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DUKE POWER

October 22, 1990

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

Subject: Oconee Nuclear Station, Unit 2
Docket No. 50-270
Special Report Concerning High Pressure
Injection Train Rendered Automatically
Inoperable Due To Inappropriate Operator Actions

Gentlemen:

This report is provided for information regarding the high pressure injection train rendered automatically inoperable.

If you have any questions, please contact Rick Matheson at (803) 885-3119.

Very truly yours,

H. B. Barron
Station Manager

/ftr

Attachment

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NRC FORM 366 (6-89) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WTH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit 2	0 5 0 0 0 2 7 0	1 OF 0 9

TITLE (4) High Pressure Injection Train Rendered Automatically Inoperable Due to Inappropriate Operator Actions

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)
										0 5 0 0 0
0 8	2 7	9 0	9 0	SPECIAL REPORT — 0 0		1 0	2 2	9 0		0 5 0 0 0

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)	1 0 0	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)	X OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	SPECIAL REPORT
		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	TELEPHONE NUMBER
Henry R. Lowery, Chairman Oconee Safety Review Group	AREA CODE 8 0 3 — 8 8 5 - 3 0 3 4

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 fifteen single-space typewritten lines) (16)

On August 27, 1990, at approximately 1212 hours with Unit 2 at 100% Full Power (FP), Operators failed to align the standby High Pressure Injection (HPI) pump to supply the "B" HPI train prior to removing the 2C HPI pump from service. This abnormal operator action left the "B" HPI train operable only by further Operator action and not by automatic Engineered Safeguards actuation as desired. This apparent Technical Specification (TS) violation was discovered at 1215 hours due to the questioning attitude of the Operations Shift Supervisor while being informed of on-going control room activities. The immediate corrective action was to return the 2C HPI pump to service at 1224 hours. A subsequent review by Duke Power Company Licensing and Design personnel revealed that no TS violation occurred as a result of this incident. The cause of this undesirable operating condition is classified as Inappropriate Action.

BACKGROUND

The High Pressure Injection (HPI) system [EIIS:BQ] comprises a major portion of the Emergency Core Cooling System (ECCS). The ECCS is designed to prevent melting or physical disarrangement of the core over the entire spectrum of Reactor Coolant System break sizes. The ECCS injects borated water into the Reactor Coolant System to remove core decay heat and to minimize metal-water reactions and the associated release of heat and fission products.

Oconee Unit 2 has three HPI pumps [EIIS:P] (pumps A, B, and C). The three pumps are installed in parallel with a cross connecting header on the discharge of the pumps capable of furnishing either or both HPI Trains A and B (see attachment 1 drawing). During normal operation, one pump is required to supply normal makeup and reactor coolant pump seal injection. A second pump functions automatically as a backup. The third pump is used only for emergency injection. The HPI pumps are powered from the 4160V switchgear. All three pumps receive an automatic Engineered Safeguard [EIIS:JE] actuation signal on low Reactor Coolant System [EIIS:AB] pressure and/or high reactor building [EIIS:NH] pressure.

Normal operational lineup of the HPI system is as follows:

A & B HPI Pump	Aligned To	A HPI Train (Normal and Emergency Injection)
C HPI Pump	Aligned To	B HPI Train (Emergency Injection)

Technical Specification (TS) 3.3.1 a (1) defines an HPI train required for unrestricted operation at less than 60% Full Power (FP) as consisting of: "an HPI pump and a flow path capable of taking suction from the borated water storage tank and discharging into the reactor coolant system automatically upon Engineered Safeguards Protective System actuation."

TS 3.3.1 c (2) states that when power level is greater than 60% FP: "Tests or maintenance shall be allowed on any component of the HPI system, provided two trains of HPI system are operable. If the inoperable component is not restored to operable status within 72 hours, reactor power shall be reduced below 60% FP within an additional 12 hours."

TS Bases, page 3.3-6, describes the requirement of TS 3.3.1 c (2) as: "...two HPI trains (two pumps and two flow paths) are required to assure adequate cooling."

EVENT DESCRIPTION

On August 27, 1990, at approximately 0200 hours with Unit 2 operating at 100% Full Power (FP), maintenance was in progress to lubricate the 2A and 2B High Pressure Injection (HPI) pumps. This work was being conducted under standing Work Request 56297A. Control Room Operator (CRO) "A", in support of the HPI pump maintenance activities, prepared procedure OP/0/A/1102/06 "Removal and Restoration of Station Equipment" (R&R procedure) to allow removal of each pump (A and B) from service as needed during the maintenance sequence. At 0240 hours, CRO "A" initiated an R&R procedure for removal of the 2C HPI pump in preparation for subsequent maintenance which was expected on his shift.

