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

August 13, 2012

10 CFR 50.73

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

Browns Ferry Nuclear Plant, Unit 2
Facility Operating License No. DPR-52
NRC Docket No. 50-260

Subject: **Licensee Event Report 50-260/2012-002-00**

The enclosed Licensee Event Report provides details of the High Pressure Coolant Injection System rendered inoperable. The Tennessee Valley Authority is submitting this report in accordance with 10 CFR 50.73(a)(2)(v)(B), 10 CFR 50.73(a)(2)(v)(D), and 10 CFR 50.73(a)(2)(i)(B).

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

Respectfully,

K. J. Polson
Vice President

Enclosure: Licensee Event Report 50-260/2012-002-00 – High Pressure Coolant Injection System Rendered Inoperable Due to an Inoperable Primary Containment Isolation Valve

cc (w/ Enclosure):

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

IE22
NRR

ENCLOSURE

Browns Ferry Nuclear Plant
Unit 2

Licensee Event Report 50-260/2012-002-00

High Pressure Coolant Injection System Rendered Inoperable Due to an Inoperable Primary Containment Isolation Valve

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See Attached

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 10/31/2013

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 FOIA/Privacy Section (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)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Browns Ferry Nuclear Plant, Unit 2	05000260	1 of 8

4. TITLE: High Pressure Coolant Injection System Rendered Inoperable Due to an Inoperable Primary Containment Isolation Valve

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
06	07	2012	2012	- 002 -	00	08	13	2012	FACILITY NAME: N/A	DOCKET NUMBER: 05000

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)*
Christopher Bennett, Licensing Engineer	256-729-2475

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
D	BJ	FCV	A391	Y					

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 June 7, 2012, at approximately 1305 hours Central Daylight Time (CDT), during performance of a surveillance procedure, a steam leak was identified on a Browns Ferry Nuclear Plant (BFN), Unit 2, High Pressure Coolant Injection (HPCI) steam line valve. The condition was evaluated and the valve was determined to be Operable. On June 12, 2012, based on advice from Engineering, Operations personnel requested a Prompt Determination of Operability.

On June 13, 2012, at approximately 1700 hours CDT, the HPCI steam line valve was determined to be incapable of performing its primary containment isolation valve (PCIV) function. Due to the steam leak coming from a valve leak sealant injection port, it was estimated that the allowable primary containment leak rate was exceeded. In accordance with Technical Specification (TS) actions for an inoperable PCIV, the associated penetration was isolated, rendering the HPCI System inoperable. The TS actions were entered for the inoperable HPCI System.

The root cause of the event was inadequate work instructions for ensuring the final plant configuration matched the required configuration.

The corrective action to prevent recurrence is to revise the Work Control Planning Procedure to require work orders to include verification that components affected by maintenance or modification are returned to the required configuration.

NARRATIVE

I. PLANT CONDITION(S)

At the time of the event, Browns Ferry Nuclear Plant (BFN), Unit 2, was in Mode 1 at approximately 100 percent rated thermal power.

II. DESCRIPTION OF EVENT

A. Event

On June 7, 2012, at approximately 1305 hours Central Daylight Time (CDT), during performance of surveillance procedure 2-SR-3.5.1.7, HPCI Main and Booster Pump Set Developed Head and Flow Rate Test at Rated Reactor Pressure, a steam leak was identified on flow control valve [FCV], 2-FCV-073-0081, High Pressure Coolant Injection (HPCI) [BJ] steam line warm-up valve. A BFN, Unit 2, Senior Reactor Operator (SRO) evaluated the condition and concluded that Operability was maintained.

On June 12, 2012, the BFN Appendix J Engineer became aware of the steam leak on valve BFN-2-FCV-73-81 and advised Operations of the need for an Operability Determination to be performed. Operations subsequently requested a Prompt Operability Determination from Engineering for the steam leak on valve 2-FCV-073-0081.

On June 13, 2012, at approximately 1700 hours CDT, it was determined that valve 2-FCV-073-0081, a double disc gate valve, was not capable of performing its intended primary containment isolation valve (PCIV) function. The basis for this determination was the discovery that the steam leak was coming from a leak sealant injection port in the valve packing area on 2-FCV-073-0081 that resulted from a missing adapter. Due to the position of the adapter port on the valve bonnet and the configuration of the valve in the primary containment isolation position, i.e. closed, a leak path from the primary containment to the secondary containment was available. Using the peak accident primary containment pressure of 50.6 psig and the dimensions of the leak sealant injection port opening, the leak rate was estimated to exceed the specified maximum allowable primary containment leak rate of 1.0 L_a. As a result, June 13, 2012, is considered the discovery date for reporting this event.

