

## LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Salem Generating Station - Unit 2										DOCKET NUMBER (2) 0 5 0 0 0 3 1 1										PAGE (3) 1 OF 0 4		
TITLE (4) Reactor Trip From 54% - SF/FF Mismatch and Low Level #24 SG																						
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 9	0 5	8 4	8 4	0 2 2	0 0 1	0 0	5 8	4							0 5 0 0 0							
OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5. (Check one or more of the following) (11)																				
1		20.402(b)				20.406(c)				<input checked="" type="checkbox"/> 50.73(a)(2)(iv)				73.71(b)								
POWER LEVEL (10)		20.406(a)(1)(i)				50.36(e)(1)				50.73(a)(2)(v)				73.71(c)								
0 5 4		20.406(a)(1)(ii)				50.36(e)(2)				50.73(a)(2)(vi)				OTHER (Specify in Abstract below and in Text, NRC Form 366A)								
		20.406(a)(1)(iii)				50.73(a)(2)(i)				50.73(a)(2)(vii)(A)												
		20.406(a)(1)(iv)				50.73(a)(2)(ii)				50.73(a)(2)(vii)(B)												
		20.406(a)(1)(v)				50.73(a)(2)(iii)				50.73(a)(2)(ix)												
LICENSEE CONTACT FOR THIS LER (12)																						
NAME J. L. Rupp										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												
X	S	J	A	L	M	X	9	9	9	Y		B	S	J	P		I	0	7	5	Y	
X	S	J	S	C		E	1	4	9	Y												
SUPPLEMENTAL REPORT EXPECTED (14)												EXPECTED SUBMISSION DATE (15)		MONTH		DAY		YEAR				
<input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)												<input checked="" type="checkbox"/> NO										

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

On September 5, 1984, a reactor trip from fifty-four percent power occurred due to steam flow/feed flow mismatch coincident with low water level in No. 24 Steam Generator. The root cause of the event was a sheared shaft on No. 22 Condensate Pump, caused by fracture of the lower pump bearing support. Air entrainment into the system caused speed oscillations of No. 22 Steam Generator Feed Pump. This, coupled with a slightly lower than normal overspeed trip setting, resulted in the pump tripping on overspeed. Due to a failure to receive the feed pump trip alarm on the control room bezel, the first indication of a problem was the automatic starting of No. 21 and No. 22 Auxiliary Feed Pumps. Realizing that the feed pump had tripped, No. 23 Auxiliary Feed Pump was started and a load reduction was attempted; however, the reactor trip was unavoidable. The lack of a feed pump trip alarm was due to a setpoint shift of the control oil pressure detector. The condensate pump was replaced with a spare, the control oil pressure detector was calibrated and the feed pump overspeed setting was adjusted to specification. Testing verified proper overspeed trip and alarm functions. The Reactor Protection System functioned as designed; however, due to its automatic actuation, the event is reportable in accordance with 10CFR 50.73(a)(2)(iv).

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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:**

Reactor Protection System [JC] - Reactor Trip From 54% - Steam Flow/Feed Flow Mismatch Coincident With Low Water Level in No. 24 Steam Generator

Event Date: 09/05/84

Report Date: 10/05/84

This report was initiated by Incident Report No. 84-143

**CONDITIONS PRIOR TO OCCURRENCE:**

Mode 1 - Rx Power 054 % - Unit Load 580 MWe

**DESCRIPTION OF OCCURRENCE:**

On September 3, 1984, No. 21 Steam Generator Feed Pump [SJ] was removed from service due to speed oscillations. Reactor power level was maintained at fifty-four percent (54%) while investigating the problem and affecting the required repairs. At 0311 hours, on September 5, 1984, control room operators acknowledged the automatic starting of No. 21 and No. 22 Auxiliary Feed Pumps [BA]. At the same time, suction flow on No. 22 Steam Generator Feed Pump (SGFP) was observed to be oscillating and the water level in all steam generators commenced decreasing. No. 23 Auxiliary Feed Pump (AFP) was started, and an attempt was made to unload the turbine generator. At 0312 hours, a reactor trip occurred due to steam flow greater than feed flow, coincident with a low water level in No. 24 Steam Generator. No. 22 SGFP was observed to be tripped; however, no feed pump trip and low control oil pressure alarm was received. In addition, a check of the local annunciator panel revealed no alarms which would have indicated the cause of the feed pump trip. In accordance with the requirements of the Code of Federal Regulations, 10CFR 50.72(b)(2)(ii), at 0402 hours, the Nuclear Regulatory Commission was notified of the automatic actuation of the Reactor Protection System.

**APPARENT CAUSE OF OCCURRENCE:**

The root cause of the event was attributed to the fracture of the bellmouth bearing support ribs on the suction of No. 22 Condensate Pump. The fractured support ribs entered the first stage of the pump suction, caused binding and resulted in a sheared shaft.

