



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

November 16, 2015

10 CFR 50.73

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

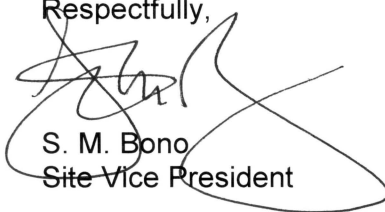
Browns Ferry Nuclear Plant, Unit 2
Renewed Facility Operating License No. DPR-52
NRC Docket No. 50-260

Subject: **Licensee Event Report 50-260/2015-002-00**

The enclosed Licensee Event Report provides details of High Pressure Coolant Injection System Inoperable Due to Turbine Steam Supply Valve Packing Failure. The Tennessee Valley Authority is submitting this report in accordance with Title 10 of the Code of Federal Regulations 50.73(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 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,

A handwritten signature in black ink, appearing to read 'S. M. Bono', written over a circular scribble.

S. M. Bono
Site Vice President

Enclosure: Licensee Event Report 50-260/2015-002-00 – High Pressure Coolant Injection System Inoperable Due to Turbine Steam Supply Valve Packing Failure

cc (w/ Enclosure):

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

ENCLOSURE

**Browns Ferry Nuclear Plant
Unit 2**

Licensee Event Report

**High Pressure Coolant Injection System Inoperable Due to Turbine Steam Supply Valve Packing
Failure**

See Enclosed

NRC FORM 366 (01-2014)		U.S. NUCLEAR REGULATORY COMMISSION			APPROVED BY OMB NO. 3150-0104		EXPIRES 01/31/2017		
LICENSEE EVENT REPORT (LER)									
1. FACILITY NAME Browns Ferry Nuclear Plant, Unit 2					2. DOCKET NUMBER 05000260		3. PAGE 1 of 6		
4. TITLE: High Pressure Coolant Injection System Inoperable Due to Turbine Steam Supply Valve Packing Failure									
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
09	16	2015	2015	002	00	11	16	2015	N/A
9. OPERATING MODE 1		11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: <i>(Check all that apply)</i>							
10. POWER LEVEL 100		<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)				
		<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)	<small>Specify in Abstract below or in NRC Form 366A</small>				
12. LICENSEE CONTACT FOR THIS LER									
FACILITY NAME Baruch Galkin, Licensing Engineer							TELEPHONE NUMBER <i>(Include Area Code)</i> (256) 614-6713		
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	C665	Y	N/A	N/A	N/A	N/A	N/A
14. SUPPLEMENTAL REPORT EXPECTED						15. EXPECTED SUBMISSION DATE			
<input checked="" type="checkbox"/> YES <i>(If yes, complete 15. EXPECTED SUBMISSION DATE)</i>									
<input type="checkbox"/> NO									
						MONTH	DAY	YEAR	
						12	16	2015	
ABSTRACT <i>(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)</i>									
<p>On September 16, 2015, at approximately 0156 Central Daylight Time (CDT), a steam leak occurred in the Unit 2 High Pressure Coolant Injection (HPCI) Room. Operators closed 2-FCV-73-3 (HPCI Outboard Isolation Valve) to isolate steam and declared the single train HPCI system inoperable. A valve packing leak had occurred immediately after 2-FCV-73-16 (HPCI Turbine Steam Supply Valve) was stroked open and closed following performance of the quarterly HPCI surveillance. Following repairs, the HPCI system was declared operable at approximately 1045 CDT on September 19, 2015. During the time period that the HPCI system was inoperable, other systems were available to provide the required safety functions.</p> <p>The causes of this event were a packing gland follower on 2-FCV-73-16 was installed upside down, and untimely action by the organization to repair after a small leak was identified in June 2015. Corrective actions include verifying the packing gland follower is installed correctly on similar valves in Units 1 and 3, revising procedures to identify the correct orientation of packing gland followers, and briefing Maintenance and Engineering personnel on the significant learnings from this event. The cause analysis of this event is being revised. If required, the results of the revised cause analysis will be provided in a supplement to this LER.</p>									

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NARRATIVE

I. Plant Operating Conditions Before the Event

At the time of discovery, Browns Ferry Nuclear Plant (BFN) Unit 2 was operating in Mode 1 at approximately 100 percent rated thermal power. BFN Units 1 and 3 were unaffected by this event.