The BFN, Unit 2, Technical Specification (TS) Limiting Condition for Operation (LCO) 3.6.1.3 requires each PCIV, except reactor building-to-suppression chamber vacuum breakers, to be Operable in Modes 1, 2, and 3, and when associated instrumentation is required to be Operable per TS LCO 3.3.6.1, Primary Containment Isolation Instrumentation. With one or more penetration flow paths with one PCIV inoperable except due to main steam isolation valve leakage not within limits, TS 3.6.1.3 Required Action A.1 requires the affected penetration flow path to be isolated by use of at least one closed and de-activated automatic valve, closed manual valve, blind flange, or check valve with flow through the valve secured within 4 hours. TS 3.6.1.3 Required Action A.2 requires that the affected penetration flow path to be verified to

be isolated once per 31 days for an isolation device outside primary containment. If the penetration flow path cannot be isolated within 4 hours, TS 3.6.1.3 Required Actions E.1 and E.2 require the unit to be placed in Mode 3 in 12 hours and in Mode 4 in 36 hours. To meet TS LCO 3.6.1.3 Required Action A.1 for an inoperable PCIV, HPCI inboard steam isolation valve, 2-FCV-073-0002, was closed on June 13, 2012, at approximately 1745 hours CDT, rendering the BFN, Unit 2, HPCI System inoperable. As a result, TS 3.5.1, ECCS-Operating, Required Actions were entered for the inoperable HPCI System.

Additionally, since the HPCI steam line warm up flow control valve had been leaking since at least June 7, 2012, BFN, Unit 2, operated longer than allowed by the TS without isolating the affected penetration.

The BFN, Unit 2, TS LCO 3.5.1 requires each Emergency Core Cooling System (ECCS) ([BJ][BO][BM]) injection/spray subsystem and the Automatic Depressurization System (ADS)[SB] function of six safety/relief valves to be Operable in Mode 1, and in Modes 2 and 3, except HPCI and ADS valves are not required to be Operable with reactor steam dome pressure less than or equal to 150 pound-force per square inch gauge (psig). With the HPCI System inoperable, TS 3.5.1 Required Action C.1 requires that Reactor Core Isolation Cooling (RCIC) System [BN] to be immediately verified Operable by administrative means and Required Action C.2 requires that the HPCI System is restored to Operable status in 14 days. On June 13, 2012, at approximately 1745 hours CDT, Operations verified that the RCIC System was Operable by administrative means.

On June 15, 2012, following successful leak sealant injection for valve 2-FCV-073-0081, Operations personnel returned the HPCI System to service. Valve 2-FCV-073-0081 is closed, deactivated, and leak sealed. This configuration satisfies TS 3.6.1.3 Required Action A.1.

B. Inoperable Structures, Components, or Systems that Contributed to the Event

The inoperable component that contributed to this event was flow control valve 2-FCV-073-0081.

C. Dates and Approximate Times of Major Occurrences

June 7, 2012, at 1305 hours CDT	During performance of surveillance procedure 2-SR-3.5.1.7, a steam leak was identified on valve 2-FCV-073-0081.
June 7, 2012, at 2041 hours CDT	Operations personnel conducted an Operability Determination for the leak on valve 2-FCV-0073-0081 and determined that it did not affect Operability.

June 12, 2012	The BFN Appendix J Engineer advised Operations personnel of the need for a Prompt Operability Determination on valve 2-FCV-073-0081 to be performed. Operations personnel subsequently requested an Operability Determination from Engineering.
June 13, 2012, at 1700 hours CDT	Site engineering notified Operations personnel that valve 2-FCV-073-0081 was unable to perform its PCIV function. Operations personnel entered TS 3.6.1.3 Required Action A.1 due to inoperable valve 2-FCV-073-0081. This action required in-line valve 2-FCV-073-0002 to be closed and deactivated within 4 hours.
June 13, 2012, at 1745 hours CDT	In-line valve 2-FCV-073-002 was closed and deactivated, as required by TS 3.6.1.3 Required Action A.1, rendering the HPCI System inoperable. As a result, the HPCI System was declared inoperable and TS 3.5.1 Required Action C.1 was entered.
June 13, 2012, at 2318 hours CDT	The BFN reported the event to the NRC.
June 15, 2012, at 0230 hours CDT	Following successful leak sealant injection of valve 2-FCV-073-0081, Operations personnel returned the HPCI System to service.