At 0400 hours, control room Senior Reactor Operator (SRO) "A" initialled R&R procedure step 2.5 verifying the Limiting Conditions For Operation and that redundant checks, required to verify operability of redundant components or systems as per Technical Specifications (TS), were met. This step is required prior to removing equipment from service.

The lubrication of the 2C pump was not started on this shift which ended at 0700 hours. Therefore this item, including the partially completed R&R, was turned over to the on-coming day shift.

Upon start of the next shift, Performance testing of the 2A and 2B HPI pumps was commenced at approximately 0700 hours by Performance Specialist (PS) "A". The testing was required due to the earlier lubrication of the pumps on the preceding shift. The tests (to verify proper pump operation) were conducted with support from Control Room Operator (CRO) "B" and in compliance with Performance procedure PT/2/A/202/11 "High Pressure Injection Performance Test."

During the above tests, the operating HPI pump (2A) was tested first as required by section 12.1 of the test procedure. Then, the 2B pump was vented and started as prescribed by procedure and later tested. No lineups are required to ensure proper pump/train alignment prior to removing either the 2A or the 2B pump from service.

Upon completion of the A and B pump tests at approximately 1130 hours, PS "A" and CRO "B" discussed whether or not the 2C HPI pump was to be lubricated. Neither individual at the time was certain of the work plan to lubricate the 2C pump. As a result, they decided to suspend the test pending clarification. Test results from both the 2A and 2B pumps had been found acceptable and proper procedure documentation had been completed through step 12.4 of the test procedure. Step 12.5 of the procedure provides instructions to properly align the HPI system by closing 2HP-27 and opening 2HP-116 prior to taking the 2C pump out of service for testing or for lubrication. When performed, these procedure steps conservatively align the 2B HPI pump to the "B" HPI train. Due to the test delay on the 2C pump, CRO "B" did not review this section of the procedure and PS "A" returned to the Performance office with the procedure.

CRO "A", upon interview during this report investigation, stated that when he prepared the R&R procedure on the earlier shift and reviewed the TS, he failed to recognize the need of aligning the 2B HPI pump to the "B" HPI train prior to removing the 2C HPI pump from service (normal practice). Therefore, the R&R was incorrectly prepared and did not accurately reflect past interpretations of TS requirements for unit operation greater than 60% FP. At 1143 hours, the Unit 2 Shift Supervisor (U2SS) completed and approved the R&R procedure initiated on the preceding shift for racking out the 2C HPI pump breaker. This procedure (while temporary in nature) was intended to provide the operator with a method to remove from service the 2C HPI pump breaker and to document his actions. This action was necessary at this time so that Maintenance personnel could resume the unfinished work of lubricating the 2C pump. Shortly after his approval, the U2SS gave the R&R to CRO "B", who in turn reviewed and also approved the document. CRO "B" then assigned a Non Licensed Operator to perform the procedure. The error in procedure development was not detected by the U2SS or CRO "B". During their review of the R&R, the U2SS or CRO "B" did not reference TS.

At 1212 hours, the 2C HPI pump breaker was racked out by the assigned Non Licensed Operator to permit pump lubrication. This action, which removed the 2C pump from service, without having first aligned the 2B HPI pump to the "B" HPI train, caused an apparent violation of TS 3.3.1 c (2) in that only one HPI train (A Train) was capable of automatic injection.

At 1215 hours, upon updating the Operations Shift Supervisor (OSS) of on-going control room activities, the U2SS apprised the OSS of the 2C HPI pump lubrication activities. This exchange of information prompted the OSS to ask further questions pertaining to proper "B" HPI train alignment with the 2C HPI pump out of service. During this line of questioning, the U2SS realized that the normal practice had not been taken to align the "B" HPI train prior to taking the 2C pump out of service.

Upon this discovery, an immediate corrective action was taken to return the 2C HPI pump and train to service by racking back in the 2C HPI pump breaker. This action was completed at 1224 hours. Due to early recognition of the deviation from normal practice and the fact that Maintenance personnel had not begun work on the pump, no delays were presented in taking this prompt action to restore the needed HPI train.

