Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

April 13, 2015

10 CFR 50.73

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Browns Ferry Nuclear Plant, Unit 3
Renewed Facility Operating License No. DPR-68
NRC Docket No. 50-296

Subject: **Licensee Event Report 50-296/2015-001-00**

The enclosed Licensee Event Report provides details of the concurrent inoperability of the Browns Ferry Nuclear Plant, Unit 3, High Pressure Coolant Injection and Reactor Core Isolation Cooling systems. The Tennessee Valley Authority (TVA) is submitting this report in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 50.73(a)(2)(v)(A), (B), and (D), as any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to shut down the reactor and maintain it in a safe shutdown condition, remove residual heat, and mitigate the consequences of an accident.

There are no new regulatory commitments contained in this letter. Should you have any questions concerning this submittal, please contact J. L. Paul, Nuclear Site Licensing Manager, at (256) 729-2636.

Respectfully,

K. J. Polson
Site Vice President

Enclosure: Licensee Event Report 50-296/2015-001-00 – High Pressure Coolant Injection and Reactor Core Isolation Cooling Inoperable Due To No Suction Source Aligned

cc (w/ Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant

ENCLOSURE

Browns Ferry Nuclear Plant
Unit 3

Licensee Event Report 50-296/2015-001-00

High Pressure Coolant Injection and Reactor Core Isolation Cooling Inoperable Due To No Suction Source Aligned

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See Enclosed

NRC FORM 366 (01-2014) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 01/31/2017

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.

LICENSEE EVENT REPORT (LER)

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4. TITLE: High Pressure Coolant Injection and Reactor Core Isolation Cooling Inoperable Due To No Suction Source Aligned

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	N/A	N/A
02	11	2015	2015	- 001	- 00	04	13	2015	N/A	N/A

9. OPERATING MODE

1

10. POWER LEVEL

100

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)*
Mark Acker, Licensing Engineer	(256) 729-7533

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	SD	HS	X000	Y	N/A	N/A	N/A	N/A	N/A

14. SUPPLEMENTAL REPORT EXPECTED

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

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
N/A	N/A	N/A

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

On February 11, 2015, at 0820 Central Standard Time, Brown's Ferry Nuclear Plant (BFN), Unit 3, declared the High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) systems inoperable due to no suction source aligned. During surveillance testing, the Condensate Storage Tank (CST) emergency discharge isolation valve energized and closed when the breaker was closed, isolating both systems from their suction source. It was subsequently determined that contacts on the local hand switch were stuck closed following performance of a previous maintenance task. Operations personnel re-opened the isolation valve using the hand switch in the Control Room, restoring operability to the HPCI and RCIC systems.

The apparent cause of this event was inadequate design review of a 2010 plant modification which allowed latent design vulnerabilities to be introduced into the plant.

The corrective actions to reduce the probability of a similar event occurring in the future were to remove thermal overload heaters from the affected breakers, preventing valve closure when these breakers are closed; to review a sample of recent engineering change packages for quality of Design Review; to repair a faulty hand switch; and to implement a design change for the CST isolation valves for all three BFN units to prevent spurious operation of the isolation valve when the associated breaker is closed.

NARRATIVE

I. Plant Operating Conditions Before the Event

Browns Ferry Nuclear Plant (BFN), Unit 3, was in Mode 1 at approximately 100 percent rated thermal power.

II. Description of Events

A. Event:

On February 11, 2015, at approximately 0820 Central Standard Time, during the performance of surveillance procedure 3-SR-3.5.1.2 (HPCI), High Pressure Coolant Injection System Monthly Valve Position Verification, Operations personnel closed the supply breaker [BKR] for flow control valve 3-FCV-2-166, Condensate Storage Tank (CST)[KA] #3 Emergency Discharge Isolation Valve [ISV], in order to verify the isolation valve was in its required open position. Indications showed the isolation valve was full open, but it was observed that isolation valve 3-FCV-2-166 inadvertently closed when its associated breaker was closed. With BFN, Unit 3, High Pressure Coolant Injection (HPCI)[BJ] and Reactor Core Isolation Cooling (RCIC)[BR] normally both aligned to take suction from CST #3, 3-FCV-2-166 was a single isolation from CST #3. When the isolation valve was closed in this alignment, HPCI and RCIC were unable to perform their design safety functions to inject water into the core. Therefore, on February 11, 2015, at approximately 0820 Central Standard Time, Operations personnel declared HPCI and RCIC inoperable.

BFN, Unit 3, entered Technical Specifications (TS) Limiting Conditions for Operation (LCO) 3.5.1, which requires each Emergency Core Cooling System (ECCS) injection/spray subsystem and the Automatic Depressurization System (ADS)[SB] function of six safety/relief valves to be operable in reactor Mode 1, and Mode 2 and Mode 3 except when HPCI and ADS valves are not required to be operable with reactor steam dome pressure less than or equal to 150 pounds per square inch, gauge (psig). Condition G was entered due to Condition C, which requires verification by administrative means that RCIC system is operable and restoration of HPCI system within 14 days, not being met. Condition G requires the unit to be placed in Mode 3 (Hot Shutdown) within 12 hours and reduction of reactor steam dome pressure to less than or equal to 150 psig within 36 hours.

