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Lawrence M. Coyle
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JAFP-14-0019
February 18, 2014

United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Subject: LER: 2013-006, Loss of HPCI Safety Function Due to Failure of "B" CST
Level Switches

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 50.73(a)(2)(v)(D), An Event or Condition that Could Have Prevented Fulfillment of a Safety Function.

There are no commitments contained in this report.

Questions concerning this report may be addressed to Mr. Chris M. Adner, Regulatory Assurance Manager, at (315) 349-6766.

Sincerely,

A handwritten signature in black ink, appearing to read "Lawrence M. Coyle", written over a large, stylized flourish.

Lawrence M. Coyle
Site Vice President

LMC/CMA/ds

Enclosure(s): JAF LER 2013-006, Loss of HPCI Safety Function Due to Failure of "B" CST
Level Switches

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



LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

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 FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@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.

1. FACILITY NAME

James A. FitzPatrick Nuclear Power Plant

2. DOCKET NUMBER

05000333

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4. TITLE

Loss of HPCI Safety Function Due to Failure of "B" CST Level Switches

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
12	17	2013	2013	006	00	02	18	2014	N/A	N/A
									FACILITY NAME	DOCKET NUMBER
									N/A	N/A

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)			
1	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
100	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME Mr. Chris M. Adner, Regulatory Assurance Manager	TELEPHONE NUMBER (Include Area Code) 3153496766
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13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
X	BJ	LS	M040	Y	X	BJ	LS	M040	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 the morning of December 17, 2013, at James A. FitzPatrick (JAF) Nuclear Power Plant, with the reactor at 100 percent power, performance of ISP-75 commenced at 0810 EST. ISP-75 functionally tests and calibrates the Condensate Storage Tank (CST) Low Water Level instrument channels of the High Pressure Coolant Injection (HPCI) System. During performance of this planned surveillance, the first level switch associated with the "B" CST that was tested (23LS-74B) failed to actuate. At 0938 EST, the Chief Instrumentation and Controls technician performing the test reported the failure of 23LS-74B to the Control Room Supervisor, and was directed to continue testing per ISP-75. Subsequent testing of the redundant "B" CST level switch (23LS-75B) revealed that the level switch actuated at a simulated CST level of 58.5 inches.

The combination of these two deficiencies would have prevented the HPCI automatic suction swap-over function until the "B" CST level dropped to 58.5 inches. This is less than the analyzed Technical Specification (TS) required value for low CST water level of 59.5 inches; per TS 3.3.5.1 Condition D, this would have resulted in the HPCI system being declared inoperable. Therefore, this event is reportable pursuant to 10 CFR 50.73(a)(2)(v)(D) as an event or condition that could have prevented fulfillment of a safety function.



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CONTINUATION SHEET**

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 FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@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.

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NARRATIVE

BACKGROUND

The High Pressure Coolant Injection (HPCI) System [EIS Identifier: BJ] at James A. FitzPatrick (JAF) is a part of the Emergency Core Cooling System (ECCS); HPCI provides and maintains an adequate coolant inventory inside the Reactor Pressure Vessel [RPV] to prevent damage to the reactor core under postulated accident scenarios. The system is comprised of various components which include pumps, valves, piping, and instrumentation. The HPCI System may be initiated by automatic or manual means, although manual initiation requires manipulation of individual pump and valve control switches. Automatic initiation occurs for conditions of Reactor Vessel Water Level – “Low Low” or Drywell Pressure – “High.”

The HPCI System monitors the levels in the Condensate Storage Tanks (CST) [TK] and suppression pool [BT], because these are the two sources of water for HPCI operation. Reactor grade water in the CSTs is the normal source. The CST suction source consists of two CSTs connected in parallel to the HPCI pump suction. Upon receipt of a HPCI initiation signal, the CST suction valve is automatically signaled to open (it is normally in the open position) unless both suppression suction valves are open. If the water level in both CSTs falls below the pre-selected level defined in the TS, first the suppression pool suction valves automatically open, and then the CST suction valves automatically close. This action completes the automatic suction source alignment function.

Two level switches [LS] are used to detect low water level in each CST, and initiate the automatic suction source alignment function. The level switches are arranged in a one-out-of-two taken twice logic. The actuation of two switches (one on each opposing “A” and “B” CST) can cause the suppression pool suction valves to open and the CST suction valve to close. The four channels of low CST level function are required to be Operable when HPCI is required to be Operable in order to ensure that no single instrument failure can preclude HPCI automatic suction source alignment to suppression pool. The two “B” CST level switches are 23LS-74B and 23LS-75B.

Preceding events

ISP-75 was performed successfully for all four HPCI CST level switches on September 30, 2013.

EVENT DESCRIPTION

I&C commenced ISP-75, “HPCI CST Low Water Level Switch Functional Test/Calibration,” at 0810 EST on the morning of December 17th, 2013, with the plant at 100 percent power. This test is designed to functionally test and calibrate the CST Low Water Level instrument channels of the HPCI System. All channels of the HPCI automatic suction source alignment logic are tested during this surveillance. The HPCI level switches on the “A” CST were tested first, and performed satisfactorily.