Subsequent to this incident, the bases for TS 3.3.1 were carefully reviewed to determine the impact of the apparent TS violation on the safety analyses. As is described in the Safety Analysis, this review indicated that the HPI system was operable during the time period that the 2C HPI pump was out of service. TS 3.3.1 c (2) states that "tests or maintenance shall be allowed on any component of the HPI system, provided two trains of HPI system are operable." However, this TS does not provide a clear definition of an HPI train. Initially, the definition of an HPI train given in TS 3.3.1 a (1) was used to determine compliance with TS

3.1 c (2). However, upon further review of the safety analyses and licensing basis, it was determined that the definition of an HPI train given for unrestricted operation at less than 60% FP, as in TS 3.3.1 a , is not fully applicable for restricted operation greater than 60% FP, in TS 3.3.1 c (2).

fact, if TS 3.3.1 c (2) is interpreted to require two automatic HPI ains, a TS violation would occur every time one of the HPI injection lves (HP-26) is tested. This event has identified the need to clarify requirements associated with two operable trains given in TS 3.3.1 c .

NCLUSIONS

reflected in the Safety Analysis, the licensing basis assumptions ssociated with Technical Specification (TS) 3.3.1 c were not violated. described in the Event Description, TS 3.3.1 c does not provide a clear finition for two operable trains. Therefore, a need to clarify this TS s been identified. The licensing documentation does not clearly state y the present wording of TS 3.3.1 c was chosen.

3.3.1 a (1) provides requirements below 60% FP while the HPI system is t in a degraded mode. TS 3.3.1 c (2) provides requirements above 60% FP ile the HPI system is in a degraded mode. Since TS 3.3.1 c (2) applies a degraded mode, two operable trains actually consist of two HPI pumps d one injection path automatically actuating upon an Engineered feguards signal with the capability to manually cross-connect HPI trains thin ten minutes from the control room. The capability to manually oss-connect HPI trains is assured by the operability of valves HP-409 d HP-410 and guidance in the station emergency operating procedure. nce the HPI configuration during the time period that the 2C HPI pump s out of service satisfied this definition of two operable trains, TS .3.1 c (2) was not violated.

or TS 3.3.1 c (2), the clarification that two operable trains actually nsist of one automatic and one manual train is entirely consistent with he requirements of the licensing basis safety analyses. When this nterpretation is considered with respect to an event where a LOCA in a ocation which causes flow from only one of the two trains of the HPI ystem to reach the reactor, concurrent with a failure of one HPI pump, it is assumed that operator action would be taken to manually re-align the PI system such that injection flow is established.

The cause of this 12 minute undesirable operating condition is classified as Inappropriate Action, in that the Unit 2 Shift Supervisor (U2SS) and Control Room Operator (CRO) "B" did not adequately review the Removal and Restoration (R&R) procedure (OP/0/A/1102/06) prior to their approvals. The U2SS and CRO "B" should have referenced TS 3.3.1 c (2) to determine the applicable requirements based on system status and normal practice

prior to approving a procedure that removed a desired train of a safety related system from service. Also, CRO "A" and Senior Reactor Operator "A" did not recognize a need to document on the R&R a normal requirement to properly sequence steps to close 2HP-27 and open 2HP-116 prior to racking out the 2C HPI pump breaker. Documentation of these requirements (by either CRO "A" or SRO "A") would have prompted fellow operators on the next shift and would have probably resulted in correct actions being taken to align the 2B HPI pump to supply the "B" HPI train.

A review of prior events over the past two years revealed several incidents in which Engineered Safeguards components have been defeated or impaired. However only one of these incidents, LER 269/88-011, involved the High Pressure Injection System. This event was also associated with lubrication and post maintenance testing of a HPI pump. In this event, on February 20, 1988, Performance personnel failed to perform a procedure requirement to vent a HPI pump prior to testing. The corrective actions to resolve problems discovered in the 1988 event were directed primarily to improvements in the Performance testing procedure. These actions ensured that the test procedure would direct the technician to first vent the pump prior to testing irregardless of the pump testing sequence. This event is considered non-recurring in that the performance test had not yet begun when this incident occurred and that Operations and not Performance personnel were involved in the inappropriate actions.

Since there were no component failures, this incident is not NPRDS reportable. There were no releases of radioactive material, no radiation exposures, or personnel injuries as a result of this event.

CORRECTIVE ACTIONS

Immediate

(1) The 2C HPI pump breaker was racked back in at 1224 hours. This action returned the pump and the "B" train to automatic service.

Subsequent

(1) Appropriate counseling has been conducted with all personnel involved with identified inappropriate actions.

Planned

(1) All licensed operators will be required to review this Special Report. Special emphasis will be placed on the importance of performing adequate reviews of R&R procedures prior to their approval and implementation. Specific guidance associated with C HPI pump removal and restoration will be included.

(2) A specific operating procedure for removal and restoration of C HPI pumps will be developed.

