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SUBJECT: LER 87-005-00:on 870624,potential tripping of high pressure injection pumps during starting.

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(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

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TITLE (4)

POTENTIAL TRIPPING OF HIGH PRESSURE INJECTION PUMPS DURING STARTING

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)
									Oconee Unit 2	0 5 0 0 0 2 7 0
0 6	2 4	8 7		0 0 5	0 0	0 7	2 4	8 7	Oconee Unit 3	0 5 0 0 0 2 8 7

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)		
POWER LEVEL (10)	0 8 7	20.402(b)	20.405(c)	50.73(a)(2)(iv)
		20.405(a)(1)(i)	50.36(c)(1)	XX 50.73(a)(2)(v)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)
		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)
		73.71(b)		
		73.71(c)		
		OTHER (Specify in Abstract below and in Text, NRC Form 366A)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
PHILIP J. NORTH LICENSING	AREA CODE 7 0 4 3 7 3 - 7 4 5 6

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CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS
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SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	XX NO				

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

On June 11, 1987 a situation was identified by analysis in which the High Pressure Injection (HPI) pump motor on each unit could trip on overcurrent during the starting of all three units' blackout loads. The situation was identified as a part of a Duke initiated auxiliary power system review following the Oconee Safety System Functional Inspection (SSFI) conducted by the NRC.

The root cause of this event was determined to be a design deficiency which resulted in an insufficient overcurrent relay setting for the HPI pump motors. While the protective relays were set to protect the equipment (i.e., HPI pump motor), it could not be determined from the available documentation that the relay settings were reviewed in conjunction with the 4160VAC auxiliary power system modifications for potential changes in system dynamics.

The immediate corrective actions were 1) to inform the plant operators of the potential problem, 2) to confirm with the operators the steps necessary to restart the HPI pump motors should they trip in a LOOP event, and 3) to initiate resetting of the HPI pump motor overcurrent relays to correct the situation.

An HPI pump trip following coincident loss of offsite power and Engineered Safeguards actuation potentially impacts FSAR small break LOCA analysis. However, HPI operation would be quickly restored by operator action. As such, the health and safety of the public was not affected by this incident.

U.S.GPO:1984-0-454-481/18759

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

Background:

The High Pressure Injection (HPI) System is designed to perform the following functions during normal reactor operation: supply the Reactor Coolant System (RCS) with fill and operational makeup water, provide seal injection water for the reactor coolant pumps, provide for purification of the reactor coolant to remove corrosion and fission products, and control the boric acid concentration in the reactor coolant. The HPI System also serves as an Emergency Core Cooling System (ECCS). In a Loss of Coolant Accident (LOCA), the HPI pumps inject borated water into the RCS to provide the necessary core decay heat removal.

The overcurrent relays for the HPI pumps were originally set to trip at 4.7 sec @ 200%. These relays were properly set below the motor locked-rotor thermal damage curve to protect the motors from high locked-rotor current; however, the setting was not sufficient to account for the effects of the HPI pump motors starting time under the three unit loss of offsite power scenario.

Description of Occurrence:

On June 11, 1987 Design Engineering identified by analysis a situation in which the High Pressure Injection (HPI) pump motors on each unit could trip on overcurrent during the starting of all three units' blackout loads. Blackout loads are those loads supplied from onsite emergency power during a loss of offsite power event (LOOP). The situation was identified as a part of a Duke initiated auxiliary power system review following the Oconee SSFI audit. Specifically, the situation was discovered during a review of relay coordination. The scenario chosen for this review was a LOOP event with all three Oconee units' blackout loads being supplied from Keowee via the underground feeder. This scenario envelopes other plant situations with regard to a relay coordination evaluation. In this scenario, the analysis of the auxiliary power system conditions and the HPI pump motor starting characteristics shows that the HPI pump motors could trip on overcurrent during starting. The protective relay settings for other motors were found acceptable.

An additional follow-up analysis was initiated to review the HPI pump motor overcurrent relaying for the scenario of LOCA in one Oconee unit concurrent with a LOOP. The preliminary results of this analysis which were available on June 19, 1987, indicated that with the present plant auxiliary power system loading, the HPI pump motors could also trip during starting under a LOCA in one unit/LOOP scenario. Based on these preliminary results, it was determined that the corrective action taken for the three unit LOOP scenario (i.e., resetting the HPI pump motor overcurrent relays) also resolved the LOCA/LOOP HPI pump tripping concern.

A further review was performed to determine the origin of the problem. The review revealed that the original licensing design basis capability was verified by preoperational testing at all three Oconee units. It was also determined the the only significant modification that could affect the HPI pump motors

capability to start was the 1979 addition of the motor-driven emergency feedwater pumps to each Oconee unit. Additionally, current Oconee periodic testing does not subject the HPI pump motors to the postulated starting conditions.

This incident is considered non-recurring as there are no past-related incidents.

