Entergy

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Entergy Nuclear Operations, Inc.
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Pete Dietrich
Site Vice President

June 22, 2009
JAFP-09-0076

United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

SUBJECT: LER: 2009-006-00, "Inoperable High Pressure Coolant Injection System"
James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
License No. DPR-59

Dear Sir or Madam:

This report is submitted in accordance with 10 CFR 73(a)(2)(v)(D), "Any event or condition that could have prevented fulfillment of the safety function of structures or systems that are needed to ... (D) Mitigate the consequences of an accident."

There is no commitment contained in this report.

Questions concerning this report may be addressed to Mr. Joseph Pechacek, Licensing Manager, at (315) 349-6766.

Sincerely,

Pete Dietrich
Site Vice President

PD/JP/ed

Enclosure(s): 1. JAF LER 2009-006-00, "Inoperable High Pressure Coolant Injection System"

cc: USNRC, Region 1
USNRC, Project Directorate
USNRC Resident Inspector
INPO Records Center

JE22
NRR

NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 08/31/2010

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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 an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
James A. FitzPatrick Nuclear Power Plant	05000333	1 OF 5

4. TITLE

Inoperable High Pressure Coolant Injection System

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	05000
04	22	2009	2009	006	00	06	22	2009	FACILITY NAME: N/A	DOCKET NUMBER: 05000

9. OPERATING MODE

1

10. POWER LEVEL

99

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

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

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Mr. Joseph Pechacek, Licensing Manager	(315) 349-6766

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
E	BJ	V	A365	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ Yes (If yes, complete 15. *EXPECTED SUBMISSION DATE*) ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On 04/22/09, during the initial startup sequence of ST-4N, "HPCI Quick-Start, Inservice, and Transient Monitoring Test (IST)", HPCI steam line isolation valves 23MOV-15, 23MOV-16, and 23MOV-60 closed on an invalid high steam flow isolation signal. The High Pressure Coolant Injection (HPCI)[EIIS=BJ] turbine tripped due to the HPCI isolation signal. This invalid HPCI steam line isolation temporarily rendered the HPCI system inoperable and thus, this condition was reported within 8 hours per 10 CFR 50.72(b)(3)(v)(D). LCO 3.5.1 Condition C, HPCI System inoperable, was entered until the cause of the isolation was determined, required adjustments were made, and SR 3.5.1.9 was satisfied.

The cause of the invalid isolation was a rapid opening of the HPCI Turbine Stop Valve 23HOV-1[EIIS=V] that caused a surge in steam flow, which exceeded the High Steam Flow isolation trip setpoint.

BACKGROUND

The safety functions of the High Pressure Coolant Injection (HPCI) [EIIS=BJ] system are to provide manual or automatic core cooling following an abnormal event that results in low reactor water level or high drywell pressure. The HPCI system provides core cooling over a wide range of reactor pressures (150 psig to 1195 psig). Testing in accordance with Technical Specification (TS) Surveillance Requirement (SR) 3.5.1.9 is performed to assure that HPCI is OPERABLE, i.e., can perform its safety-related functions if needed. If the results of SR 3.5.1.9 are not satisfactory (i.e., the performance of a safety function is not assured), the system is declared inoperable.

When the HPCI system is initiated, the HPCI Turbine Steam Supply Isolation Valve (23MOV-14) opens admitting steam to 23HOV-1. Simultaneously the HPCI auxiliary oil pump starts, and when the 23HOV-1 actuator reaches a sufficient pressure, the 23HOV-1 poppet valve opens reducing the pressure in the balance chamber, allowing the actuator to open the main disc against system pressure. Once unseated, the opening stroke of 23HOV-1 is limited by oil flow to the hydraulic actuator through a 3/16" orifice. If the balance chamber pressure is set too low, it can cause rapid erratic operation of 23HOV-1, due to an excessive imbalanced differential pressure across the main disc at the point of unseating. This condition can result in a surge in steam flow and an automatic isolation of the system. If the balance chamber pressure is set too high, it can prevent operation of 23HOV-1 due to an excessive pressure above the poppet valve, thereby, preventing system start-up and operation. As such proper balance chamber pressure is critical to ensure proper stop valve operation.

