



Post Office Box 2000, Decatur, Alabama 35609-2000

June 13, 2023

10 CFR 50.73
10 CFR 50.4(a)

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

Browns Ferry Nuclear Plant, Unit 1
Renewed Facility Operating License No. DPR-33
NRC Docket No. 50-259

Subject: Licensee Event Report 50-259/2023-001-01 – High Pressure Coolant Injection System Inoperable Due to a Torn Valve Diaphragm

Reference:

1. Non-Emergency Event Notification 56321 – High Pressure Coolant Injection Inoperable
2. TVA letter to NRC, “Licensee Event Report 50-259/2023-001-00 – High Pressure Coolant Injection System Inoperable Due to a Torn Valve Diaphragm,” dated March 27, 2023 (ML23086C092)

The enclosed Licensee Event Report provides details of a failed diaphragm which resulted in the inoperability of the High Pressure Coolant Injection system. 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 any 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. As noted in the referenced letter, TVA planned to supplement this LER to provide additional time to complete the root cause evaluation.

Accordingly, enclosed is a supplement to the subject LER (i.e., LER 50-259/2023-001-01), which provides additional detail into the causal factors of the event and includes additional corrective actions to prevent recurrence.

U.S. Nuclear Regulatory Commission

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

Respectfully,



Manu Sivaraman
Site Vice President

Enclosure: Licensee Event Report 50-259/2023-001-01 – High Pressure Coolant Injection System Inoperable Due to a Torn Valve Diaphragm

cc (w/ Enclosure):

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



LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)
(See NUREG-1022, R.3 for instruction and guidance for completing this form
<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/>)

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, Library, and Information Collections Branch T-6 A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollections.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk ail: oir_submission@omb.eop.gov. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

1. Facility Name Browns Ferry Nuclear Plant, Unit 1	2. Docket Number 05000259	3. Page 1 OF 6
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4. Title
High Pressure Coolant Injection System Inoperable Due to a Torn Valve Diaphragm

5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved	
Month	Day	Year	Year	Sequential Number	Revision No.	Month	Day	Year	Facility Name	Docket Number
01	24	2023	2023	- 001	- 01	06	13	2023	N/A	05000 N/A
									Facility Name	Docket Number
									N/A	05000 N/A

9. Operating Mode 1	10. Power Level 100
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11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: (Check all that apply)

<input type="checkbox"/> 10 CFR Part 20	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 10 CFR Part 50	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 10 CFR Part 21	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 10 CFR Part 73
<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 21.2(c)	<input type="checkbox"/> 50.69(g)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.77(a)(1)
<input type="checkbox"/> 20.2203(a)(2)(iii)		<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> 73.77(a)(2)(i)
<input type="checkbox"/> 20.2203(a)(2)(iv)		<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> 73.77(a)(2)(ii)
<input type="checkbox"/> 20.2203(a)(2)(v)		<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)	

OTHER (Specify here, in abstract, or NRC 366A).

12. Licensee Contact for this LER

Licensee Contact Ryan Coons, Licensing Engineer	Phone Number (Include area code) 256-729-2070
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13. Complete One Line for each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable to IRIS	Cause	System	Component	Manufacturer	Reportable to IRIS
B	BJ	FCV	C665	Y	N/A	N/A	N/A	N/A	N/A

14. Supplemental Report Expected) <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (If yes, complete 15. Expected Submission Date	15. Expected Submission Date
	Month Day Year N/A N/A N/A

16. Abstract (Limit to 1560 spaces, i.e., approximately 15 single-spaced typewritten lines)

On January 24, 2023 at 0121 CST, the Browns Ferry Nuclear Plant, Unit 1, High Pressure Coolant Injection (HPCI) was declared inoperable because the normally-open HPCI Steam Line Condensate Outboard Drain Valve failed closed, apparently due to a failed diaphragm. On January 24, 2023, at 0743 CST, eight-hour Event Notification 56321 was made to the NRC.

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 any 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.

The diaphragm prematurely failed due to a part manufacturing issue, which led to the local delamination between the fabric and the ethylene propylene diene monomer (EPDM) material, in conjunction with a lack of complete reinforcement fabric coverage at the tear site. The failed diaphragm was replaced. TVA will proactively replace the diaphragms on Browns Ferry Nuclear Plant Units 2 and 3. HPCI Steam Line Condensate Outboard Drain Valve diaphragms will be reclassified and reprocurd as QA 1 components, and any existing QA 3 diaphragms will be reclassified as obsolete.



**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

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1. FACILITY NAME Browns Ferry Nuclear Plant, Unit 1	<input checked="" type="checkbox"/> 050	2. DOCKET NUMBER 00259	3. LER NUMBER		
	<input type="checkbox"/> 052		YEAR 2023	SEQUENTIAL NUMBER - 001	REV NO. - 01

NARRATIVE

I. Plant Operating Conditions before the Event

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

II. Description of Event

A. Event Summary

On January 24, 2023 at 0121 CST, the BFN, Unit 1, High Pressure Coolant Injection (HPCI) was declared inoperable because the normally-open HPCI Steam Line Condensate Outboard Drain Valve (1-FCV-073-0006B) [FCV] failed closed, apparently due to a failed diaphragm. On January 24, 2023, at 0743 CST, eight-hour Event Notification (EN) 56321 was made to the NRC.

