PSE&G

Public Service Electric and Gas Company P.O. Box 236 Hancocks Bridge, New Jersey 08038-0236

Nuclear Business Unit

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U.S. Nuclear Regulatory Commission
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LER 272/97-003-00
SALEM GENERATING STATION - UNIT 1
FACILITY OPERATING LICENSE NO. DPR-70
DOCKET NO. 50-272

Gentlemen:

This Licensee Event Report (LER) entitled "Non Conservative Single Failure Assumption - Postulated Loss of Service Water" is being submitted pursuant to the requirements of the Code of Federal Regulations 10CFR50.73(a)(2)(ii)(B).

Sincerely,

David F. Garchow
General Manager
Salem Operations

Attachment

DVH

C Distribution
LER File 3.7

NRC FORM 366 (4-95)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4)
Non-Conservative Single Failure Assumption - Postulated Loss of Service Water System

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 NAME	DOCKET NUMBER
									Salem Unit 2	05000311
01	31	97	97	- 003 -	00	03	03	97	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
			20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)
POWER LEVEL (10)	000		20.2203(a)(1)		20.2203(a)(3)(i)	X	50.73(a)(2)(ii)		50.73(a)(2)(x)
			20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
			20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
			20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A
			20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Dennis V. Hassler, LER Coordinator	609-339-1989

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

During the development of a Failure Modes and Effects Analysis, in support of NRC Generic Letter 96-06, "Assurance of Equipment Operability and Containment" for the Service Water System (SWS), a SWS alignment that is more hydraulically challenging than previously analyzed was discovered. The previous alignment assumed, during a Loss of Coolant Accident, a single failure of the Component Cooling Water (CCW) heat exchanger valve, and resulted in three SW pumps supplying flow to two full open CCW Heat Exchangers, five Component Fan Cooling Units (CFCU), and three Emergency Diesel Generators (EDGs). The new more limiting alignment assumes a single failure of a 125 Vdc channel, and results in two SWS pumps being in a runout condition, that could cause insufficient SWS flow rates.

The cause of this occurrence was the hydraulic impact of a modification was not considered. Corrective actions include modifications to restore the system hydraulics and reviews of the modification process.

This LER is being submitted pursuant to 10CFR50.73.(a)(2)(ii), any condition that was outside the design bases of the plant.

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

PLANT AND SYSTEM IDENTIFICATION

Westinghouse - Pressurized Water Reactor

Service Water System {BI}
Emergency Diesel Generators {EK}
DC Power System - Class 1E {EJ}
Containment Fan Cooling System {BK}
Emergency Air System {LE}
Component Cooling Water System {CC}

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

CONDITIONS PRIOR TO OCCURRENCE

At the time of identification, Salem Unit 1 was shutdown and defueled, and Salem Unit 2 was in Mode 5.

DESCRIPTION OF OCCURRENCE

During the development of a Failure Modes and Effects Analysis in response to Generic Letter 96-06, "Assurance of Equipment Operability and Containment" for the Service Water System (SWS) {BI}, a SWS alignment that is more hydraulically challenging than previously analyzed was discovered. The previous alignment assumed, during a Loss of Coolant Accident, a single failure of the Component Cooling Water (CCW) heat exchanger valve {CC/V}, and resulted in three SWS pumps supplying flow to two full open CCW Heat Exchangers, five Reactor Containment Fan Cooling Units (CFCU) {BK}, and three Emergency Diesel Generators (EDGs){EK}. The new more limiting alignment assumes a single failure of a 125 Vdc channel {EJ}, and results in two SWS pumps being in a runout condition that could cause insufficient SWS flow rates.

This condition occurred after a modification, implemented in 1992, resulted in four valves in each of the five SWS CFCU headers (a total of 20 valves) failing open on a loss of 125 Vdc control power. These four valves (the SW58 SWS inlet to CFCU, the SW72 SWS outlet from CFCU, the SW57 SWS CFCU back pressure control valve, and SW223 flow control unit) allow SWS flow through the CFCUs.

The SWS is an open cooling water system. The SWS has a total of six pumps per unit, supplying two headers. Each vital bus powers one primary SWS pump and one back-up SWS pump. The SWS is designed to provide an adequate supply of cooling water to the reactor safeguard and auxiliary equipment. The major safeguard cooling loads that are supplied by the SWS include the CCW heat exchangers (two per unit), the EDG (three per unit) and the CFCUs (five per unit). Additional loads are supplied by the SWS, such as room coolers and component coolers; however, these loads are hydraulically insignificant. During normal operation, the SWS also supplies cooling to components in the Turbine-Generator Area (TGA).