The steam flow signal to the HPCI Steam Line containment isolation logic is provided in order to isolate the steam lines in the event of a steam line break.

EVENT DESCRIPTION

On 04/22/09, during the initial startup sequence of ST-4N, "HPCI Quick-Start, Inservice, and Transient Monitoring Test (IST)", HPCI steam line isolation valves 23MOV-15, 23MOV-16 and 23MOV-60 closed on an invalid high steam flow isolation signal. The High Pressure Coolant Injection (HPCI)[EIIS=BJ] turbine tripped due to these primary containment HPCI isolation valves closing. This invalid HPCI steam line isolation temporarily rendered the HPCI system inoperable and thus, this condition was reported within 8 hours per 10 CFR 50.72(b)(3)(v)(D).

A video observation identified a rapid erratic opening of Turbine Stop Valve 23HOV-1 in approximately 1 second. As a result of the rapid erratic opening of 23HOV-1, there was a surge in HPCI Steam line flow that caused an invalid high steam flow trip signal to be applied to the HPCI Steam line containment isolation valves. A normal opening of 23HOV-1 would restrict steam flow resulting in a smaller steam flow transient.

Based on the invalid automatic isolation of the HPCI steam line the HPCI system was declared inoperable and LCO 3.5.1 Condition C was entered. The plant remained in LCO 3.5.1 Condition C until the cause of the isolation was determined, system restoration was completed, and SR 3.5.1.9 was satisfied.

EVENT ANALYSIS

When the HPCI system is initiated, the HPCI Turbine Steam Supply Isolation Valve (23MOV-14) opens admitting steam to 23HOV-1. To allow 23HOV-1 to open against full system pressure, a balancing chamber permits the pressure above the stop valve main disc to be reduced through a poppet valve to the downstream piping. Balance chamber pressure is controlled through two internal equalizing valves that allow some steam to

EVENT ANALYSIS (continued)

be admitted to the balance chamber from the upstream side of the stop valve main disc. When the HPCI system is started, the HPCI Turbine Steam Supply Isolation valve 23MOV-14 opens admitting steam to 23HOV-1. Simultaneously, the HPCI auxiliary oil pump starts and when 23HOV-1 actuator pressure reaches approximately 68 psig (at 1000psig reactor pressure), the 23HOV-1 poppet valve opens, reducing the pressure in the balance chamber and allowing the main disc to open against system pressure.

If the balance chamber pressure is set too low it can cause rapid erratic operation of 23HOV-1 due to excessively imbalanced differential pressure across the main disc at the point of unseating resulting in abnormal start-up of the system and potential automatic isolation. If the balance chamber pressure is set too high, it can prevent operation of 23HOV-1 due to an excessive pressure above the poppet valve, thereby preventing system start-up and operation. As such proper balance chamber pressure is critical to ensure proper stop valve operation.

Video observation of the attempted HPCI start-up indicated a rapid erratic opening of 23HOV-1 immediately prior to the system isolation. HPCI Steam Line Flow, as recorded in the Post Trip Log (PTL), showed a spike during the 23HOV-1 opening. Investigation determined that the spike in steam flow initiated a high steam flow trip signal for the HPCI steam line isolation valves. Rapid erratic opening of 23HOV-1 is symptomatic of the balancing chamber pressure being set low in the band.

The balance chamber pressure was set at 146 psig in 1999, and the HPCI system exhibited normal response during start-up until January of 2009. In January 2009, during a post maintenance test 23HOV-1 exhibited a rapid erratic opening. This was determined to be the result of insufficient warming of the steam lines that had been isolated during the maintenance window. Discussions with the vendor, the co-author of the EPRI Terry Turbine Maintenance Guide, and industry experts determined that no adjustment to balance chamber pressure, which had not been adjusted since being set in 1999, was required. Following the April 2009 occurrence that resulted in a HPCI system isolation, an engineering team again consulted with the vendor, EPRI, and industry experts and determined that the balance chamber pressure was the cause of the rapid erratic opening of 23HOV-1, that in turn was the cause of the invalid steam line isolation signal due to the surge in steam line flow. The balance chamber was still set at 146 psig, which was within the manufacturer's and General Electric Service Information Letter (SIL) guidance of 100 to 180 psig. However, this set point was slightly lower than the EPRI guidance of 150 to 200 psig. Since the balance chamber pressure was determined to be the cause of the rapid opening of 23HOV-1 and the subsequent system isolation, the EPRI pressure range was adopted and the set pressure was adjusted to the upper region of the band.

