



**PSEG**

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

Nuclear Business Unit

February 15, 1995

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

Attn: Document Control Desk:

SALEM GENERATING STATION  
LICENSE NO. DPR-75  
DOCKET NO. 50-311  
UNIT NO. 2

SUPPLEMENTAL LICENSEE EVENT REPORT 94-010-01

This report is made pursuant to Code of Federal Regulations 10CFR50.73 and details results of additional root cause analysis.

On January 31, 1995, the Senior Resident NRC Inspector was advised that the anticipated submittal date of this report would be February 17, 1995.

Sincerely,

J. C. Summers  
General Manager -  
Salem Operations

SORC Mtg. 95-021  
MJPJ:pc

C Distribution  
LER File

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PDR ADOCK 05000311  
S PDR

The power is in your hands.

**LICENSEE EVENT REPORT (LER)**

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

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), 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.

FACILITY NAME (1) Salem Generating Station - Unit 2	DOCKET NUMBER (2) 05000311	PAGE (3) 1 OF 6
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TITLE (4) Controlled Reactor Shutdown Due to 21 Centrifugal Charging Pump Inoperable Greater Than 72 Hours

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
9	22	94	94	010	01	02	15	95	FACILITY NAME	DOCKET NUMBER 05000
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9) 1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)									
POWER LEVEL (10) 100%	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)						
	20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)						
	20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER						
	20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	(Specify in Abstract below and in Text, NRC Form 366A)						
	20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)							
	20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)							

LICENSEE CONTACT FOR THIS LER (12)

NAME Michael J. Pastva, LER Coordinator	TELEPHONE NUMBER (Include Area Code) 609 339-5160
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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
X	B	SC	N402	N					

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
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ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

At 0108 hours, on 9/19/94, 21 Centrifugal Charging Pump (CCP) was removed from service for scheduled preventive maintenance (PM) and subsequent post-maintenance testing results satisfied ASME operability criteria. Increased vibration was measured in the pump speed increaser however, the vibration was felt not to impact operability and the pump was returned to service, at 1800 hours on 9/21/94. Following unstable and increasing speed increaser vibration, 21CCP was declared inoperable, at approximately 0100 hours on 9/22/94 (effective from prior removal from service on 9/19/94). At 0108 hours (9/22/94) the Technical Specification (TS) action time expired and at 1222 hours (same day) the Unit was placed in MODE 4 (HOT SHUTDOWN). The speed increaser was replaced, the pump was satisfactorily tested; and, at 2241 hours on 9/25/94, the TS action was exited. The vibration in the speed increaser, Nuttal Gear Corp., Model No. SU-1023-8X, resulted from corrosion of the speed increaser gear tooth surfaces possibly aggravated by changing the motor to speed coupling gap. The corrosion resulted from moisture intrusion of the speed increaser gear case, and the incorrect coupling gap resulted from an error in the technical manual. Procedures have been revised to ensure the coupling gap is set correctly. The oil sampling and PM programs and design will be reviewed and appropriate action will be taken.

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PLANT AND SYSTEM IDENTIFICATION:

Westinghouse - Pressurized Water Reactor

Energy Industry Identification System (EIIS) and Institute of Electrical and Electronics Engineers (IEEE) Component Function Identifiers codes are identified in the text as {xx/xx}

IDENTIFICATION OF OCCURRENCE:

Controlled Reactor Shutdown Due To 21 Centrifugal Charging Pump Inoperable Greater Than 72 Hours

Event Date: 9/22/94

Supplemental LER Report Date: 2/15/95

Prior Submittal Report Date: 10/12/94

The original submittal of this report was initiated by Incident Report No. 94-271.

CONDITIONS PRIOR TO OCCURRENCE:

Mode 1 Reactor Power 100% - Unit Load 1080 MWe

At 0108 hours on September 19, 1994, 21 Centrifugal Charging Pump (CCP) {BQ/P} was removed from service for scheduled preventive maintenance (PM). One of the activities was to investigate unusual noise from the speed increaser {BQ/P/SC} during pump operation, dating back to March of 1994. Vibration trending of the speed increaser by System Engineering, with assistance from Maplewood Labs, had been initiated in January 1994. In May 1994, a work order was initiated to replace the speed increaser during the next Unit refueling/maintenance outage (2R8), due to increasing vibration. The decision to replace the speed increaser was based upon engineering judgement that with vibration present the pump was operable and able to perform its intended function. The PM was completed, and an adjustment was made to the motor shaft to speed increaser coupling. While performing the coupling alignment, the as-found alignment gap was believed to be incorrect, based upon review of a figure illustration in the technical manual. This was identified to System Engineering and the gap was readjusted according to the technical manual. In addition, System Engineering and Plant Maintenance personnel believed that readjusting the gap corrected at least a portion of the pump speed increaser noise/vibration concern. Following post-maintenance testing, the pump and motor vibrations were satisfactory and testing results satisfied ASME criteria for pump operability. However, increased vibration in the speed

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CONDITIONS PRIOR TO OCCURRENCE: (cont'd)

increaser was recorded. System Engineering reviewed this vibration data and the vendor was consulted in order to determine if the vibration impacted operability of the pump. Based on an engineering assessment, it was determined the pump was operable and it was returned to service, at 1800 hours on September 21, 1994. Additional vibration readings were then recommended by System Engineering to further verify their assessment and that the vibration remained stable.