D. Other Systems or Secondary Functions Affected

There were no other systems or secondary functions affected by this event.

E. Method of Discovery

This event was discovered during the satisfactory performance of surveillance procedure 2-SR-3.5.1.7.

F. Operator Actions

Operations personnel verified that the RCIC System was Operable by administrative means, removed the HPCI System from service by closing 2-FCV-073-0002 from the Main Control Room [NA], declared the HPCI System inoperable, and entered TS 3.5.1 Condition C.

G. Safety System Responses

There were no safety system responses to this event.

III. CAUSE OF THE EVENT

A. Immediate Cause

The immediate cause was an open hole in the side of the bonnet (stuffing box) of valve 2-FCV-073-0081 that resulted from a missing leak sealant injection port adapter.

B. Root Cause

The root cause was inadequate work instructions for configuration control to ensure the final plant configuration matched the required configuration documented in an Engineering Document Change (EDC).

IV. ANALYSIS OF THE EVENT

The Tennessee Valley Authority (TVA) is submitting this report in accordance with 10 CFR 50.73(a)(2)(v)(B) and (D), any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to remove residual heat and mitigate the consequences of an accident; and 10 CFR 50.73(a)(2)(i)(B), any operation or condition which was prohibited by the plant's Technical Specifications.

During the Spring 2009 refueling outage for BFN, Unit 2, the old leak sealant was removed and new packing was installed in order to remove a Temporary Alteration Control Form (TACF) on valve 2-FCV-073-0081. During these maintenance activities, the leak sealant injection adapter was removed and never replaced on the valve bonnet. An EDC was implemented to allow the leak sealant adapter [LOV], 2-LOV-073-0581, to remain on the valve bonnet.

During the Spring 2011 refueling outage for BFN, Unit 2, maintenance personnel documented in the applicable work order that there was an open hole on the side of the valve bonnet of 2-FCV-073-0081 and notified their supervisor. In addition, during the performance of BFN, Unit 2, operating instruction 2-OI-73, Operating Instruction for the HPCI System, during this refueling outage, it was found that the leak sealant adapter was not located on valve 2-FCV-073-0081 as required by an EDC. There was no leak present from the leak sealant injection port in the valve packing area during either of these times. On April 4, 2011, during this refueling outage, a service request was written to document the missing leak sealant adapter and the loss of plant configuration control. Engineering performed an evaluation and concluded that the valve was fully functional.

NARRATIVE

On June 7, 2012, at approximately 1305 hours CDT, during performance of surveillance procedure 2-SR-3.5.1.7, a steam leak was identified on valve, 2-FCV-073-0081. A BFN, Unit 2, SRO evaluated the condition and concluded that Operability was maintained.

On June 12, 2012, the BFN Appendix J Engineer advised Operations of the need for an Operability Determination to be performed. Operations subsequently requested a Prompt Operability Determination from Engineering for the steam leak on valve 2-FCV-073-0081.

On June 13, 2012, at approximately 1700 hours CDT, it was determined that valve 2-FCV-073-0081 was not capable of performing its intended PCIV function. Due to inadequate work instructions for configuration control, there were no verification requirements in work orders or maintenance procedures to ensure that a leak sealant injection adapter, which was considered a permanent piece of plant equipment by an EDC, was reinstalled on the 2-FCV-073-0081 valve during maintenance activities. As a result, the leak sealant injection adapter was removed and never replaced on the valve bonnet which resulted in a steam leak from the remaining hole. It was determined that the valve was not capable of performing its intended PCIV function and was declared inoperable in accordance with TS 3.6.1.3. To meet TS 3.6.1.3 Actions for an inoperable PCIV, the HPCI inboard steam isolation valve (i.e., valve 2-FCV-073-0002), was closed rendering the BFN, Unit 2, HPCI System inoperable. As a result, TS LCO 3.5.1 Actions were entered.

