PSEG

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Nuclear Business Unit

OCT 02 1995

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

Attn: Document Control Desk

HOPE CREEK GENERATING STATION
DOCKET NO. 50-354
LICENSEE EVENT REPORT NO. 95-019-00

This Licensee Event Report entitled " Reactor Core Isolation Cooling System Jockey Pump Suction Piping Inoperable Since Plant Startup" is being submitted pursuant to the requirements of the Code of Federal Regulations 10CFR50.73(a)(2)(vii).

Sincerely,

Mark E. Reddemann
General Manager -
Hope Creek Operations

SORC Mtg. 95-091

DVH

C Distribution
LER File

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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

LICENSEE EVENT REPORT (LER)

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

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TITLE (4)
REACTOR CORE ISOLATION COOLING SYSTEM JOCKEY UMP SUCTION PIPING INOPERABLE SINCE PLANT STARTUP

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
										05000
06	28	86	95	-- 019	-- 00	10	02	95	FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	1
POWER LEVEL (10)	100

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)
	20.2203(a)(1)		20.2203(a)(3)(i)		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)
Mr D. La Mastra, Principal Engineer	609-339-1793

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 July 31, 1995 while performing the quarterly In-Service Test (IST) of the Reactor Core Isolation Cooling (RCIC) jockey pump, it was observed that the pump was cavitating when the pump suction was aligned to the torus. This was only the second time this test was performed with the system aligned in its worst case accident configuration (i.e., suction from the torus). Previous tests were aligned from the Condensate Storage Tank, the systems' normal suction source. The initial engineering evaluation attributed the pump cavitation to the lack of net positive suction head due to the lower suction pressure available from the torus. Subsequently it was determined by calculation that the design of the RCIC suction piping, one inch diameter pipe, did not address the maximum anticipated pump flow rate required to establish the feedwater penetration sealing when aligned for suction from the torus. This was a design flaw that existed from plant startup. The overall safety significance has been determined to be low. The function of the RCIC jockey pump is keepfill for the RCIC system piping and to provide a water seal for the feedwater containment penetrations. This event is reportable in accordance with 10 CFR 73(a)(2)(vii), any condition that caused at least one independent train to become inoperable in a single system to control the release of radioactive material.

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

PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor (BWR/4)

Reactor Core Isolation Cooling (RCIC) Jockey Pump suction piping {BN/PSP}*

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

IDENTIFICATION OF OCCURRENCE

Event Date: June 28, 1986 (Initial Plant Criticality)

Date Determined to be Reportable: August 31, 1995

CONDITIONS PRIOR TO OCCURRENCE

Plant in OPERATIONAL CONDITION 1 (Power Operation)
Reactor Power 100% of rated power, 1109 MWe

There were no structures, components, or systems that were inoperable at the start of the event that contributed to the event.

DESCRIPTION OF OCCURRENCE

During the July 31,1995 performance of the quarterly RCIC Jockey pump In-Service Test (IST) procedure, HC.OP-IS.BD-0002(Q), it was observed that the pump would cavitate when pump suction was aligned to the torus. This was the second time the quarterly IST had been performed with suction aligned to the torus. The first test with suction aligned to the torus was in April 1995. The suction pressure obtained from the torus was lower than suction pressure obtained when suction was aligned to the CST (7 psig vs 30 psig) due primarily to the difference in elevation head. The suction path from the torus was added to this pump's IST as a resolution to Incident Report 94-184 (CD-775G). The previous suction path from the CST was difficult to monitor equipment for performance degradation in accordance with ASME XI-IWP-1500, due to changes in CST level. The solution, at the time, was to obtain a constant suction source either by performing future tests at the same CST level, or using the torus as the suction source. It was decided to use the torus after conversations with the Operations Department staff.

DESCRIPTION OF OCCURRENCE (cont'd)

The July 31, 1995 IST was rejected due to pump developed head being substantially less than the new baseline established in April 1995 and the pump was declared inoperable. The cause of the insufficient pump head was attributed to pump cavitation. The cavitation was thought to be the result of insufficient net positive suction pressure (NPSH) due to the lower NPSH available from the torus combined with possible obstruction or degradation of the internal diameter of the one inch piping. This was believed to be confirmed by realigning the suction to the CST and observing that the cavitation noise stopped and the pump's performance returning to previously accepted trending criteria. To address the NPSH requirements, the one inch diameter suction piping was replaced with two inch diameter suction piping via Engineering Change Authorization (ECA) 4HE-0262. This ECA was completed on August 31, 1995. While performing the ECA, the one inch diameter pipe that was removed was examined for possible obstruction or degradation of the internal diameter. However, no obstruction or internal diameter degradation was observed. At this point, it was determined by calculation, that the RCIC jockey pump with a one inch diameter suction piping would not have been able to meet the requirement to supply a water seal to the feedwater check valves following a DBA. Subsequent analysis confirmed this determination. The design with a one inch diameter RCIC suction pipe existed since initial criticality.

