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

April 21, 2011

10 CFR 50.73

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

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

Subject: **Licensee Event Report 50-296/2010-003-02**

Reference:
1. Letter from TVA to NRC, "Licensee Event Report 50-296/2010-003-00," dated May 25, 2010.
2. Letter from TVA to NRC, "Licensee Event Report 50-296/2010-003-01," dated August 2, 2010.

On May 25, 2010, the Tennessee Valley Authority (TVA) submitted Licensee Event Report (LER) 2010-003 for the Browns Ferry Nuclear Plant, Unit 3 (Reference 1) which contained a commitment to provide details on long-term corrective actions on the Maintenance Rule recovery plan. Reference 2 was submitted on August 2, 2010, which provided the recovery plan for long-term corrective actions.

This revision to LER 50-296/2010-003 provides additional information after performing an apparent cause evaluation on the excess flow check valve failures.

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

IE22
NRR

Enclosure: Licensee Event Report 50-296/2010-003-02 -
Multiple Test Failures of Excess Flow Check Valves

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 50-296/2010-003-02 -
Multiple Test Failures of Excess Flow Check Valves

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 3	05000296	1 of 6

4. TITLE: Multiple Test Failures of Excess Flow Check Valves

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
03	26	2010	2010	- 003	- 02	04	21	2011	FACILITY NAME: N/A	DOCKET NUMBER: 05000

9. OPERATING MODE

4

10. POWER LEVEL

000

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)*
Eric Bates, Licensing Engineer	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
X	AD, BJ	V	M090	Y					

14. SUPPLEMENTAL REPORT EXPECTED

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

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
NA	NA	NA

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

On March 26, 2010, it was determined that 5 of 15 Excess Flow Check Valves (EFCVs) tested following Unit 3 Cycle 14 operation failed to meet Technical Specifications (TS) Surveillance Requirement (SR) 3.6.1.3.8, which requires verification that a representative sample of reactor instrumentation line EFCVs actuate to the isolation position on a simulated instrument line break signal. With the discovery of multiple failures during unit shutdown for refueling, multiple EFCVs may have been inoperable during Cycle 14 operation.

TS Limiting Condition for Operation 3.6.1.3 requires that each Primary Containment Isolation Valve be operable in reactor Modes 1, 2, and 3, and when the associated instrumentation is required to be operable. Given the multiple failures of EFCVs, it is likely that Unit 3 did not comply with the applicable Required Actions and associated Completion Times of TS 3.6.1.3 Action C. Accordingly this situation is being reported as any operation or condition prohibited by the plant's Technical Specifications, i.e., 10 CFR 50.73(a)(2)(i)(B).

The failed EFCVs were replaced. In accordance with the implementation of the Maintenance Rule (10 CFR 50.65) the Browns Ferry Nuclear Plant (BFN), Units 1, 2, and 3 EFCVs have been placed in Maintenance Rule a(1) status. The BFN Corrective Action Program has implemented actions to improve reliability of the EFCVs.

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Browns Ferry Nuclear Plant Unit 3	05000296	2010	-- 003	-- 02	2 of 6

NARRATIVE

I. PLANT CONDITION(S)

At the time of discovery, Browns Ferry Nuclear Plant (BFN), Units 1 and 2 were at approximately 100 percent power (3458 MWT) and unaffected by the event. Unit 3 was in a refueling outage.

II. DESCRIPTION OF EVENT

A. Event

On March 26, 2010, the Tennessee Valley Authority (TVA) determined that 5 of 15 Excess Flow Check Valves [CKV] (EFCVs) tested following Unit 3 Cycle 14 operation failed to meet the acceptance criteria of Technical Specifications (TS) Surveillance Requirement (SR) 3.6.1.3.8. SR 3.6.1.3.8 requires verification, on a 24 month frequency, that a representative sample of reactor instrumentation line EFCVs actuate to the isolation position on a simulated instrument line break signal. With the discovery of multiple failures while the unit was shut down for refueling, more than one EFCV may have been inoperable during Cycle 14 operation.

BFN Unit 3 TS Limiting Condition for Operation (LCO) 3.6.1.3 requires that each Primary Containment Isolation Valve (PCIV) be operable in reactor Modes 1, 2, and 3, and when the associated instrumentation is required to be operable per LCO 3.3.6.1, "Primary Containment Isolation Instrumentation." If the multiple EFCV failures had been identified in an applicable Mode, the unit would have been in Condition C of TS 3.6.1.3. TS 3.6.1.3 Required Action C.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, or blind flange within 12 hours for EFCVs. TS 3.6.1.3 Required Action C.2 requires verification, once per 31 days, that the affected penetration flow path is isolated. If Required Actions and associated Completion Times for Condition C are not met, then Condition E is entered and requires the unit be in Mode 3 (Hot Shutdown) within 12 hours and in Mode 4 (Cold Shutdown) within 36 hours. Given the multiple failures of EFCVs, it is likely that these failures occurred when the unit was in an applicable Mode and that BFN Unit 3 failed to comply with the Required Actions and associated Completion Times defined in TS 3.6.1.3.