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

DESCRIPTION OF OCCURRENCE (Cont'd)

The minimum recirculation requirements for accident conditions can be met with two SWS pumps operating.

Two 125 Vdc failure scenarios have been identified as being more severe than the previous single failure assumptions: 1) failure of the Unit 2 "B" 125 Vdc channel and 2) failure of the Unit 2 "C" 125 Vdc channel. Additional similar failure scenarios are being evaluated to determine the impact on the SWS.

"B" 125 Vdc Channel Failure - Unit 2

In the beginning of the Loss of Offsite Power (LOOP) - Loss of Coolant Accident (LOCA) response a failure of the "B" 125 Vdc channel results in: 1) the control valves for the 22 and the 24 CFCUs failing full open (the remaining three CFCUs control valves open to control flow at the nominal accident flow rate in approximately 60 seconds); 2) the 22SW122, SWS CCW flow control valve failing open; and 3) SWS flow demands for three EDGs. Thus the two available SWS pumps are supplying water to all five CFCUs, two of which have control valves full open, a CCW Heat Exchanger, 3 EDGs, and other miscellaneous safety related coolers.

"C" 125 Vdc Channel Failure - Unit 2

The failure of the Unit 2 "C" 125 Vdc channel would become more challenging as the station began to enter the recirculation phase of the LOOP LOCA response (e.g., about 20 minutes into the transient). The failure of the "C" 125 Vdc channel results in: 1) the control valves for the 23 and the 25 CFCUs failing full open (the remaining three CFCUs control valves open to control flow at the nominal accident flow rate in approximately 60 seconds) and 2) the "B" EDG flow control valve eventually failing wide open. Thus the two available SWS pumps are supplying water to all five CFCUs, two of which have control valves full open, three EDGs, one of which has a control valve full open, and other miscellaneous safety related coolers. In the beginning of the LOOP LOCA response, the flow control valves for the CCW Heat Exchangers would receive a close signal; however, as the plant entered the recirculation phase, the Emergency Operating Procedures (EOPs) direct operators to ensure a minimum safeguards alignment (i.e., only three CFCUs aligned) prior to re-opening a CCW Heat Exchanger flow path. With the "C" 125 Vdc failure, the 23 and 25 CFCUs can not be isolated, and are not operable. The remaining three CFCUs are needed to maintain containment temperature. Therefore, establishing SWS flow to the CCW heat exchangers may cause excessive SWS flow demand, with subsequent SWS pump runout.

In either of these scenarios, it is possible that the SWS pumps would experience runout conditions, and cavitation. This runout condition, and cavitation could cause insufficient SWS flow rates.

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CAUSE OF OCCURRENCE

The cause of occurrence is that the hydraulic impact of the modification was not considered, and no mechanical cross-discipline review of the modification package was performed. Contributing to this cause was a lack of appreciation for the importance of and knowledge of the Design and Licensing Basis. In addition, when this modification was being developed in the early 1990's the hydrodynamic operation of the SWS was not fully analyzed.

PRIOR SIMILAR OCCURRENCES

LER 272/95-025 documented a similar concern with SWS flows and the potential for runout and cavitation of the SWS pumps.

SAFETY CONSEQUENCES AND IMPLICATIONS

There were no safety consequences as a result of this occurrence. The modifications were installed in 1992 for both units; and a LOOP LOCA with a coincident loss of 125 Vdc did not occur during this limited time.

If left uncorrected, high SWS pump flow would have the potential to affect the ability of the system to meet design basis requirements. While no specific guidance existed, the condition would have been readily detectable by low system pressure alarm (overhead alarm) or fluctuating pump amperage indications (control console), and the operators could have taken mitigating actions.

Generic Letter 91-018 states that Probabilistic Risk Assessment (PRA) is a useful tool for determining relative safety significance. The probability of these scenarios is very low.

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CORRECTIVE ACTIONS

1. The SW223 Valves for the five Unit 2 CFCUs will be modified to fail closed on a loss of 125 Vdc power prior to entry into Mode 3.

2. The SW122 Valves for the two Unit 2 CCW heat exchangers will be modified to fail closed on a loss of 125 Vdc power prior to entry into Mode 3.

3. A qualified hydraulic model of the SWS has been bench marked and is available for analyzing flow through the system.

4. The SWS for Unit 1 will be analyzed, and appropriate modifications implemented as necessary prior to entry into Mode 3.

5. As part of the many activities undertaken in preparation for Salem restart, the processes for configuration control have been reviewed, and PSE&G has reasonable assurance that both the plant procedures and plant configuration are in conformance with Salem Design Bases.