The post ECA IST was performed on September 2, 1995 with the new two inch diameter suction piping aligned to the torus. Acceptable pump performance was achieved with no indication of cavitation.

ANALYSIS OF OCCURRENCE

The RCIC jockey pump has two distinct safety related functions. The first function is to maintain the RCIC system piping filled with water to prevent waterhammer upon RCIC pump start as described in the Hope Creek Generating Station (HCGS) UFSAR Section 5.4.6.2.4.

The RCIC jockey pump's second function is to provide and maintain a water seal on the two feedwater containment penetrations as described in HCGS UFSAR Section 6.2.3.2.3. This occurs as follows:

a. Following a DBA LOCA, the feedwater system upstream of the Containment Isolation Valves (CIV) provides a water seal for the zero to approximately one hour time frame as stated in HCGS SER NUREG-1048 Supplement 3, Section 6.2.3. This water seal provides the barrier to prevent the containment bypass leakage of gaseous radioactive effluents.

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ANALYSIS OF OCCURRENCE (cont'd)

b. The long term water seal, during the one hour to 30 day time period, is then provided by RCIC and/or High Pressure Coolant Injection (HPCI) jockey pump systems, which are manually aligned from the control room following the postulated LOCA.

The original HPCI jockey pump suction piping is two inches in diameter. The HPCI jockey pump has been tested with suction aligned to the torus with no problems identified.

APPARENT CAUSE OF OCCURRENCE

The apparent cause of this event is a failure to address in the design calculation the suction from the torus and the required NPSH for the feedwater water seal. Cavitation in the pump resulted when the pump internal pressure was reduced when aligned to the torus. The available NPSH was below the minimum vapor pressure of the pump internal low pressure regions. No startup testing records could be located that identified the original test configuration for the jockey pump. Therefore it is indeterminate if the RCIC jockey pump was ever previously tested with pump suction aligned from the torus.

SAFETY SIGNIFICANCE

It has been determined that the consequences of having the RCIC jockey pump unable to perform the feedwater sealing function is of low safety significance and is bounded by the analyses as described in the HCGS UFSAR. This determination is based on the following:

As described in the HCGS UFSAR, the feedwater system upstream of the number 3 feedwater heaters provides a water seal for the zero to approximately one hour time frame. This water seal provides the barrier until the long term water seal, during the one hour to 30 day time frame, provided by the RCIC and/or HPCI pump systems can be manually aligned from the control room following the postulated LOCA. Similarly, based upon engineering judgment, the feedwater system is also expected to maintain its integrity for the one hour to 30 day time period. Additionally:

a. The HPCI jockey pump is unaffected by the RCIC suction piping problem and thus would have been available for the water seal function except for those periods for which HPCI was unavailable for maintenance.

SAFETY SIGNIFICANCE (cont'd)

b. The feedwater fill line network is designed with a crosstie between the two feedwater lines immediately upstream of the outboard containment isolation valves. This crosstie permits either the RCIC or the HPCI jockey pump to independently provide and maintain the feedwater line water seal.

c. The dose calculations for offsite as well as control room habitability for a DBA LOCA do not take credit for the feedwater sealing function. The analysis is based on leakage at the Technical Specifications limit for total containment leakage which includes the contribution from the feedwater check valves. This contribution is calculated without a water seal in place. Therefore, the DBA dose assessment is bounding without a water seal being present.

d. RCIC normally takes suction from the CST. RCIC suction will only swap from the CST to the torus as a result of: low CST level (which is caused by loss of the CST due to a seismic event, hurricane, or tornado), or operator action. Therefore, the RCIC system suction from the CST remaons operable even under normal postulated accident conditions.

e. Only in the event of a DBA LOCA, combined with the HPCI jockey pump also being inoperable, combined with the loss of the CST, would the feedwater outboard isolation valves have been required to provide the required isolation barrier without the benefit of a water seal. However, during a 145 day period, 9/29/87 to 2/20/88, leak tightness of the feedwater penetrations was indeterminate due to excessive leakage found during an IST. During this period, the feedwater outboard isolation valves could not have been depended upon to provide adequate isolation. This was reported in LER 354/88-003-01. A PRA analysis was performed to determine the probability of the occurrence of the combination a DBA LOCA, inoperable HPCI jockey pump, and loss of the CST. The resultant probability was significantly small (1.0×10^{-8}).

PREVIOUS SIMILAR OCCURRENCES

A review of previous events did not identify any past reportable events that involved an undersized piping system design.

The IST Program has been reviewed and no other conditions similar to those described in this LER were identified.

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CORRECTIVE ACTIONS

The RCIC jockey pump suction piping was replaced in ECA 4HE-0262 with two inch diameter piping and components. The RCIC jockey pump was successfully retested with suction from the torus.

The affected design calculations, BD-16(Q) and BC-30(Q) have been revised to reflect the revised RCIC jockey pump suction piping, as well as to account for the water loop seal mode of RCIC jockey pump operation.