Additionally, BFN, Unit 3, entered TS LCO 3.5.3, which requires the RCIC system to be operable in reactor Mode 1, and Mode 2 and Mode 3 with reactor steam dome pressure greater than 150 psig, for RCIC inoperability. Condition B was entered due to Condition A, which requires verification by administrative means that HPCI system is operable and restoration of RCIC system within 14 days, not being met. Condition B requires the unit to be placed in Mode 3 (Hot Shutdown) within 12 hours and reduction of reactor steam dome pressure to less than or equal to 150 psig within 36 hours.

On February 11, 2015, at approximately 0824 Central Standard Time, Operations personnel opened isolation valve 3-FCV-2-166 from the Unit 1 Control Room [NA], declared HPCI and RCIC Operable, and exited associated TS LCOs.

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NARRATIVE

B. Status of structures, components, or systems that were inoperable at the start of the event and that contributed to the event:

There were no structures, components, or systems that were inoperable at the start of the event and that contributed to the event.

C. Dates and approximate times of occurrences:

February 11, 2015, at 0730 Central Standard Time	Operations personnel commenced surveillance procedure 3-SR-3.5.1.2 (HPCI).
February 11, 2015, at 0820 Central Standard Time	Breaker 3-BKR-2-166 closed. Isolation valve 3-FCV-2-166 spuriously closed. HPCI and RCIC were declared inoperable due to no suction source aligned, and entered applicable TS actions.
February 11, 2015, at 0824 Central Standard Time	Isolation valve 3-FCV-2-166 remotely opened from the Unit 1 Control Room. Breaker 3-BKR-2-166 opened. Operations declared HPCI and RCIC Operable following alignment of the CST for suction and exited applicable TS actions.
February 11, 2015, at 1516 Central Standard Time	NRC was notified.

D. Manufacturer and model number (or other identification) of each component that failed during the event:

Hand switch [HS] 3-HS-2-166B was installed during initial construction. The manufacturer could not be identified.

E. Other systems or secondary functions affected:

There were no other systems or secondary systems affected.

F. Method of discovery of each component or system failure or procedural error:

On February 11, 2015, at approximately 0820 Central Standard Time, Operations personnel identified that isolation valve 3-FCV-2-166 inadvertently closed when its associated breaker was closed.

G. The failure mode, mechanism, and effect of each failed component, if known:

The cause for the inadvertent closure of isolation valve 3-FCV-2-166 was contacts on local hand switch 3-HS-2-166B being stuck closed when they should have been open.

H. Operator actions:

Operations personnel declared Unit 3 HPCI and RCIC inoperable due to no suction source aligned and entered TS LCO 3.5.1 Condition G for HPCI inoperability and TS LCO 3.5.3 Condition B for RCIC inoperability.

Operations personnel re-opened isolation valve 3-FCV-2-166 using hand switch 3-HS-2-166B in the Unit 1 Control Room and when the valve indicated full open, directed the operator in the field to open the breaker for 3-FCV-2-166 to prevent further movement.

Operations personnel declared Unit 3 HPCI and RCIC Operable following alignment of the CST for suction, and exited TS LCO 3.5.1 Condition G and TS LCO 3.5.3 Condition B.

I. Automatically and manually initiated safety system responses:

There were no automatic or manual safety system responses associated with this event.

III. Cause of the event:

A. The cause of each component or system failure or personnel error, if known:

The direct cause of this event was determined to be contacts on local hand switch 3-HS-2-166B being stuck closed instead of open.

B. The cause(s) and circumstances for each human performance related root cause:

The apparent cause of the event was determined to be inadequate design review of Design Change Notice (DCN) 69786 which allowed latent design vulnerabilities to be introduced into the plant.

Specifically, the assumption, that breakers required by TS to be closed regularly for maintenance would remain open as the sole means of preventing spurious valve closures, introduced a vulnerability into safety-related systems.

A more thorough design review may have revealed this vulnerability and ultimately prevented the event from occurring by demonstrating the need for an alternate means of preventing spurious valve closure.

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NARRATIVE

IV. Analysis of the event:

The Tennessee Valley Authority (TVA) is submitting this report in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 50.73(a)(2)(v)(A), (B), and (D), as any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to shut down the reactor and maintain it in a safe shutdown condition, remove residual heat, or mitigate the consequences of an accident.

The safety function of HPCI is to assure that the reactor is adequately cooled to limit fuel cladding temperature in the event of a small break in the nuclear system and loss of coolant which does not result in rapid depressurization of the reactor vessel. The safety function of RCIC is to provide makeup water to the reactor vessel during shutdown and isolation from the main heat sink to supplement or replace the normal makeup sources and operate automatically in time to obviate any requirement for the Core Standby Cooling Systems. Because the suction source was isolated, HPCI and RCIC were unable to perform their safety functions.