CAUSE OF EVENT

The 23HOV-1 balance chamber pressure was set low in the pressure band resulting in a rapid erratic opening of 23HOV-1 during the HPCI start-up sequence. This resulted in a steam flow surge that exceeded the HPCI High Steam Flow isolation setpoint, which initiated the isolation of the HPCI steam line.

EXTENT OF CONDITION

No other turbine stop valve in the plant operates using a balance chamber with adjustable pressure, therefore, the condition is limited to this application.

FAILED COMPONENT IDENTIFICATION

Manufacturer:	AMETEK
Model No.:	M67-05774-V
NPRDS Manufacturer Code:	A365
NPRDS Component Code:	V
FitzPatrick Component Id:	23HOV-1

CORRECTIVE ACTIONS

Immediate Corrective Actions:

1) Revised procedure IMP-23.12, HPCI Stop Valve Steam Balance Chamber Adjustment, to change the acceptance range for the balance chamber pressure to 150 to 200 psig as described in the EPRI Maintenance Guide.
2) Adjusted 23HOV-1 balance chamber pressure to 192 psig. Post-work testing was completed under hot and cold start conditions.
3) Tested the HPCI system and returned it to operable with no restrictions or limitations.
4) Performed HPCI Steam Line High Flow Transmitter Calibration.
5) Performed HPCI Auto Isolation Instrument Functional Test / Calibration.

Completed Corrective Actions:

1) Performed a root cause analysis.

2) To assure future HPCI operability, a confirmatory HPCI test program has been generated. This program includes the following additional HPCI turbine startup testing.
   - One week after initial declaration of operability.
   - Three weeks after initial declaration of operability.
   - Seven weeks after initial declaration of operability.
   - Fifteen weeks after initial declaration of operability.
   - Return to normal surveillance interval thereafter.

ASSESSMENT OF SAFETY CONSEQUENCES

The Emergency Core Cooling Systems (ECCS) use two independent methods (flooding and spraying) to cool the core during a Loss of Coolant Accident (LOCA). ECCS consists of the High Pressure Coolant Injection (HPCI) System, the Core Spray (CS) System, the Low Pressure Coolant Injection (LPCI) mode of the Residual Heat Removal (RHR) System, and the Automatic Depressurization System (ADS). The Reactor Isolation Cooling System is a high pressure injection source for reactor coolant inventory and cooling that is available under accident conditions.

ASSESSMENT OF SAFETY CONSEQUENCES (continued)

HPCI was declared inoperable at 0837 on April 22, 2009. After completing corrective maintenance and post maintenance testing, HPCI was declared operable at 0345 on April 28, 2009. During this time, reactor power was approximately 100 percent, the condensate and feedwater systems provided normal makeup to the reactor vessel, and the RCIC, ADS, LPCI, and CS remained operable.

Based on the cause of the HPCI isolation, if HPCI initiation had been required operators could have diagnosed the invalid isolation using control room indication and restarted HPCI per OP-15, "High Pressure Coolant Injection System." If plant parameters warranted, operators would have restored and maintained plant parameters per the Emergency Operating Procedures (EOPs). In the event that HPCI could not be restored and other mitigation strategies were unsuccessful, the Reactor Pressure Vessel would be depressurized to allow low pressure injection.

Based on the continuous Operability of redundant ECCS systems and considerations of operator manual actions to make HPCI available, the safety significance of this event is low.

SIMILAR EVENTS

There has not been a similar event within the past 10 years.

REFERENCES

1. JAF Condition Report CR-JAF-2009-01398, HPCI Steam Line Isolation During Start-up.
2. Event Notification, EN 45008, April 22, 2009, HPCI Steam Line Isolation During Surveillance Testing.
3. Electric Power Research Institute, "Terry Turbine Maintenance Guide, HPCI Application," EPRI TR-1007459, November 2002.
4. General Electric, Service Information Letter (SIL) 352, HPCI Turbine Stop Valve Balance Chamber Adjustment.