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 any 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.

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, systems, or components (SSCs) whose inoperability contributed to this event.

C. Dates and approximate times of occurrences

Dates and Approximate Times	Occurrence
January 24, 2023, 0121 CST	BFN, Unit 1, HPCI is declared inoperable when the HPCI Steam Line Condensate Outboard Drain Valve failed closed.
January 25, 2023, 0215 CST	BFN, Unit 1, HPCI is declared operable following the satisfactory completion of repair work and its associated post-maintenance testing (PMT).

D. Manufacturer and model number of each component that failed during the event

The failed component was a Crane Company flow control valve, part number AO-498-S1-1.

E. Other systems or secondary functions affected

No other systems or secondary functions were affected.



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NARRATIVE

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

The failure of the normally-open HPCI Steam Line Condensate Outboard Drain Valve was discovered when the valve suddenly closed.

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

A tear in the diaphragm found during disassembly allowed the air pressure to leak excessively from below the diaphragm to the non-pressure side of the diaphragm. Air volume available was not enough to maintain pressure in the lower chamber. Therefore, the valve drifted shut due to the spring to close function of the operator.

H. Operator actions

There were no operator actions associated with this event.

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. Cause of each component or system failure or personnel error

The diaphragm prematurely failed due to a part manufacturing issue, which led to the local delamination between the fabric and the ethylene propylene diene monomer (EPDM) material, in conjunction with a lack of complete reinforcement fabric coverage at the tear site.

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

There were no human performance related root causes associated with this issue.



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IV. Analysis of the event

The HPCI system 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 steam supply system and loss of coolant which does not result in rapid depressurization of the reactor vessel. 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 (LPCI) [BO] operation or core spray system [BM] operation maintains core cooling. Due to the HPCI system's inoperability, it would have been unable to perform its safety function.

A failure analysis conducted by TVA Central Labs reported that the EPDM diaphragm material exhibited elevated hardness's at the flange contact surface, which could have impacted the diaphragm's ability to maintain a sufficient sealing force. There was abrasive wear damage at the top of the bulge immediately adjacent to the tear, which might have been incidental to the failure. Circumferential cracking was found around the diaphragm's circumference at the corner between the flange sealing surface and the bulge. These cracks did not penetrate the nylon fabric reinforcement. At the failure point, there was delamination between the nylon fabric and the EPDM layer. Additionally, there was a lack of nylon fabric reinforcement at the tear in the diaphragm, which critically hampered the diaphragm's ability to resist tearing.

The diaphragm was originally classified as QA3 and was not considered a "basic component" since QA3 components do not carry a dedication 10 CFR 50, Appendix B. Therefore, the diaphragm failure is not reportable under 10 CFR Part 21.

BFN's Maintenance Strategy was to refurbish the actuator on a 10-year periodicity; historically, these refurbishments have been performed on a 6-year periodicity. BFN's Maintenance Strategy is not causal to this failure because this diaphragm failed after 4 years.

V. Assessment of Safety Consequences

This event resulted in inoperability and unavailability of the single train of the BFN, Unit 1, HPCI system resulting in the inability of the HPCI system to perform its safety function to mitigate the consequences of an accident. In the event of an emergency, the RCIC system remained operable, and all Automatic Depressurization Systems (ADS) were available during this event to facilitate core cooling by low pressure Emergency Core Cooling Systems (ECCS). Additionally, BFN has an installed diesel-backed Emergency High Pressure Makeup Pump (EHPMP) that operators can utilize to inject high pressure water to the reactor vessel per 1-EOI-1 as needed when HPCI is unavailable. Based on the above, during the time period that the HPCI system was inoperable, sufficient systems were available to provide the required safety functions to protect the health and safety of the public. There was no significant reduction to the health and safety of the public or plant personnel for this event.



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NARRATIVE

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, RCIC was verified to be operable by Operations personnel. Additionally, all other ECCS and ADS systems remained operable for the duration of the event.

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 shutdown.

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

HPCI was inoperable from the time of discovery on January 24, 2023, 0121 CST until the diaphragm was replaced and its associated PMT was completed on January 25, 2023, 0215 CST. The BFN, Unit 1, HPCI system was inoperable for approximately one (1) day.

VI. Corrective Actions

Corrective Actions are being managed by the TVA's corrective action program under Condition Report (CR) 1830955.

A. Immediate Corrective Actions

The diaphragm was replaced under WO 123430246.

B. Corrective Actions to Prevent Recurrence or to reduce the probability of similar events occurring in the future

TVA will proactively replace the diaphragms on BFN, Units 2 and 3. HPCI Steam Line Condensate Outboard Drain Valve diaphragms will be reclassified and reprocured as QA 1 components, and any existing QA 3 diaphragms will be reclassified as obsolete.

VII. Previous Similar Events at the Same Site

A search of LERs from BFN, Units 1, 2, and 3 over the last five years identified no similar events.



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NARRATIVE

VIII. Additional Information

There is no additional information.

IX. Commitments

There are no new commitments.