Extent of Condition

The extent of condition was considered to be valves with known steam leaks that are also classified as PCIVs. It has been determined that there are currently six other PCIVs in the plant with leaks identified with work orders. None of the existing leaks identified are from a missing leak sealant injection port adapter and Engineering and Operations found that operability was maintained for each of these six valves. Work Orders are in place to correct each leak in accordance with the Work Management System.

Extent of Cause

The extent of cause includes all work orders planned to implement TACFs and/or EDCs which do not contain verification that the final configuration matches the required configuration. TVA will review existing works orders planned to implement TACFs and/or EDCs to ensure they include a requirement for verification that components affected by maintenance or modifications activities have been returned to the required configuration.

V. ASSESSMENT OF SAFETY CONSEQUENCES

The consequences of the actions identified in this report led to a steam leak through the packing of flow control valve 2-FCV-073-0081. This steam leak resulted in the valve being declared inoperable due to the fact that it could not perform its intended PCIV

function. This resulted in the closure of valve 2-FCV-073-0002 in accordance with TS requirements and rendered the HPCI System inoperable.

The HPCI System permits the nuclear plant to be shut down while maintaining sufficient reactor vessel water inventory until the reactor vessel is depressurized. The HPCI System continues to operate until the reactor vessel pressure is below the pressure at which Low Pressure Coolant Injection [BO] operation or Core Spray (CS) [BM] system operation can maintain core cooling. If a Loss of Coolant Accident occurs, the reactor scrams upon receipt of a low-water-level signal or a high-drywell-pressure signal. The HPCI System starts when the water level reaches a preselected height above the core, or if high pressure exists in the primary containment (drywell).

Despite the reduction in defense-in-depth due to the inoperability of the HPCI System, redundant systems such as the ADS, the CS System, and the Residual Heat Removal System remained Operable, as allowed by the TS, to respond to postulated accidents and maintain safe shutdown capability. In addition, as required by TS 3.5.1, Required Action C.1, Operations verified that the RCIC System was Operable.

With respect to the PCIV function, with one PCIV inoperable (i.e., 2-FCV-073-0081), the inboard steam isolation valve (i.e., 2-FCV-073-0002) is capable of performing the primary containment isolation function. A review of operations logs, from the time period when the steam leak from valve 2-FCV-073-0081 was present, indicated that valve 2-FCV-073-0002 was Operable and capable of maintaining primary containment leakage through the associated penetration within the limits when BFN, Unit 2, was in Mode 1, 2, or 3. As a result, there was no loss of the primary containment isolation safety function during this time period.

Therefore, TVA concluded that there was no significant reduction to the health and safety of the public for this event.

VI. CORRECTIVE ACTIONS - The corrective actions are being managed by TVA's corrective action program.

A. Immediate Corrective Actions

On June 15, 2012, a TACF was completed for valve 2-FCV-073-0081. The valve was electrically disabled in the closed position, a leak sealant injection adapter was installed, the valve was injected with sealant to stop the steam leak, and the HPCI System was returned to service.

B. Corrective Actions to Prevent Recurrence

1. Review existing work orders planned to implement TACFs and/or EDCs to ensure they include a requirement for verification that components affected by maintenance or modifications activities have been returned to the required configuration.

2. Revise procedure NPG-SPP-07.6, NPG Work Control Planning Procedure, to specifically require that work orders include verification that components affected by maintenance or modifications activities have been returned to the required configuration.

VII. ADDITIONAL INFORMATION

A. Failed Components

The failed component was flow control valve 2-FCV-073-0081. This component was manufactured by Anchor Darling/Flowserve with a manufacturer serial number of E125T-3-1.

B. Previous Similar Events

A search was performed on the BFN LER data base for the past five years. Similar LER 50-296/2007-004-00, Manual Isolation of HPCI Due to a Steam Leak, was identified. This event was similar in that the HPCI System was isolated due to a leak. However, the cause of this event was a through wall leak in the valve and not the failure to maintain the valve in the required configuration.

A search was performed on BFN corrective action program. Problem Evaluation Reports (PERs) 134495,147819, 228565, 252382, and 550072 were identified.

C. Additional Information

The corrective action document for this report is PER 566687.

D. Safety System Functional Failure Consideration

In accordance with NEI 99-02, this event is considered a safety system functional failure because it could have prevented fulfillment of the HPCI System safety functions to remove residual heat and to mitigate the consequences of an accident.

E. Scram With Complications Consideration

This condition did not include a scram.

VIII. COMMITMENTS

There are no commitments.