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United States Nuclear Regulatory Commission
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Perry Nuclear Power Plant
Docket No. 50-440
LER 2002-002-00

Ladies and Gentlemen:

Enclosed is Licensee Event Report (LER) 2002-002, Failure of the High Pressure Core Spray Pump to Start. This event is being reported in accordance with 10CFR50.73(a)(2)(v)(D), as an event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident. There are no regulatory commitments contained in this letter. Any actions discussed in this document that represent intended or planned actions, are described for the NRC's information, and are not regulatory commitments.

If you have questions or require additional information, please contact Mr. Vernon K. Higaki, Manager – Regulatory Affairs, at (440)-280-5294.

Very truly yours

For William R. Kanda
Enclosure: LER 2002-002

cc: NRC Project Manager
NRC Resident Inspector
NRC Region III

IE22

NRC FORM 366 (7-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by Internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a

LICENSEE EVENT REPORT (LER)

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

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE Failure of the High Pressure Core Spray Pump to Start

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
10	23	02	2002	– 002	– 0	12	23	02	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE	1
10. POWER LEVEL	98.3

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

20.2201(b)	20.2203(a)(3)(ii)	50.73(a)(2)(ii)(B)	50.73(a)(2)(ix)(A)
20.2201(d)	20.2203(a)(4)	50.73(a)(2)(iii)	50.73(a)(2)(x)
20.2203(a)(1)	50.36(c)(1)(i)(A)	50.73(a)(2)(iv)(A)	73.71(a)(4)
20.2203(a)(2)(i)	50.36(c)(1)(ii)(A)	50.73(a)(2)(v)(A)	73.71(a)(5)
20.2203(a)(2)(ii)	50.36(c)(2)	50.73(a)(2)(v)(B)	OTHER Specify in Abstract below or in NRC Form 366A
20.2203(a)(2)(iii)	50.46(a)(3)(ii)	50.73(a)(2)(v)(C)	
20.2203(a)(2)(iv)	50.73(a)(2)(i)(A)	✔ 50.73(a)(2)(v)(D)	
20.2203(a)(2)(v)	50.73(a)(2)(i)(B)	50.73(a)(2)(vii)	
20.2203(a)(2)(vi)	50.73(a)(2)(i)(C)	50.73(a)(2)(viii)(A)	
20.2203(a)(3)(i)	50.73(a)(2)(ii)(A)	50.73(a)(2)(viii)(B)	

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
David A. Bowen, Compliance Engineer	(440) 280-5597

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
X	BG	SWGR	ABB	Y					

14. SUPPLEMENTAL REPORT EXPECTED		15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	✔ NO				

16. ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On October 23, 2002, at 1113, the High Pressure Core Spray (HPCS) pump failed to start during routine testing of the HPCS Room Cooler at the Perry Nuclear Power Plant (PNPP). At the time of the failure, the HPCS system was inoperable for the conduct of the testing and required Technical Specification actions had already been completed.

The root cause of the failure was determined to be mechanical wear of the pump motor breaker cell switch operating linkage. Contributing to the failure was misalignment of this linkage related to a previous breaker replacement, and inadequate visual inspection of the cell switch contact alignment due to inadequate procedural detail. Following adjustment of the cell switch linkage and verification of proper operation, HPCS was returned to operable status at 1529 on October 24, 2002.

Adequate redundant Emergency Core Cooling Systems remained available during the unavailability of HPCS, but HPCS is significant from a risk perspective. Therefore, this event is considered to have had moderate safety significance.

This event was reported to the NRC via the Emergency Notification System on October 23, 2002, at 1216, (ENF #39311) in accordance with 10CFR50.72(b)(3)(v)(D) as a condition that could have prevented the fulfillment of a safety function needed to mitigate the consequences of an accident.

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

I) INTRODUCTION

The High Pressure Core Spray (HPCS) system [BG] is one of four Emergency Core Cooling Systems (ECCS) at the Perry Nuclear Power Plant (PNPP). The primary purpose of the HPCS system is to maintain reactor vessel water inventory following a small reactor coolant boundary break, which does not depressurize the reactor vessel. HPCS also provides spray cooling during reactor coolant boundary breaks that result in uncovering the reactor core.

