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

September 19, 2011

10 CFR 50.73

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

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

Subject: **Licensee Event Report 50-259/2011-008-00**

On July 20, 2011, Browns Ferry Nuclear Plant personnel recorded an unexpected increase in vibrations on the High Pressure Coolant Injection (HPCI) Booster Pump thrust bearings while performing quarterly surveillance 1-SR-3.5.1.7, HPCI Main and Booster Pump Set Developed Head and Flow Rate Test at Rated Reactor Pressure. The Tennessee Valley Authority (TVA) has made an initial conservative determination that this condition affected the mission time and thus the operability of the HPCI system for an unknown period of time. TVA is submitting this report in accordance with 10 CFR 50.73(a)(2)(i)(B), as any operation or condition which was prohibited by the plant's Technical Specifications.

The causal analysis for this event is still in progress because an outside testing agency is evaluating the thrust bearings to establish if the expected mission time could have been met. Upon completion of the causal analysis, TVA will submit a supplemental LER.

Pursuant to the guidance contained in NUREG 1022, Revision 1, Section 5.1.1, an LER is required to be submitted within 60 days of discovery date. For this report, the sixty days ended on Sunday, September 18, 2011. If the report date ends on a Saturday, Sunday, or holiday, reports submitted on the first working day following the end of the 60 days are acceptable.

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.

IE22
NRR

Respectfully,

K. J. Polson
Vice President

Enclosure: Licensee Event Report 259/2011-008 -High Vibrations on High Pressure Coolant Injection Booster Pump Thrust Bearings

cc (w/ Enclosure):

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

Enclosure

Browns Ferry Nuclear Plant
Unit 1

Licensee Event Report 259/2011-008-00
High Vibrations on High Pressure Coolant Injection Booster Pump Thrust Bearings

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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
	LICENSEE EVENT REPORT (LER)	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.

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Browns Ferry Nuclear Plant Unit 1	05000259	1 of 5

4. TITLE: High Vibrations on High Pressure Coolant Injection Booster Pump Thrust Bearings

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
07	20	2011	2011	- 008 -	00	09	19	2011	N/A	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)*
Paul A. Herrmann III, Licensing Program Manager	256-614-7180

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
B	BJ	P	B580	Y					

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☒ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☐ NO		12	09	11

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

On July 20, 2011, Browns Ferry Nuclear Plant (BFN) personnel performed quarterly surveillance 1-SR-3.5.1.7, HPCI Main and Booster Pump Set Developed Head and Flow Rate Test at Rated Reactor Pressure. During this surveillance, BFN personnel recorded an unexpected rate of increase in vibrations on the High Pressure Coolant Injection (HPCI) Booster Pump thrust bearings. Upon performing a disassembly for inspection purposes, the bearings were discovered to be in a tandem arrangement, which transmits thrust in only one direction (away from the gearbox). The correct bearing configuration is back-to-back.

The Tennessee Valley Authority (TVA) has made an initial conservative determination that this condition affected the mission time and thus the operability of the HPCI system for an unknown period. Thus, the Unit 1 HPCI system was inoperable longer than allowed by Technical Specification 3.5.1.C. TVA is reporting this event in accordance with 10 CFR 50.73(a)(2)(i)(B), as any operation or condition which was prohibited by the plant's Technical Specifications.

The causal analysis for this event is still in progress because an outside testing agency is evaluating the thrust bearings to establish if the expected mission time could have been met. Upon completion of the causal analysis, TVA will submit a supplemental LER.

NARRATIVE

I. PLANT CONDITION(S)

Browns Ferry Nuclear Plant (BFN) Unit 1 was in Mode 1 at approximately 100 percent thermal power. BFN Units 2 and 3 were also in Mode 1 at 100% power.

II. DESCRIPTION OF EVENT

A. Event

On July 20, 2011, BFN personnel performed quarterly surveillance 1-SR-3.5.1.7, HPCI Main and Booster Pump Set Developed Head and Flow Rate Test at Rated Reactor Pressure. During this surveillance, BFN personnel recorded an unexpected rate of increase in vibrations on the High Pressure Coolant Injection [BJ] (HPCI) Booster Pump thrust bearings.

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

There were no inoperable structures, components, or systems that contributed to this event.

C. Dates and Approximate Times of Major Occurrences

March 16, 2005	HPCI Booster Pump thrust bearings installed.
July 20, 2011 at 0250 Central Daylight Time (CDT)	1-SR-3.5.1.7 was started.
July 20, 2011 at 1350 CDT	1-SR-3.5.1.7 was completed. Increased rate of vibration observed on the HPCI booster pump thrust bearings
July 23, 2011 at 1511 CDT	Work started on replacing the HPCI Booster Pump thrust bearings.
July 27, 2011 at 0638 CDT	Work completed on replacing the HPCI Booster Pump bearings.

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 while performing 1-SR-3.5.1.7.

F. Operator Actions

There were no operator actions.

G. Safety System Responses

There were no safety system responses.