Cause of Occurrence:

The potential tripping of the HPI pump motors on overcurrent during starting under a LOCA/LOOP scenario and a three unit LOOP scenario has existed since 1979 when the motor-driven emergency feedwater pumps were installed. This conclusion is based on analytical data only.

It is concluded from analytical data that the root cause of this problem was a design deficiency. The overcurrent relay setting for the HPI pump motors was not sufficient to account for the effects of extended starting times for the HPI pump motors under the auxiliary power system voltage and loading conditions associated with LOCA/LOOP event or a three unit LOOP event. While the protective relays were set to protect the equipment (i.e, HPI pump motor), it could not be determined from available documentation that the relay settings were reviewed in conjunction with the 4160VAC auxiliary power system modifications for potential changes in system dynamics.

Corrective Actions:

The immediate corrective actions were to:

- o Notify the plant operators of the potential problem and to confirm with the operators the steps necessary to restart the HPI pumps should they trip in a LOOP event.
- o Initiate the resetting of the HPI pump motor overcurrent relays to correct the problem.
- o Reset all HPI pump motor overcurrent relays.

Supplemental corrective actions were to review the HPI pump motor overcurrent relay setting for the LOCA/LOOP scenario and confirm that the new overcurrent relay settings are acceptable for this scenario.

Planned corrective actions are to review future auxiliary power systems modifications to assess the impact of the modification on protective relay settings.

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Analysis of Occurrence:

The Chapter 15 transients in the Oconee FSAR were reviewed to determine the impact of the HPI pump trip problem. Two design basis transients were identified which would be impacted by the problem: a three unit loss of offsite power, and a coincident loss of offsite power and loss of coolant accident. These transients are discussed as follows:

The three unit LOOP is bounded by the Loss of All Station Power Accident (FSAR Section 15.8.3). The analysis of this accident demonstrates acceptable consequences while taking no credit for HPI operation. Therefore, the HPI pump problem has no impact on this design basis transient.

The coincident LOCA and LOOP scenario is analyzed in FSAR Section 15.14 (Loss of Coolant Accidents). No credit is taken for HPI operation during a large break LOCA, so there is no impact on that analysis. Small break LOCAs are break sizes less than 0.5 ft^2, and the analyses of these breaks do take credit for automatic actuation of HPI on low RCS pressure. If the HPI pumps had failed to start automatically during such a transient, this failure would have been quickly detected as the operators verified appropriate Engineered Safeguards (ES) actuation per the Emergency Operating Procedure. At that point the operators would reset the ES logic and manually start the HPI pumps from the control room, thus, providing the required injection flow. Because of the additional delay in obtaining HPI flow the transient would technically be outside the bounds of the licensing basis analysis. However, the peak cladding temperature resulting from the worst case small break LOCA is 1092°F, much less than the acceptance criterion of 2200°F. Furthermore, this worst case break assumes relatively little HPI flow in the first ten minutes due to an assumed worst case single failure and because half of the remaining HPI flow is assumed to be lost out the break. Therefore, it is apparent that the severity of this accident would not be significantly increased by the HPI pump motor trip.

A third scenario, slightly different from the coincident LOCA and LOOP, is a small break LOCA with a LOOP at a later time. In this instance an Engineered Safeguards actuation would have occurred, and HPI flow would have been verified prior to the loss of power. As in the previous case, the HPI pumps would be assumed to trip upon restoration of emergency power. However, the HPI pump status is clearly displayed on the RZ module in the control room. Furthermore, the Loss of Power Procedure also requires verification of HPI flow. Therefore, it is considered that any loss of high pressure injection would be of short duration due to compensatory operation actions, and that the impact of the HPI pump trip on the severity of the accident would be minimal.

A further point to consider is the extremely low probability of the occurrence of a LOCA and loss of offsite power at essentially the same time. Except for extremely large magnitude seismic events (which are very low probability and beyond the seismic design basis of Oconee) there is essentially no interdependency between the two events. Therefore, the initiation frequency of

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the event of concern is very low, so it has no impact on the overall plant core melt risk.

The problem with HPI pump trip following coincident loss of offsite power and Engineered Safeguards actuation potentially impacts the FSAR Section 15.14 small break LOCA analysis. However, it is apparent that HPI operation would be quickly restored from the control room, and the effect on the outcome of the accident would be negligible. Furthermore, the probability of the two events occurring in the same time frame is insignificant. Therefore, it may be concluded that no additional risk to the health and safety of the public was presented as a result of this incident.

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July 24, 1987

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

Subject: Oconee Nuclear Station
Docket No. 50-269, -270, -289
LER 269/87-05

Gentlemen:

Pursuant to 10CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 269/87-06 concerning potential tripping of High Pressure Injection Pumps during starting.

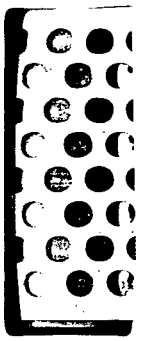
This report is submitted in accordance with §50.73(a)(2)(v). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

Hal B. Tucker

PJN/208/jgc

Attachment



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