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**APPARENT CAUSE OF OCCURRENCE: (cont'd)**

The sheared shaft, in turn, resulted in air entrainment into the system. Air entering the suction of No. 22 SGFP resulted in cavitation and speed oscillations. This was verified by the observed flow oscillations and visual observations of the pump by personnel just prior to the pump trip.

The electrical overspeed trip setting of the feed pump was found to be two-hundred, eighty (280) RPM low (5800 RPM). Since the initial pump speed was approximately five-thousand (5000) RPM, it is felt that No. 22 SGFP tripped as a result of an overspeed condition, caused by the introduction of air into the system.

It was discovered that the feed pump overspeed trip and local alarm functions operate off of two independent contacts. Testing confirmed that these two contacts do not make up simultaneously; therefore it was possible for the pump trip to occur without getting a corresponding trip alarm on the local annunciator panel. The lack of the flashing feed pump trip light on the control room bezel was due to the setpoint of the low control oil pressure device shifting. The lack of this alarm explains why the first indication of a problem was the automatic starting of No. 21 and No. 22 AFP's.

The AFP's started as the result of the trip signal from No. 22 SGFP, concurrent with the presence of an auto trip signal from No. 21 SGFP (low suction pressure and low bearing oil pressure because the pump was out of service for repairs).

**ANALYSIS OF OCCURRENCE:**

This reactor trip, on steam flow/feed flow mismatch with low steam generator water level, is an anticipatory trip. Its function is to prevent a loss of heat sink capability, by sensing conditions which would eventually result in a dry steam generator. By tripping the reactor prior to reaching the low-low level setpoint in the steam generator, the required starting time and capacity requirements for the Auxiliary Feed System [BA] are reduced; thereby, minimizing the thermal transient on the steam generators and the Reactor Coolant System [AB]. The Reactor Protection System [JC] functioned as designed. This occurrence involved no undue risk to the health or safety of the public. Because of the automatic actuation of the Reactor Protection System, the event is reportable in accordance with the Code of Federal Regulations, 10CFR 50.73(a)(2)(iv).

**CORRECTIVE ACTION:**

The condensate pump manufacturer (Ingersoll-Rand) had previously expressed concern with the bellmouth bearing support design. They recommended that, when pump overhaul was necessary, the four (4) rib support presently installed be replaced with a new six (6) rib design. The new supports are presently being manufactured, and are not yet available.

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**CORRECTIVE ACTION: (cont'd)**

Prior to this event, during the recent refueling outage, the supports for No. 11 and No. 13 Condensate Pumps (Unit 1) were inspected; no defects were noted. Unit 2 pumps were scheduled for inspection during the upcoming refueling outage. This is the first failure of this sort ever experienced with any of the condensate pumps. No. 22 Condensate Pump was replaced with a spare pump. The bearing support was inspected prior to installation; the inspection results were satisfactory.

Concerning No. 22 SGFP, the overspeed trip device was adjusted to the proper setpoint of six-thousand, eighty (6080) RPM, and the low control oil pressure device was recalibrated. Subsequent testing verified satisfactory trip and bezel alarm functions. A Design Change Request is being prepared to place the overspeed trip and local annunciator alarm functions on the same contacts; thereby, insuring that they occur simultaneously. This Design Change will be applicable to the feed pumps on both Unit 1 and Unit 2.

As previously stated, during this event No. 21 SGFP was out of service for investigation and testing related to speed oscillations. Although not attributed to this event, the findings warrant mentioning at this time. The magnetic speed pick-up sensor, which supplies the speed input to the control tachometer was found to be damaged. The sensor was physically damaged because of a loose bracket, which allowed the sensor to contact the moving shaft. Prior to this, on August 26, 1984, a reactor trip occurred as the result of No. 24 Steam Generator low-low water level. This low water level was the result of No. 21 SGFP tripping. That event (documented in LER 84-021-00) was also caused by a faulty magnetic speed pick-up sensor, and the sensor was replaced at that time. Following that event, the pump was monitored. Operation was satisfactory until speed oscillations were experienced on September 3, 1984, at which time, the pump was removed from service. Examination of the sensor (which was replaced following that first occurrence) revealed wear, and that failure has subsequently been attributed to the loose bracket which was not apparent at that time. After this determination, the sensor brackets of the remaining feed pumps on both Unit 1 and Unit 2 were inspected. Inspection results were satisfactory; no similar problems were noted.

Following this occurrence (September 5, 1984), No. 21 and No. 22 SGFP's were instrumented prior to Unit startup. They remained instrumented for approximately three (3) weeks. Operation of both pumps was satisfactory, and no further corrective action was deemed necessary.

*Jim G. Smith Jr.*

General Manager-  
Salem Operations

JLR:tns

SORC Mtg 84-137B



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

Salem Generating Station

October 5, 1984

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 84-022-00

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,

A handwritten signature in dark ink, appearing to read "J. M. Zupko, Jr.", written in a cursive style.

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

JR:kl1

CC: Distribution

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The Energy People