(3) Appropriate station management personnel will determine if the new operating procedure should be referenced in applicable maintenance lubrication procedures.

(4) A specific ETQS task to address removal and restoration of C HPI pumps will be developed for Reactor Operators and Senior Reactor Operators. Future licensed operators will receive this training.

(5) Technical Specification 3.3.1 c requirements will be reviewed to determine if a license amendment is needed to clarify the definition of "two trains of HPI shall be operable."

SAFETY ANALYSIS

The original Technical Specifications (TS) for Oconee required two independent trains, each consisting of an High Pressure Injection (HPI) pump and a flow path capable of taking suction from the Borated Water Storage Tank and discharging into the Reactor Coolant System, to be operable at full power. Assuming a LOCA with a loss of offsite power and the worst single failure, this lineup assured that at least one HPI pump and injection flow path would be available. In April of 1978, Babcock and Wilcox (B&W) concluded that the worst break location for the small break analyses is on the discharge side of the reactor coolant pumps (RCP). Prior to this time, the worst break location was thought to have been on the suction side of the RCPs.

If a small break on the discharge side of the reactor coolant pumps occurs, it is assumed that all of the HPI flow into the broken cold leg is lost out the break. Thus, for the pump discharge break location and worst single failure, only 50% of the flow rate of one HPI pump would reach the core. B&W concluded that this HPI capacity was inadequate to assure compliance with the limits of 10 CFR 50.46. As a result of this concern, Duke Power committed to two changes in the HPI system. First, the TS were revised to require all three pumps to be operable above 60% Full Power. Second, a cross-connect line was added to the discharge side of the HPI pumps. This line allows the operators to cross connect HPI trains from the control room (via valves HP-409 and HP-410).

Currently, the licensing basis small break LOCA analyses take credit for two HPI pumps and one HPI flow path being available during the initial stages of the accident. For the RCP discharge break, 50% of the injection flow is assumed to be lost out the break. The licensing basis analyses take credit for operator action to cross-connect HPI trains within the

first ten minutes of the accident. Once the HPI trains are cross-connected, the HPI lineup consists of two HPI pumps injecting through two flow paths. At this point in the accident, the licensing basis analyses assume that 30% of the injection flow is lost out the broken cold leg. The remaining 70% would enter the core. The flow splits for an HPI line break differ from the flow splits for a cold leg pump discharge break. This is because the injection line associated with the break location is exposed to atmospheric pressure for the HPI line break versus system pressure for the cold leg pump discharge break. However, for both scenarios, the flow associated with two HPI pumps injecting through two HPI trains (three cold legs) is sufficient to ensure that the limits of 10 CFR 50.46 are not violated.

TS 3.3.1 c (2) allows up to 72 hours for testing or maintenance of an HPI component. Because of the limited period of time allowed for testing or maintenance, it is not considered necessary to consider a single failure coincident with the limiting small break LOCA. Thus, if the limiting small break LOCA occurred during the time period that the C HPI pump was out of service, HPI pumps A and B would have automatically started on an Engineered Safeguards actuation signal with injection through the A train.

During the first few minutes of the accident, a significant fraction of the HPI flow would have been lost out the break. However as directed in the Emergency Operating Procedure, the operators would have cross-connected HPI trains within ten minutes, resulting in adequate HPI flow reaching the reactor vessel. This scenario is consistent with the assumptions in the licensing basis small break analyses. It is concluded that it is not necessary to have each of the two operable HPI pumps aligned to a separate train during testing or maintenance in order to meet licensing requirements. However, the practice of aligning each operable pump to a separate train will be continued.

After a review of the licensing basis requirements for the HPI system, it is concluded that the TS 3.3.1 c (2) requirement for two operable trains is satisfied if two HPI pumps and one flow path are automatically available upon Emergency Safeguards actuation with the capability to manually cross-connect to the other flow path within ten minutes. In the conditions experienced during this event, or during a single failure, operator action must occur for the HPI system to perform its intended safety function. A Station Emergency Operating Procedure is available and provides operator guidance to ensure timely actions. As required by TS 3.3.1 c (1), HP-409 and HP-410 must also be operable to allow the operators to cross-connect trains within ten minutes. Since the HPI configuration during the time period while the C HPI pump was out of service satisfied these requirements, the licensing basis safety analyses were not violated.

Thus, even if a small break LOCA had occurred during the time period the C HPI pump was out of service (total time: 12 minutes), adequate HPI flow would have been made available. In summary, the event would not have affected the health and safety of the public.

DUKE POWER COMPANY

Oconee Nuclear Station PIR# 2-090-0081

ATTACHMENT 1