PSEG

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

Nuclear Business Unit

SEP 18 1996

LR-N96286

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

Gentlemen:

LER 272/96-020-00
SALEM GENERATING STATION - UNIT 1
FACILITY OPERATING LICENSE NO. DPR-70
DOCKET NO. 50-272

This Licensee Event Report entitled "Containment Fan Coil Units Outside Plant Design Basis" is being submitted pursuant to the requirements of the Code of Federal Regulations 10CFR50.73(a)(2)(ii) and 10CFR50.73(a)(2)(vii).

Sincerely,

David F. Garchow
General Manager -
Salem Operations

Attachment

SORC Mtg. 96-127

JMO/tcp

C Distribution
LER File 3.7

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Attachment A

The following represents the commitments that Public Service Electric & Gas (PSE&G) made to the Nuclear Regulatory Commission (NRC) relative to this LER (272/96-020-00). The commitments are as follows:

1. The design change process has undergone substantial improvements in the level of detail required since the 1976 event that introduced the Service Water TGA closure time delay. Thus, there are no additional corrective actions provided for that cause.

2. A modification to provide overpressure protection for the CFCUs will be implemented prior to the respective unit's entry into Mode 4.

3. An appropriate CFCU ESF response time will be determined and a Technical Specification change will be submitted as soon as possible to support planned Unit 2 entry into Mode 3.

4. The ESF response time testing procedure will be revised and affected portions of the procedure performed to reflect the appropriate ESF response time prior to the respective unit's entry into Mode 3.

5. The service water TGA isolation time delay relays will be incorporated into the surveillance program and tested satisfactorily prior to the respective unit's entry into Mode 4.

6. An assessment of the TGA isolation time delay upon other essential service water loads will be completed prior to respective unit entry into Mode 4.

7. A detailed review of the master time response procedure will be conducted in the course of the Salem Technical Specification Surveillance Improvement Project (TSSIP). The scope and content of the TSSIP program was described previously in LER 311/95-008-00. The TSSIP review is expected to be completed by December 31, 1997. A preliminary review of the master time response surveillance procedure has been completed which indicates that acceleration of the TSSIP schedule is not warranted.

NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
SALEM GENERATING STATION UNIT 1	05000272	1 OF 5

TITLE (4)
Containment Fan Coil Units Outside Plant Design Basis

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
08	20	96	96	- 020 -	00	09	18	96	Salem, Unit 2	05000311
									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)	X	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)

On August 20, 1996, engineering personnel concluded that both of the Salem units had the potential to operate outside the design basis. This condition resulted from a 1976 startup test modification that added approximately thirty (30) seconds of time delay in the isolation of non-essential service water loads. As a result of the delay in isolating non-essential portions of the service water system, design basis service water flows to the Containment Fan Coil Units (CFCUs) in certain single failure accident scenarios could not be achieved in the Technical Specification limit of less than or equal to 45 seconds for accidents. Also, in examining the impact of Westinghouse Nuclear Safety Advisory Letter (NSAL) 96-003, an engineering review identified that as service water was being restored to the CFCU, water trapped in the CFCU would be subject to significant thermal expansion due to the delay in opening the CFCU flow control valves (SW223s). Significant thermal expansion could result in pressurization of CFCU components and associated Service Water piping beyond design limits. This event is reportable in accordance with 10 CFR 50.73(a)(2)(ii)(B), a condition outside the design basis of the plant and 10 CFR 50.73(a)(2)(vii)(D), a single condition caused two independent trains to become inoperable in a single system designed to mitigate the consequences of an accident.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
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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

Essential Service Water System {BI/}*
Containment Fan Cooling System/Fan Coil Unit {BK/FCU}

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

CONDITIONS PRIOR TO OCCURRENCE

At the time of identification, Salem Units 1 and 2 were shutdown and defueled.