DESCRIPTION OF OCCURRENCE:

At 2330 hours (same day), the subject additional vibration readings indicated unstable and increasing vibration in the 21CCP speed increaser. This condition challenged pump operability and at approximately 0100 hours, on September 22, 1994, it was declared inoperable (effective September 19th removal from service). Insufficient time remained to restore the pump to Operable status prior to expiration of the 72-hour action time of Technical Specification (TS) 3.5.2.a, which occurred at 0108 hours (September 22nd). At 0230 hours (same day), a controlled shutdown was initiated. At 0300 hours (same day), the NRC was notified of the initiation of the controlled shutdown, in accordance with 10CFR50.72(b)(i)(A). At 0509 hours (same day), the Unit was placed in MODE 3 (HOT STANDBY) and, at 1222 hours (same day) was placed in MODE 4 (HOT SHUTDOWN), as required by TS 3.5.2.a.

ANALYSIS OF OCCURRENCE:

In MODES 1 through 3, operability of two (2) independent Emergency Core Cooling Systems subsystems ensures sufficient emergency core cooling capability in the event of a Loss-Of-Coolant Accident assuming the loss of one subsystem through any active single failure consideration. Whenever a single CCP is unavailable, the redundant CCP will provide high head injection flow for the mitigation of any design base accident.

APPARENT CAUSE OF OCCURRENCE:

Upon measuring high vibration in the 21CCP speed increaser, it was conservatively determined that the pump was inoperable from when it was previously removed from service on September 19. As such, there was insufficient time to restore the pump to Operable status prior to expiration of the action time constraints of TS 3.5.2.a.

The cause of the 21CCP speed increaser high vibration is attributed

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APPARENT CAUSE OF OCCURRENCE: (cont'd)

to "Design Manufacturing, Construction/Installation", as classified in NUREG-1022, Appendix B, due to component failure of the speed increaser. This is based on the following:

Subsequent investigation, including vendor disassembly/inspection of the speed increaser, has concluded that the increasing vibration in the 21CCP speed increaser resulted from localized corrosion of the speed increaser gear tooth surfaces from rust buildup. A contributor to the increasing vibration may have resulted from resetting the coupling in accordance with the vendor manual. Use of the manual resulted in a establishing an incorrect gap between the motor and speed increaser shaft, which allowed for undamped axial speed increaser shaft vibration. The incorrect gap occurred because Figure 3d-4 of the technical manual incorrectly indicated the gap should be set from the tip of the speed increaser gear shaft wear button to the pump motor shaft, whereas the correct gap is measured from the base of the wear button. This discrepancy in the vendor manual, had previously been documented in a deficiency report, dated March 24, 1986.

The localized corrosion of the speed increaser gear teeth is attributed to moisture in the speed increaser gear case. This corrosion did not generate a significant volume of corrosion products that would accumulate in the gear case oil reservoir to allow detection by normal oil sampling program. As a result, the corrosion was not identified until disassembly of the speed increaser by the vendor during the root cause analysis.

Chemistry analysis determined the moisture did not originate from the gear case cooler (service water cooling medium) as high levels of sodium were not found in the gear case lubricant. The gear case and the cooler were replaced. In addition, a pressure test of the removed cooler confirmed that cooler leakage did not exist. Based upon the results of the lubricant analysis and the cooler leak test, it is concluded that the moisture most likely originated through the case vent breather cap.

Other potential sources of moisture considered:

LER 272/83-048/03L reported failure of Unit 1 11CCP on August 15, 1983, where the CCP was rendered inoperable as the result of a tube leak in the speed increaser lube oil cooler. Corrective action included a recurring preventive maintenance task to replace the CCP speed increaser coolers during each

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APPARENT CAUSE OF OCCURRENCE: (cont'd)

task to replace the CCP speed increaser coolers during each Unit's respective refueling outages. This recurring task was established with the intent of eventually replacing the coolers (constructed of copper-nickle) with ones using a different material (titanium). Documentation shows that since implementation of the recurring CCP cooler replacement, no additional cooler tube failures have occurred since 1983, indicating the interim action is effective. As such, a possible speed increaser cooler tube failure is discounted as a factor in the corrosion of the 21CCP speed increaser gear teeth.

Based upon review of the storage maintenance program requirements for CCP speed increasers, and contact with the vendor it has been determined that improvement in the prevention of corrosion of the speed increaser internals may be required. As such, the possibility of pre-existing and undetectable corrosion of the speed increaser gear teeth as a potential factor in this occurrence cannot be discounted.

PREVIOUS OCCURRENCES:

Based upon review of documentation, the high vibration of 21CCP pump speed increaser, as presently understood, is an isolated occurrence. LER 272/89-033-00, reported the inoperability 12CCP due to equipment failure of the pump speed increaser, attributed to inadequate service water cooling flow through the speed increaser lube oil cooler. Although the cause of the inadequate flow could not be determined, corrosion as possible a contributor to the 1989 occurrence has been discounted. In addition, review of prior industry events did not reveal a prior occurrence involving corrosion within CCP speed increasers.

SAFETY SIGNIFICANCE:

This occurrence is reportable pursuant to the requirements of 10CFR50.73(a)(2)(i)(A), due to completion of a TS-required shutdown. During this occurrence 22CCP was available, if required, to provide high head injection flow for the mitigation of any design base accident.

CORRECTIVE ACTION:

The 21CCP speed increaser, Nuttal Gear Corp., Model No. SU-1023-8X, was replaced, the pump was satisfactorily tested; and, at 2241 hours on September 25, 1994, the Action of TS 3.5.2.a was exited.

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CORRECTIVE ACTION: (cont'd)

Maintenance procedures have been revised to help ensure proper CCP-to-speed increaser coupling adjustment.

A vendor manual update/correction has been submitted to fix the subject vendor manual figure discrepancy.

PSE&G is evaluating methods to prevent or minimize moisture in the 21CCP gear case, as well as in the other CCP gear cases, and appropriate action will be taken. In addition, PM, oil sampling, and storage maintenance requirements for CCP speed increasers will be evaluated and appropriate action will be taken.



General Manager -  
Salem Operations

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SORC Mtg. 95-021