II. Description of Events**A. Event:**

On September 16, 2015, at approximately 0156 Central Daylight Time (CDT), Operations personnel in the Main Control Room (MCR) received fire alarms for the Unit 2 High Pressure Coolant Injection (HPCI) [BJ] Room following a report of steam in that room. At approximately 0200, MCR operators closed 2-FCV-73-3 (HPCI Steam Line Outboard Isolation Valve) [FCV] to isolate the steam leak and declared HPCI inoperable per Technical Specification (TS) Limiting Condition for Operation (LCO) 3.5.1, Emergency Core Cooling Systems (ECCS) - Operating, Condition C. The steam leak occurred immediately after 2-FCV-73-16 (HPCI Turbine Steam Supply Valve) [FCV] was stroked open and closed following performance of quarterly HPCI surveillance. Subsequent investigation identified that most of the 2-FCV-73-16 valve packing was expelled.

At approximately 0910 CDT on September 16, 2015, 8-hour event notification 51398 was made to the NRC in accordance with 10 CFR 50.72(b)(3)(v)(D), due to the failure of a single train system affecting accident mitigation.

Following repairs, HPCI was declared operable at approximately 1045 CDT on September 19, 2015.

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.

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C. Dates and approximate times of occurrences:

June 17, 2015, 0652 CDT	Operators identified a small packing leak on 2-FCV-73-16 valve.
June 18, 2015, 2108 CDT	Valve was stroked during quarterly surveillances.
September 16, 2015, 0153 CDT	Declared Unit 2 HPCI operable upon completion of quarterly surveillance.
September 16, 2015, 0156 CDT	Fire alarms for the Unit 2 HPCI Room and phone calls alerted the Main Control Room to the steam leak from 2-FCV-73-16 valve packing which occurred when the valve was stroked open and closed for performance of quarterly surveillance.
September 16, 2015, 0200 CDT	Closed 2-FCV-73-3 valve and declared Unit 2 HPCI inoperable.
September 16, 2015, 0910 CDT	NRC was notified via Event Notification 51398.
September 19, 2015, 1045 CDT	HPCI was declared operable.

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

No component failures were identified that occurred during the event. Valve packing for Crane 10 X 8 inch Flex Wedge disc gate valve (2-FCV-73-16) failed due to improper installation.

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:

The method of discovery is self-revealing by sudden development of the steam leak.

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

There were no failed components related to this event.

H. Operator actions:

MCR operators isolated the steam leak by closing an upstream valve and declared HPCI inoperable.

I. Automatically and manually initiated safety system responses:

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

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III. Cause of the event

The cause analysis of this event is being revised. If required, the results of the revised cause analysis will be provided in a supplement to this LER.

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

The technicians, who installed the packing gland follower in April 2013, failed to recognize it was installed upside down. Also, the organization failed to recognize the level of urgency to repack 2-FCV-73-16 valve after the small leak was identified in June 2015.

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

There were two human performance issues that contributed to the packing failure. First, the technicians, who installed the packing gland follower in April 2013, failed to recognize it was installed upside down. This gland follower has a two piece design. The upper piece was upside down. A review identified that the packing procedure and valve procedures provided no guidance on the correct orientation of a two piece packing gland follower. Second, the organization took untimely action to repair valve 2-FCV-73-16 after the small leak was identified in June 2015, due to a misclassification of leak severity.

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)(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.

On June 17, 2015, operators identified a small packing leak on 2-FCV-73-16. Routine inspections by the system engineer and others indicated that the packing leak remained steady between June 2015 and the development of the steam leak on September 16, 2015. Based upon the classification of leak severity, the valve repacking was scheduled for December 14, 2015.