The HPCS system includes a motor-driven centrifugal pump, powered from a safety related diesel backed electrical bus. The pump discharges into the reactor vessel through a spray sparger located above the reactor core using associated system piping, valves, controls, and instruments.

The plant was in Mode 1 at 98.3 percent of rated thermal power and at normal operating pressure and temperature at 1113 on October 23, 2002. The HPCS system had been administratively declared inoperable to support periodic testing of the HPCS Pump Room Cooler [BG-CLR]. Technical Specification (TS) required actions for inoperability of the HPCS system had been completed.

II) EVENT DESCRIPTION

Testing of the HPCS Room Cooler had progressed to the step that called for starting the HPCS pump. HPCS system indications appeared to be normal prior to the attempt to start the pump. The control room staff attempted to the start the pump in accordance with the System Operating Instruction (SOI). When the pump did not initially start, the Unit Supervisor directed the operator to make a second attempt to start the pump, believing that the control switch may not have been held in the start position long enough. Again the pump did not start.

A visual inspection of the breaker [BG-BKR] and cell switch [BG-SWGR] was conducted. This inspection noted no obvious, abnormal indications. The as-found conditions were preserved by placing the area under quarantine for investigation. Results of this initial inspection were reported to the Control Room. The Control Room staff re-verified that the TS required actions for inoperability of HPCS had been completed.

A Condition Report (CR 02-03972) was written to document the event, and a work order was generated to determine and correct the cause of the failure. Troubleshooting activities included breaker/cubicle interface checks, a visual inspection of the breaker, and an operational test of the breaker using a test box which were performed with satisfactory results. Troubleshooting identified that one of the rotary contacts of the breaker closure circuit cell switch had not engaged to make a proper connection and resulted in an open pump start circuit. The cell switch is a unit that contains eight individually adjustable double-break rotary contacts mounted on a shaft. The seven other cell switch contacts were all in the proper position. The contacts are positioned by a mechanical linkage driven by the racking action of the breaker.

Breaker position indication power is independant of the cell switch positions and indicated that power was available to start the pump.

This event is being reported in accordance with 10CFR50.73(a)(2)(v)(D), as an event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

III) CAUSE OF EVENT

The root cause of the failure was determined to be mechanical wear of the pump motor breaker cell switch operating linkage. Contributing to the failure was misalignment of this linkage related to a previous breaker replacement (in 1994), and inadequate visual inspection of the cell switch contact alignment due to inadequate procedural detail.

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

The operating linkage for this cell switch consists of two levers connected through pins to an adjustable rod. As the breaker is racked in or out, a pin on the breaker activates one lever causing it to pivot, moving the adjustable rod which in turn moves the second lever and positions the cell switch. Mechanical wear compounded misalignment of the cell switch linkage such that eventually, one of the rotary contacts in the cell switch breaker closure circuitry failed to make a proper connection.

The investigation found that the existing switch linkage misalignment was more than could be accounted for by normal wear alone. The cell switch linkage may not have been properly adjusted when the breaker was replaced in 1994 with a refurbished breaker. The cell switch and breaker are not a matched set and therefore may require adjustment any time the breaker/cell switch combination is changed. In this case, variations in the tolerances for the location of the operating pin on the breaker resulted in a change of the cell switch alignment when the breaker was replaced.

The electrical maintenance procedure did not contain specific criteria for the visual inspection of the cell switch contact alignment. The visual inspection of the cell switch contact alignment did not verify that the contacts were in the full, flat horizontal position for correct engagement, although a satisfactory functional check was achieved when the replacement breaker was installed.

IV) SAFETY ANALYSIS

This event is considered to have moderate safety significance.

The Emergency Core Cooling Systems are designed to provide protection against postulated loss of coolant accidents (LOCA) caused by ruptures in primary system piping. They are also designed to ensure that no single active component failure will prevent automatic initiation and successful operation of the minimum required ECCS. The ECCS uses two independent methods (flooding and spraying) to ensure that the reactor core is adequately cooled in the event of a LOCA.

The ECCS consist of three divisions, any two of which have been evaluated to be capable of mitigating the spectrum of breaks in the accident analyses. The ECCS include the High Pressure Core Spray (HPCS) System, the Low Pressure Core Spray (LPCS) System [BM], and the Low Pressure Coolant Injection (LPCI) [BO] mode of the Residual Heat Removal (RHR) System. The Automatic Depressurization System (ADS) is also considered an ECCS.