DCN 69786 was implemented on September 13, 2010, and changed the configuration of the breaker from normally closed to normally open to address fire concerns. This required a subsequent change in surveillance procedure 3-SR-3.5.1.2 (HPCI), which added the requirement for Operations personnel to close the breaker in order to verify the valve position. It was assumed during the design change process that the breakers for this isolation valve would remain open at all times, eliminating the requirement for redundant measures against spurious valve closure. The impacts of assumptions made by previous design changes were inadequately addressed; therefore, the design review for DCN 69786 was inadequate, which allowed latent design vulnerabilities to be introduced into the plant.

V. Assessment of Safety Consequences

This event resulted in inoperability and unavailability of the single trains of the BFN, Unit 3, HPCI and RCIC systems resulting in the inability of the HPCI and RCIC systems to perform their safety functions for shutting down the reactor and maintaining it in a safe shutdown condition, mitigation of the consequences of an accident, and the removal of residual heat in the event that the reactor was shut down.

Several alternate methods were available to Operations personnel in the event of an emergency to provide core cooling, safe and sustainable shutdown of the reactor, residual heat removal, and mitigation of accident consequences. Cross-tie valves allowed for taking HPCI and RCIC suction from four other available CSTs. The ability to align HPCI suction to the Unit 3 suppression pool was also present.

For Design Basis Accidents, in the event of inoperability of HPCI and RCIC systems due to lack of a suction source, adequate core cooling is ensured by the operability of the other low pressure ECCS injection/spray subsystems in conjunction with the ADS. BFN Unit 3 Operations logs were reviewed to determine if ADS or the low pressure ECCS were inoperable during the time period of the HPCI system inoperability. The results of the review are as follows.

- For ADS, all ADS valves were operable during the time period and ADS initiation capability was maintained during this time period.
- For the low pressure ECCS subsystems, i.e., two Core Spray [BM] subsystems and two Low Pressure Coolant Injection [BO] subsystems, all low pressure ECCS subsystems were operable during the time period. Low pressure ECCS initiation capability was also maintained during this time period. With HPCI and RCIC inoperable, operable low pressure ECCS subsystems and ADS are capable of providing adequate core cooling in the event of a design basis accident or transient.

Based on the above, during the time period that the HPCI and RCIC systems were inoperable, sufficient systems were available to provide the required safety functions to protect the health and safety of the public. Therefore, TVA has concluded that there was no significant reduction to the health and safety of the public or plant personnel for this event.

A. Availability of systems or components that could have performed the same function as the components and systems that failed during the event:

During this event, all other ECCS and ADS systems remained operable.

B. For events that occurred when the reactor was shut down, availability of systems or components needed to shut down the reactor and maintain safe shutdown conditions, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident:

This event did not occur when the reactor was shut down.

C. For failure that rendered a train of a safety system inoperable, an estimate of the elapsed time from discovery of the failure until the train was returned to service:

This event resulted in inoperability of the BFN, Unit 3, HPCI and RCIC systems for approximately four minutes from the time the isolation valve was isolated until the isolation valve was remotely opened.

VI. Corrective Actions

Corrective Actions are being managed by TVA's corrective action program under Problem Evaluation Report 988444.

Interim Corrective Actions

1. Removed thermal overload heaters from isolation supply valve breakers 3-BKR-2-166, 1-BKR-2-170, and 2-BKR-2-162 to prevent valve closure when breaker is closed for valve position verification.
2. Repaired faulty hand switch 3-HS-2-166B.

Corrective Actions To Reduce Probability of Similar Events Occurring in the Future

The following corrective actions reduce the likelihood of recurrence:

1. System Engineering Supervisors to review 15 engineering change packages, chosen based on risk and complexity, which were implemented between January 2010 and December 2014 for quality of the Design Review. Provide feedback where strengths or gaps are identified. Initiate Service Requests for any conditions adverse to quality or potential adverse trends.
2. Issue engineering change packages for all three BFN units to prevent spurious operation of CST isolation valves while allowing Operations personnel to close the CST isolation valve breakers each month for valve position verification as required by surveillance procedures 1/2/3-SR-3.5.1.2, ECCS Monthly Valve Position Verification, and 1/2/3-SR-3.5.3.2, RCIC System Monthly Valve Position Verification.

VII. Additional Information:

A. Previous similar events at the same plant:

A search of Licensee Event Reports and corrective action program documents revealed that no similar events are known to have occurred at any BFN unit over the past three years.

B. Additional Information:

There is no additional information.

C. Safety System Functional Failure Consideration:

This event resulted in the inability of the BFN, Unit 3, HPCI and RCIC systems to perform their safety functions for safe and sustainable shutdown of the reactor, mitigation of the consequences of an accident, and removal of residual heat in the event that the reactor was shut down. In accordance with NUREG-1022, this event is considered a safety system functional failure.

D. Scram with Complications Consideration:

This event did not result in a reactor scram.

VIII. COMMITMENTS

There are no new commitments.