DESCRIPTION OF OCCURRENCE

On August 20, 1996, following an internal engineering review of the Containment Fan Coil Units, engineering personnel concluded that both of the Salem units had the potential to operate outside the design basis. This condition resulted from a plant modification that added approximately thirty (30) seconds of time delay in the isolation of non-essential service water loads. The delay was added during pre-operational testing in 1976 to alleviate system transients observed during testing. As a result of the delay in closing service water isolation valves to the turbine generator area systems, design basis service water flows to the CFCUs in certain single failure scenarios could not be achieved in the Technical Specification limit of less than or equal to 45 seconds. Also, in examining the impact of NSAL-96-003, an engineering review identified that as service water was being restored to the CFCU under Loss Of Offsite Power/Loss Of Coolant Accident (LOOP/LOCA) conditions, water trapped in the CFCU would be subject to significant thermal expansion due to the delay in opening the CFCU flow control valves (SW223s). Significant thermal expansion could result in pressurization of CFCU components and associated Service Water piping beyond design limits. This pressurization might also have affected the ability of the SW223 valves to reopen once an open signal was received.

The Containment Fan Cooling System is designed to recirculate and cool the containment atmosphere in the event of a Loss of Coolant Accident and thereby ensure that the containment pressure will not exceed its design value of 47 psig at 271 degrees F (100-percent relative humidity).

The Containment Ventilation System which includes the Containment Fan Cooling System, is designed to remove the normal heat loss from equipment and piping in the reactor containment during plant operation and to remove sufficient heat from the reactor containment, following the initial LOCA containment pressure transient, to keep the containment pressure from exceeding the design pressure. The fan cooler units continue to remove heat after the LOCA and reduce the containment pressure close to atmospheric within the first 24 hours.

DESCRIPTION OF OCCURRENCE (cont'd)

The Service Water System provides cooling to the CFCUs under normal operations and accident conditions in addition to a number of other safety related and non-safety related loads. Isolation of the non-safety related loads protects the critical nuclear safety portions of the system by isolating the non-safety flow demands. This design feature is particularly important for the design basis LOCA or Main Steam Line Break with a loss of offsite power since this condition results in a high flow demand with a minimum number of available pumps. In certain single failure system alignments, the timing of the closure is important for the CFCUs, which are located at a high elevation and are required to perform their design safety function early in the accident. Due to the impact of the time delay, closure of the Turbine Generator Area (TGA) service water isolation valves (isolates non-essential loads) occurs approximately 56 seconds after the start of the LOCA. During accidents coincident with a LOOP, a single failure to start of the 'A' emergency diesel generator or of a Service Pump, results in less than full flow to the CFCUs (due to the combined effects of the potential for two phase flow and Service Water flow to more than three CFCUs) within the 45 seconds defined by the ESF response time in the Technical Specifications until closure of the TGA isolation valves is complete. Single failures to start of the other emergency diesel generators do not result in insufficient Service Water Flow within the 45 second ESF response time.

In 1976, during plant startup testing for Salem Unit 1, significant water hammer concerns were identified for the service water system during LOOP events. As a result, a nominal thirty second time delay was added to the closure of the TGA motor operated isolation valves.

NSAL-96-003, received on July 10, 1996, described the potential for vapor pocket creation in the CFCU and a resulting waterhammer transient from vapor pocket collapse. The formation of a vapor pocket at Salem is a combined effect of continued heat input driven by CFCU fan coastdown and drainage of the large vertical leg of CFCU Service Water piping following a LOOP. A 1994 PSE&G analysis previously examined waterhammer for the CFCUs because of the large elevation differences between the service water piping and the CFCUs. This analysis proved to be bounding for the vapor pockets described by the NSAL. However, further investigation into the detailed event time sequence that had been developed to support evaluations of the TGA isolation issue revealed another issue as a result of the heat input from CFCU fan coastdown.

A second phase of heatup occurs for several seconds after the initial repressurization/waterhammer and until the reopening of the CFCU flow control valves (SW223s) following the automatic start of CFCUs. The continued heat input during this second phase into a solid water volume creates an overpressurization concern. This concern had not been previously analyzed. For a leak tight system, i.e. minimal valve leakage, the overpressure condition could exceed design pressure for the CFCU components and attached Service Water piping. In addition, this overpressure condition might prevent reopening of the SW223 valves once the CFCU fans restart.