For accidents which do not quickly depressurize the reactor, if HPCS is not available to maintain water level, mitigation includes automatic initiation of ADS in combination with LPCI and LPCS. In such a situation, the ADS is designed to open the selected safety/relief valves (S/RVs), depressurizing the Reactor Coolant System (RCS) and allowing the LPCI and LPCS to overcome RCS pressure and inject coolant into the vessel. If the break is large, RCS pressure initially drops rapidly, allowing the LPCI and LPCS systems to inject coolant into the core.

The HPCS pump had been operated satisfactorily on August 28, 2002. The failure was discovered on October 23, 2002, at 1113, and the system was restored to operable status on October 24, 2002, at 1529, resulting in twenty-eight hours and sixteen minutes of unavailability from discovery until return to service. During this period while the system was unavailable, the other ECCS were available.

To assess the impact of the failure on the probability of core damage, an Incremental Conditional Core Damage Probability (ICCDP) was calculated. The unavailability exposure used for this calculation was derived by using half of the time period between the last successful surveillance performance and the time of discovery, after subtracting the time HPCS was not required as a result of a plant outage during the same period. The calculated ICCDP was 3.32E-6. Using Regulatory Guide 1.174, An Approach For Using Probabilistic Risk Assessment In Risk-Informed Decisions on Plan-Specific Changes To the Licensing Basis, as a reference, this event is considered to have moderate safety significance since the calculated ICCDP was greater than 1E-6.

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

V) CORRECTIVE ACTIONS

The cell switch linkage for the HPCS pump breaker was adjusted to obtain proper alignment. Proper cell switch/linkage operation was verified, both visually and electrically, during breaker racking evolutions. Proper operation of the system, as a whole, was confirmed on October 23, 2002, at 1848, when the HPCS pump was started in accordance with the system operating instruction. The system was declared operable at 1529, October 24, 2002.

No obvious deficiencies were identified during a visual inspection of the safety-related and non-safety related 5kV switchgear. However, work orders have been generated to make adjustments as appropriate to assure proper alignment of the cell switch/linkage is maintained. A verification check of these cell switch contacts using test equipment has been completed for the safety-related switchgear which confirmed the results of the visual inspection.

Other corrective actions identified by the investigation and captured in the corrective action program include:

Revision of the electrical maintenance procedure to provide additional criteria for the inspection of cell switch contacts and evaluation of the need to provide training on the changes to the maintenance/inspection procedure. These corrective actions are intended to ensure that cell switch contacts are properly engaged following maintenance activities, which verifies the operating linkage is properly adjusted for possible misalignment or wear.

Evaluation of revising the system operating instruction to include a visual check of the switch contact position when performing breaker racking evolutions and evaluation of the need to provide training for the instruction changes. These corrective actions are intended to ensure that cell switch contacts are properly engaged following routine activities to monitor for potential wear of the operating linkage.

This event has been documented in the PNPP corrective action program. The corrective actions will be tracked and implemented in accordance with the processes and requirements of the corrective action program.

VI) PREVIOUS SIMILAR EVENTS

A search of Licensee Event Reports (LER) over the past 3 years from the Perry plant found that no similar events had been reported.

A review of the PNPP Corrective Action Program identified three similar events. In June 2001 (CR 01-2441), a Reactor Feed Booster Pump failed to start, and the investigation found the breaker cell switch was not making good contact on the contact points. This was corrected by adjusting the switch linkage. A corrective action for that event provided awareness training for electrical maintenance personnel. This corrective action by itself was not sufficient to prevent the current event. In March 2001 (CR 01-1347), a breaker cell switch did not change position and was found to be dirty. While similar, the corrective action for that event would not have been expected to prevent the current event. In 1998 (Potential Issue Form 98-125), following routine breaker maintenance, the HPCS pump failed to start for retest. The investigation of that event determined no cause and documented no evidence of the pump's failure to start as being associated with cell switch misalignment.

COMMITMENTS

No regulatory commitments were identified in this report.

Energy Industry Identification System (EIIS) Codes are identified in the text by square brackets [XX].