curves were issued with a limit of 400 MVAR. No problems of this nature have been experienced when the Unit has been operated below 500 MVAR.

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PLANT AND SYSTEM IDENTIFICATION:

Westinghouse - Pressurized Water Reactor

Energy Industry Identification System (EIIS) codes are identified in the text as {xx}

IDENTIFICATION OF OCCURRENCE:

GENERATOR-TURBINE/REACTOR TRIP DUE TO LOSS OF FIELD ON THE MAIN GENERATOR

Event Date: 03/12/87

Report Date: 04/09/87

This report was initiated by Incident Report No. 87-094

CONDITIONS PRIOR TO OCCURRENCE:

Mode 1 Reactor Power 100% - Unit Load 1160 MWe

DESCRIPTION OF OCCURRENCE:

On March 12, 1987, at 0930 hours, following a load increase from 1140 to 1160 MWe, Salem Unit No. 2 experienced a Generator-Turbine/Reactor Trip. At the time of the occurrence, Unit No. 2 was operating at 1160 MWe and 530 MVAR output. Although within the operating guidelines, this MVAR output represented the highest value of MVAR output ever recorded for the Salem Units.

The first out annunciator window F-47, "Generator Protection" {IT} was illuminated, indicating that it was the initiating event leading to the Generator-Turbine/Reactor Trip. Prior to the Trip, the operators had increased the Generator {TB} power output from 1140 MWe to 1160 MWe. After the load change, the G-6 overhead annunciator window, "Generator Exciter Field Overcurrent" alarmed, and the voltage regulator transferred from auto to manual. When this occurred, Generator field current was observed to drop from 5500 amps to approximately 3000 amps, and then the Generator-Turbine/Reactor Trip occurred.

Relay flags were observed on the regular and back-up Generator Protection circuits "Loss of Field" relays. The Generator regular protection multi-trip relay which had operated, provides the input to the G-13 overhead annunciator window, "Generator Diff and Loss of Field" which did alarm.

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DESCRIPTION OF OCCURRENCE: (cont'd)

In summary, the relay flags indicate the initiating event for the Generator-Turbine/Reactor Trip was a loss of the Generator field.

APPARENT CAUSE OF OCCURRENCE:

It is known that the cause of the Reactor Trip was the Turbine Trip caused by Generator Protection Relay operation resulting from a loss of field. Investigations into the "root cause" for the loss of the generator field have not yielded a positive conclusion.

At this point, the "root cause" of this occurrence remains under investigation. Although it has not been definitely proven, the investigation results suggest that a loss of excitation occurred due to a bumped transfer when the voltage regulator was shifted from auto to manual. In accordance with design, the auto to manual shift of the voltage regulator was initiated by the Exciter Overcurrent Protection. The loss of excitation regular protection initiated a trip of the Generator.

ANALYSIS OF OCCURRENCE:

A Turbine trip is initiated by the Generator Protection in order to limit equipment damage when a fault is indicated in either the Main Generator, Main Transformers, or the Auxiliary Power Transformers. With the power level above ten percent (10%), a Generator-Turbine Trip initiates a Reactor Trip in order to limit the primary and secondary plant transient associated with the loss of load.

The Generator-Turbine/Reactor Trip results in a short term release of steam to the condenser via the steam dump. The steam release removes sensible heat from the Reactor Coolant System and avoids Steam Generator Safety valve actuation.

The Trip is anticipatory in nature and is included as part of good engineering practice and design. No credit is taken in any of the safety analysis for this Trip. Reactor protection during power operation is provided by the Power Range Detectors for rapid transients and by the Overtemperature Delta Temperature/Overpressure Delta Temperature Protection for slower developing transients.

The plant is designed for four hundred (400) trips from full power. This was Trip No. 101 for the Unit. A significant portion of the Unit Trips have been from less than full power. Therefore, this Trip was within the design basis of the plant.

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ANALYSIS OF OCCURRENCE: (cont'd)

All systems functioned as designed, therefore, no undue risk to the health and safety of the public was involved. However, due to the automatic operation of the Reactor Protection System, this event is reportable in accordance with the Code of Federal Regulations 10CFR50.73 (A)(2)(iv).

CORRECTIVE ACTION:

The Relay Department verified the settings and the operation of all of the relays which had their flags dropped and other selected relays which could have caused the event. All of the relays were found to be satisfactory and no adjustments were required.

All of the voltage regulator protection functions were verified. The verification included setpoints checks, functional operation, and annunciation correlations. The protection functions verified were Generator Exciter Field Overcurrent, Generator Field Overvoltage, and Volts/Hertz protection. The testing indicated that the protection functions operated as per design.

Setpoint adjustments were required for the Generator Field Overvoltage and Exciter Field Overcurrent Relays. However, the as found condition would not have caused a loss of the Generator Field.

The Voltage Regulator Auto/Manual Mismatch Alarm was also found to be set incorrectly, such that it would not alarm on an auto/manual setpoint mismatch. This has also been corrected.

The Generator Vendor was contacted regarding the sequence of events. The Vendor's response was that the alarm "Generator Exciter Field Overcurrent" and transfer from auto to manual should have been simultaneous. This was confirmed in testing. As per their suggestion, all of the protective functions were verified. A review of the system design with the Vendor is continuing.


In addition, since the "Loss of Field" could have been caused by opening of the exciter field breaker, all of the trips which open the breaker were evaluated and eliminated as possible initiating events.

The Trip occurred when the Unit was being operated at the upper limit of the Generator capability curve, in the region of (530 MVAR lag and 1160 MWe). Therefore, it was decided during a subsequent Station Operations Review Committee meeting, (Mtng. No. 87-15) that due to the results of the investigations, power operation should be permitted with MVAR limited to a value of 400 MVAR or less. No problems of this nature have been experienced when the Unit has been operated below the 500 MVAR area.

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Investigations into the cause of the loss of generator field are continuing. A supplemental report will be submitted when these investigations are completed.


General Manager -
Salem Operations

RKH:pc

SORC Mtg. 87-026



PSEG

Public Service Electric and Gas Company P.O. Box E Hancocks Bridge, New Jersey 08038

Salem Generating Station

April 9, 1987

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

Dear Sir:

SALEM GENERATING STATION
LICENSE NO. DPR-75
DOCKET NO. 50-311
UNIT NO. 2
LICENSEE EVENT REPORT 87-004-00

This Licensee Event Report is being submitted pursuant to the requirements of 10CFR 50.73(a)(2)(iv). This report is required within thirty (30) days of discovery.

Sincerely yours,

J. M. Zupko, Jr.
General Manager-
Salem Operations

RKH:pc

Distribution

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