NARRATIVE

III. CAUSE OF THE EVENT

The causal analysis for this event is still in progress because an outside testing agency is evaluating the thrust bearings to establish if the expected mission time could have been met. Upon completion of the causal analysis, TVA will submit a supplemental LER.

A. Immediate Cause

One of the thrust bearings was installed backwards in the Unit 1-HPCI Booster Pump.

B. Root Cause

To be determined.

C. Contributing Factors

To be determined.

IV. ANALYSIS OF THE EVENT

The Tennessee Valley Authority (TVA) has made an initial conservative determination that this condition affected the mission time and thus the operability of the HPCI system for an unknown period. Thus, the Unit 1 HPCI system was inoperable longer than allowed by Technical Specification 3.5.1.C. TVA is submitting this report in accordance with 10 CFR 50.73(a)(2)(i)(B), as any operation or condition which was prohibited by the plant's Technical Specifications.

The high vibration points in alarm were the Main Pump Inboard Bearing Horizontal (CH), the Main Pump Outboard Bearing Horizontal (DH), and the Booster Pump Outboard Bearing Horizontal (HH). The CH and DH vibration points were previously evaluated in Problem Evaluation Report (PER) 378921, and the cause of the high vibrations was found to be the HPCI System being out of alignment.

The HH point vibration trend, which is the HPCI booster pump, indicated a rate of increase with stage 3 bearing defects visible in the vibration spectrum. Due to the uncertain functionality, the decision was made to inspect and repair the outboard thrust bearings for the Unit 1 HPCI Booster Pump on an emergent basis.

Maintenance personnel began disassembly of the Unit 1 HPCI Booster Pump, BFN-1-PMP-073-0029, to replace the outboard thrust bearings, due to increasing vibration trends and wear metal content in the oil sample. The outboard bearing is the thrust bearing consisting of two angular contact ball bearings (SKF 7315 BECBM) with bronze cages. These bearings are configured in a back-to-back arrangement to take thrust in both axial directions. During the disassembly, a large amount of bronze shavings and flakes were present in the bottom of the bearing housing, and the oil ring retainer was contacting the outboard bearing cage. The bearings were found in a tandem arrangement, which would handle thrust in only one direction (away from the gearbox). This was an incorrect installation and the cause of the bearing problems. Disassembly of the bearings showed heavy wear to the inner races, light wear to the

outer race, and cage damage from contact with the retainer ring and adjacent bearing inner race. The HPCI pump was last rebuilt in 2005 as part of the Unit 1 restart effort. At that time, the pump was completely overhauled with a new rotating element, seals and bearings.

The causal analysis for this event is still in progress because an outside testing agency is evaluating the thrust bearings to establish if the expected mission time could have been met. Upon completion of the causal analysis, TVA will submit a supplemental LER. The event date will also be evaluated as part of the review of the causal analysis.

V. ASSESSMENT OF SAFETY CONSEQUENCES

Prior to declaring the HPCI System inoperable to perform 1-SR-3.5.1.7, the Reactor Core Isolation Cooling System [BN] was verified to be operable. 1-SR-3.5.1.7 collects the HPCI turbine and pump set vibration levels and records the data. The bearing vibration acceptable normal range is ≤ 0.325 inches/second (in/s), the alert range is >0.325 to 0.7 in/s, and the required action range is >0.7 in/s. The vibration reading taken during the performance of 1-SR-3.5.1.7 on July 20, 2011, was 0.4980 in/s. This reading was within the alert range, so it did not require an action.

The causal analysis for this event is still in progress because an outside testing agency is evaluating the thrust bearings to establish if the expected mission time could have been met. Upon completion of the causal analysis, TVA will submit a supplemental LER with a revised assessment of safety consequences.

VI. CORRECTIVE ACTIONS

The corrective actions are being managed by TVA's corrective action program. These corrective actions may be modified based on the results of the causal analysis.

A. Immediate Corrective Actions

The Unit 1 HPCI booster pump outboard bearings have been replaced and correctly configured in a back-to-back configuration.

B. Corrective Actions

1. Initiate Work Orders to collect oil samples from Unit 2 and Unit 3 booster pumps.
2. Initiate Work Orders to check for correct thrust bearing installation in Unit 2 and Unit 3 booster pumps.

VII. ADDITIONAL INFORMATION

A. Failed Components

Unit 1 HPCI booster pump, BFN-1-PMP-073-0029.

NARRATIVE

B. Previous LERs or Similar Events

High vibrations were previously identified on Unit 1 HPCI Main Pump and Booster Pump in PER 378921.

C. Additional Information

The corrective action documents for this report are specified in PERs 405165 and 408067.

D. Safety System Functional Failure Consideration

This event will be evaluated for a safety system function failure according to NEI 99-02, as part of the supplemental LER.

E. Scram With Complications Consideration

This event was not a complicated scram according to NEI 99-02.

VIII. COMMITMENTS

There are no commitments associated with this LER.