The investigation revealed organizational weakness in classification of the severity of steam leaks, which determines the level of urgency of the work order prioritization process. When the small steam leak occurred in June 2015, a low leak severity classification was assigned, based upon the visible plume. The high pressure steam leak had a section of the plume that was invisible. Therefore, the total plume size met the criteria of a more severe leak classification. The higher steam leak severity would have procedurally driven the steam leak repair to occur within three weeks, which was well before the larger leak occurrence in September 2015.

The reversed orientation of the gland follower causes a beveled packing gland surface to interface with a flat gland follower surface. As the packing is tightened, the gland follower presses against the gland to provide the compression force on the packing material. In the correct orientation, the beveled surface of the packing gland interfaces with the corresponding beveled surface of the gland follower. The mating of the beveled surfaces aids in ensuring proper radial alignment of the gland while the packing is being compressed. The function of the gland follower is to transfer the compression force to the gland. The beveled feature on one side of the gland follower aids in proper radial alignment; however, the orientation of the gland follower is not critical to performing this function. Technicians measured the as-found gland nut

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travel and found that the difference in the travel of the two gland nuts was only 0.020 inch. This small difference supports an acceptable distribution of force on the gland.

A Past Operability Evaluation was conducted for this event. It was concluded that 2-FCV-73-16 valve passed all surveillance requirements from the time the new valve was installed (April 2013) until the time of discovery of the small steam leak. These include quarterly valve stroking for timing and quarterly HPCI flow rate testing which would have stroked the valve in excess of 20 times since having installed the gland follower upside down.

V. Assessment of Safety Consequences

The HPCI pump, which is steam turbine driven pump, is provided 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 HPCI pump permits the nuclear plant to be shut down, while maintaining sufficient reactor vessel water inventory until the reactor vessel is depressurized.

The reversed orientation of the gland follower on the HPCI Turbine Steam Supply Valve 2-FCV-73-16 does not by itself present an operability concern since the valve demonstrated its ability to stroke open in order to support a HPCI system injection. Closure of the HPCI Outboard Isolation Valve 2-FCV-73-3 in order to isolate the steam leak and declaring the single train Unit 2 HPCI system inoperable, resulted in the inability of HPCI to perform its safety function. However, during the time period that the HPCI system was inoperable, other systems were available to provide the required safety functions.

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

During the period that the HPCI system was inoperable, all other Emergency Core Cooling Systems (ECCS), including Automatic Depressurization System, were available to mitigate abnormal and accident conditions. Upon declaration of HPCI inoperability, Reactor Core Isolation Cooling System was verified as operable.

B. For events that occurred when the reactor was shut down, availability of systems or components needed to shutdown 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:

Since steam leak isolation on September 16, 2015 at approximately 0200 CDT, the estimated elapsed time of inoperability is approximately 80.75 hours, until the system was declared operable at approximately 1045 CDT on September 19, 2015.

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VI. Corrective Actions:

Corrective Actions are being managed by TVA's Corrective Action Program under Condition Report (CR) 1082405.

To identify the orientation of valve packing, the maintenance procedures will be revised. Maintenance and engineering personnel will be briefed on the significant learnings of the packing failure of 2-FCV-73-16.

The packing gland follower on similar valves in Units 1 and 3 will be verified as installed correctly.

VII. Additional Information:**A. Previous Similar Events at the same plant:**

A search of BFN Licensee Event Reports (LERs) for Units 1, 2, and 3 within the last five years revealed the following event. LER 50-260/2012-002-00 - Unit 2 High Pressure Coolant Injection System Rendered Inoperable Due to an Inoperable Primary Containment Isolation Valve. On June 7, 2012, a steam leak from a leak sealant injection port in the valve packing area resulted in exceeding the allowable primary containment leak rate. The resolution of the packing injection port leak would not have prevented the 2-FCV-73-16 valve packing leak.

B. Additional Information:

There is no additional information.

C. Safety System Functional Failure Consideration:

This event is considered a safety system functional failure, because it could have prevented fulfillment of the HPCI System safety functions to mitigate the consequences of an accident.

D. Scram with Complications Consideration:

This event did not result in a reactor scram.

VIII. COMMITMENTS

There are no new commitments.