DESCRIPTION OF OCCURRENCE (cont'd)

In examining potential changes to the CFCU ESF response time, a review identified that the existing CFCU ESF response time surveillance described in the master time response procedure did not examine CFCU service water valve reopening time in determining that the CFCU ESF response time was within the Technical Specification 3.3.2.1 Limiting Condition for Operation. Nor were the TGA service water isolation time delay relays included in the master time response procedure. The time delay relays were not included in preventative maintenance or surveillance programs.

CAUSE OF OCCURRENCE

There are several causes for the condition of the Salem CFCUs.

1. A plant design change implemented to address water hammer effects during plant startup testing failed to update the plant design basis or consider the impact on other analyses and design inputs.

2. Heatup of the CFCUs during fan coastdown was unrecognized as an input into CFCU system and component design until the issuance of NSAL-96-003 by Westinghouse in June 1996.

3. The response time testing procedures for ESF response time did not address the need to examine service water valve timing in the supply of cooling to the CFCUs.

PRIOR SIMILAR OCCURRENCES

LER 272/95-015-01 discussed differences between containment design parameters and accident analyses. The corrective action to examine UFSAR chapter 15 for design and licensing basis discrepancies would not have identified the impact of the time delay since that feature was undocumented.

LER 272/95-025-00 discussed potential service water pump runout and inadequate NPSH caused by high flow rates. The corrective actions addressed ensuring adequate service water pump NPSH.

LER 272/96-015-00 discussed inadequate CFCU heat removal performance during a period in 1993 due to biofouling. The corrective actions addressed ensuring CFCU heat exchanger performance and operation of the service water chlorination system.

SAFETY CONSEQUENCES & IMPLICATIONS

There are no safety consequences to the condition since both units are in a defueled condition and neither unit has experienced a CFCU demand during accident conditions. During a LOOP/LOCA, the implications of this condition are that the CFCUs may have either been unable to perform their heat removal role due to

SAFETY CONSEQUENCES & IMPLICATIONS (cont'd)

overpressurization or if there was sufficient system leakage to prevent overpressurization, that the resultant CFCU operation would have occurred a short time later than credited by containment analyses.

For the first case, during a LOOP, a failure to start of either the 'A' or 'C' emergency diesel generator results in the loss of one of the two containment spray pumps. In the assumed absence of the CFCUs (based upon the conservative assumption of insufficient leakage for thermal expansion within the five separate CFCU paths), a single spray pump has the capability for 209 E+06 BTU/HR heat removal, but this figure is less than the design basis requirement of 250.8 E+06 BTU/HR for containment heat removal during a LOCA. An inability to remove sufficient heat from the containment could result in containment pressures and temperatures in excess of the design basis.

In the second case, late heat removal by the CFCUs has been analyzed for periods up to ten seconds later than the Technical Specification response time of 45 seconds and shown to have no impact on peak containment pressure and temperature. An analysis to demonstrate adequate containment temperature and pressure response in consideration of the service water isolation time delays is in progress and results are expected to be similar to the previous analysis.

CORRECTIVE ACTION

1. A modification to provide overpressure protection for the CFCUs will be implemented prior to the respective unit's entry into Mode 4.

2. An appropriate CFCU ESF response time will be determined and a Technical Specification change will be submitted as soon as possible to support planned Unit 2 entry into Mode 3.

3. The ESF response time testing procedure will be revised and affected portions of the procedure performed to reflect the appropriate ESF response time prior to the respective unit's entry into Mode 3.

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6. A detailed review of the master time response procedure will be conducted in the course of the Salem Technical Specification Surveillance Improvement Project (TSSIP). The scope and content of the TSSIP program was described previously in LER 311/95-008-00. The TSSIP review is expected to be completed by December 31, 1997. A preliminary review of the master time response surveillance procedure has been completed which indicates that acceleration of the TSSIP schedule is not warranted.