At 0938 on December 17th, the Chief Instrumentation and Controls (I&C) technician performing ISP-75 reported failure of level switch 23LS-74B to the Control Room Supervisor. The I&C Supervisor responsible for the testing was also informed of the failure and documented the deficiency via Condition Report (CR) CR-JAF-2013-06304 at 0852 EST. The Shift Manager (SM) and I&C Supervisor discussed the equipment failure and

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the SM determined that the switch was Inoperable per TS. The SM then directed the Control Room Supervisor (CRS) to initiate an emergent active LCO and develop a status control tagout equipment failure. The Chief I&C technician was directed to continue testing per ISP-75. As-Left testing was performed on 23LS-74B with satisfactory results.

Subsequent testing determined that the 23LS-75B level switch actuated below the required simulated CST level. Actuation of this level switch occurred at a simulated CST level of 58.5 inches vice the required level per ISP-75 of between 59.95 and 61.05 inches. The actuation of the second level switch below the Technical Specification (TS) allowable value was communicated to the CRS and I&C Supervisor at 1025 EST and documented (via CR-JAF-2013-06306) at 1019 EST. Calibration of 23LS-75B was performed and As-Left functional testing was conducted with satisfactory results.

EVENT ANALYSIS

High Pressure Coolant Injection Operability

The prerequisites to ISP-75 require the Shift Manager to review TS Table 3.3.5.1-1, "Emergency Core Cooling System Instrumentation" (specifically Function 3d), and ensure that one of the following actions have been taken:

1. Determined HPCI System is not required to be Tech Spec Operable
2. Declared the HPCI System Inoperable

The HPCI System was declared Inoperable at 0810 EST for performance of ISP-75. The failure of 23LS-74B was reported to the control room supervisor at 0938 EST. The actuation of 23LS-75B at below the TS allowable value was reported to the Control Room Supervisor at 1025 EST.

TS Limiting Condition of Operation (LCO) 3.3.5.1 Condition D, requires the HPCI System to be declared Inoperable within one hour of discovery of loss of automatic suction source alignment capability. The combination of these two deficiencies would have potentially prevented the HPCI automatic suction source alignment function until the CST "B" level dropped to 58.5 inches. This level is less than the Technical Specification allowable value of ≥ 59.5 inches CST water level. This would have resulted in the HPCI System being declared Inoperable (per TS), and represents a loss of safety function for the single-train HPCI System. The JAF SM notified the NRC via the Emergency Notification System (ENS 49660) pursuant to 10 CFR 50.72(b)(3)(v)(D).

CAUSE OF EVENT

The direct mechanistic cause of the failure of 23LS-74B, as determined by a causal analysis, was binding in the float chamber caused by the presence of corrosion products. Further consideration of this mechanistic cause led to the determination that this failure was due to inadequate preventative maintenance resulting in the degradation of 23LS-74B. Improvements in future preventative maintenance are applicable to all Magetrol Model 291MPG-S1MD4DC level switches of common construction (carbon steel float chambers).

The direct mechanistic cause for the actuation of 23LS-75B at less than the TS allowable set point has not been determined. A follow-up action exists for the removal, disassembly, and inspection of 23LS-75B, and is scheduled for March of 2014.

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EXTENT OF CONDITION

The extent of condition discussed herein only considers the failure mode(s) associated with 23LS-74B, because (as stated above) the disassembly and inspection of 23LS-75B is not complete.

The extent of condition for this event extends to the remaining HPCI CST level switches (associated with the "A" CST), as well as the Reactor Core Isolation Cooling (RCIC) [BN] CST level switches as they are connected to the same tanks (CST). The RCIC level switches are similar in design and function; however, the float chambers are constructed of stainless steel.

A Condition Report has been written to determine the existence of other level switches at JAF of similar design, and their susceptibility to this failure mode.

HPCI System:

The condition was discovered on 23LS-74B which makes the other HPCI CST level switches susceptible to this failure mode. The other HPCI level switches are of the same manufacturer and provide a redundant function for the HPCI suction transfer logic. Previous RCIC CST switch failures were due to microswitch plunger corrosion preventing switch actuation. As part of the extent of condition on the previous RCIC failures, the HPCI level switch microswitches were inspected for corrosion. The inspections were satisfactory with no microswitch deficiencies noted. In addition, the HPCI topworks unit is sealed with cap o-ring and conduit seal, which RCIC does not have. Since the remaining HPCI switches are similar (construction and function) there is a reasonable likelihood that they may exhibit a common failure mode.

RCIC System:

The RCIC CST level switches are susceptible to this failure mode due to the similar design and function. The HPCI level switch float chamber is constructed of carbon steel with a stainless steel float. RCIC level switches are constructed with a stainless steel float chamber and float. No evidence of corrosion products were found during a previous inspection of the float chamber internals associated with the "B" CST RCIC level switch 13LS-76B. These results coupled with the corrosion resistant material makeup of the RCIC level switches provides reasonable assurance that there is a low risk of this condition being present in the CST level switches associated with the RCIC System. No additional corrective actions associated with this extent of condition are planned for the RCIC level switches.

FAILED COMPONENT IDENTIFICATION:

Manufacturer:	Magnetrol
Manufacturer Model Number:	291MPG-S1MD4DC
NPRDS Manufacturer Code:	M040
NPRDS Component Code:	LS
FitzPatrick Component ID:	23LS-74B and 23LS-75B

CORRECTIVE ACTIONS

Completed Actions

- Replaced 23LS-74B on January 10, 2014
- Performed a CST water sample to determine the suspended solids level and/or presence of foreign materials on January 26, 2014
- Increased ISP-75 performance frequency from an approximate ninety day periodicity to an approximate forty-five day periodicity.

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Future Actions

- Perform an Extent of Condition review to identify level switches at JAF of similar design, and their susceptibility to this failure mode.
- Perform disassembly, inspection, and replacement of the remaining HPCI level switches identified in the Extent of Condition review.
- Perform sample of any corrosion products and foreign material found in the remaining HPCI CST level switches to determine composition.
- Develop and implement replacement Preventative Maintenance (PM) for the HPCI level switches.

SAFETY SIGNIFICANCE

Nuclear Safety

Actual Consequences

There were no actual nuclear safety consequences during this period as a result of this event.

Potential Consequences – Delayed Shifting of the HPCI Suction from the CST to the Suppression Pool

The aggregate effect of the combined deficiencies is a loss of redundancy in the opening circuit for the HPCI suppression pool suction valves due to failure of 23LS-74B to actuate along with a delay in the time at which the suction transfer would have been initiated as a result of the lower actuation point for 23LS-75B.

The safety significance of delayed shifting of the HPCI suction from the CST to the suppression pool is a higher potential for air entrainment in the HPCI suction flow due to lower tank level at completion of the suction source transfer. An engineering evaluation determined that the minimum CST level for initiation of automatic suction source transfer to preclude air entrainment in the HPCI suction is 34.14 inches. Actuation of 23LS-75B during the December 17, 2013 performance of ISP-75 occurred at 58.5 inches, which is well above this lower limit. Therefore, the risk associated with the HPCI automatic suction source transfer occurring at the As Found level is minimal.

Potential Consequences - Probabilistic Risk Assessment Implications

Equipment Out of Service (EOOS) Probabilistic Risk Assessment (PRA) was used to analyze the failure of 23LS-74B, and the subsequent loss of HPCI automatic suction source alignment (failure of 23LS-75B to actuate at the TS allowable value of ≥ 59.5 inches). The loss of HPCI automatic suction source alignment does not result in an increase in core damage frequency. The JAF EOOS PRA model does not account for the HPCI automatic suction source alignment function; instead, the model assumes that the HPCI System takes suction from the CSTs for the entire twenty-four hour mission time. The twenty-four hour HPCI mission time is based on the ASME PRA standard. Thus the loss of automatic suction source alignment does not result in an increase in core damage frequency.

Radiological Safety

There was no radiological safety impact. No release, exposure, or increase in potential risk thereof was consequence of this condition.

Industrial Safety

There was no industrial safety impact, as this condition was associated with HPCI CST level switch component failures.

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SIMILAR EVENTS

No similar events associated with the HPCI System were identified.

The following Condition Reports (CR) document similar events associated with the RCIC Low Level CST automatic suction source alignment function.

RCIC Level Switches Fail to Trip on Low CST Level		
Condition Report	Cause	Applicability
CR-JAF-2013-00061	Intermittent failure due to water intrusion	Not applicable; The HPCI switches used at JAF have a sealed conduit entrance and a cap and o-ring.
CR-JAF-2013-04311 CR-JAF-2013-04312	Corrosion of the microswitch contacts due to water intrusion	Not applicable; water intrusion and corrosion is not an issue based on EOC inspections on the HPCI switches.
CR-JAF-2013-05576	Maladjustment during installation due to lack of vendor manual instructions	Not applicable; The HPCI level switch mechanisms are a different design and have not underwent adjustments to the actuator plate or microswitch position.

Although the internal operating experience (OE) tabulated above establishes a similarity in potential impact (defeating the automatic suction source transfer function), the causal evaluations did not identify a similar failure mode associated with binding due to corrosion in the float chamber.

REFERENCES

- Condition Report: CR-JAF-2013-06304 Equipment Apparent Cause Evaluation
- Condition Report: CR-JAF-2013-06344
- Condition Report: CR-JAF-2013-06306 Failure of 23LS-75B to Actuate at the TS Allowable Value
- Technical Specifications and Bases, 3.3.5.1, "Emergency Core Cooling System (ECCS) Instrumentation"
- Technical Specifications and Bases, 3.5.1, "Emergency Core Cooling Systems (ECCS) and Reactor Core Isolation Cooling (RCIC) System"
- ISP-75, HPCI CST Low Water Level Switch Functional Test / Calibration