On March 27, 2010, at 0500 hours Central Daylight Time (CDT), surveillance testing in accordance with SR 3.6.1.3.8 was completed satisfactorily on the replacement valves for the five failed EFCVs.

On April 3, 2010, the additional EFCV expanded scope inspections and tests were completed satisfactorily.

On April 8, 2010, BFN Unit 3 began Cycle 15 operation.

TVA is submitting this report in accordance with 10 CFR 50.73(a)(2)(i)(B), as any operation or condition prohibited by the plant's Technical Specifications.

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

None

NARRATIVE

C. Dates and Approximate Times of Major Occurrences

May 17, 2008	During the BFN Unit 3 Cycle 13 refueling outage, no EFCVs failed to meet SR 3.6.1.3.8. Unit 3 began Cycle 14 operation.
February 27, 2010	Operations personnel entered a planned Manual Scram in accordance with plant procedures to end Unit 3 Cycle 14 operation and to begin the Unit 3 Cycle 14 refueling outage.
March 26, 2010	TVA determined that multiple EFCVs failed to meet SR 3.6.1.3.8 during surveillance testing.
March 27, 2010, at 0500 hours CDT	After replacing the five valves that failed, surveillance testing in accordance with SR 3.6.1.3.8 was completed satisfactorily.
April 3, 2010	Additional EFCV expanded scope inspections and tests were completed satisfactorily.
April 8, 2010	Unit 3 began Cycle 15 operation.

D. Other Systems or Secondary Functions Affected

None

E. Method of Discovery

The failures were identified during the Unit 3 Cycle 14 refueling outage during performance of SR 3.6.1.3.8, which requires verification, on a 24 month frequency, that a representative sample of reactor instrumentation line EFCVs actuate to the isolation position on a simulated instrument line break signal.

F. Operator Actions

None

G. Safety System Responses

None

III. CAUSE OF THE EVENT

A. Immediate Cause

The immediate cause for this reportable condition is multiple, undetectable failures of EFCVs to perform the required primary containment isolation function, which existed for longer than allowed by the TS.

B. Root Cause

While two of the EFCV failures were due to small particles lodged in the valve annulus area, which prevented the poppet from seating against the valve body, the origination of the

NARRATIVE

particles could not be determined. The remaining three EFCV failures were due to the EFCVs not actuating. Visual examination and manipulation of the valve poppet did not reveal any obvious reason for the lack of actuation. The most probable cause for the lack of actuation is sticking of the poppet mechanism. Sticking is assumed to be a time-dependent phenomenon which controls the EFCV unavailability as a function of the surveillance testing interval.

C. Contributing Factors

None

IV. ANALYSIS OF THE EVENT

The condition being reported is the operation of BFN Unit 3 in a manner prohibited by the TS.

Of the 15 EFCVs tested following Unit 3 Cycle 14 operation, five EFCVs failed to pass the acceptance criteria of TS SR 3.6.1.3.8. While two of the EFCV failures were due to small particles lodged in the valve annulus area, which prevented the poppet from seating against the valve body, the origination of the particles could not be determined. The remaining three EFCV failures were due to the EFCVs not actuating. Visual examination and manipulation of the valve poppet did not reveal any obvious reason for the lack of actuation. The failed EFCVs were replaced.

In order to provide reasonable assurance that the overall reliability of the EFCVs is maintained, five additional EFCVs (about 10 percent of the untested population) were randomly selected, physically removed from the instrument lines, visually inspected, and tested using an equivalent alternate testing method. One of these valves was mishandled at removal, so two additional valves were inspected and tested. Each of the additional EFCVs was successfully bench tested to meet the TS SR 3.6.1.3.8 acceptance criteria. In addition, the seven EFCVs that were removed for the additional testing were replaced with new EFCVs that had been bench tested and demonstrated to meet the acceptance criteria of TS SR 3.6.1.3.8 prior to installation.

V. ASSESSMENT OF SAFETY CONSEQUENCES

The safety consequences of a failure of an EFCV associated with an instrument line break are not significant and have been previously evaluated by General Electric and reviewed and accepted by the Nuclear Regulatory Commission for BFN in support of a revision of the TS SR for EFCVs.

EFCVs are installed in boiling water reactor instrument lines, which penetrate the primary containment boundary, to limit the release of fluid in the event of an instrument line break. At BFN, EFCVs are not required to close in response to a containment isolation signal and are not postulated to operate under post-Loss-of-Coolant-Accident (LOCA) conditions. At BFN, EFCVs are not needed to mitigate the consequences of an accident because an instrument line break coincident with a design basis LOCA would be of a sufficiently low probability to be outside the design basis.

The radiological consequences evaluated by BFN for an instrument line break do not credit the EFCVs for isolating the break. The evaluation assumes a discharge of reactor water through an instrument line with a 1/4 inch orifice during the detection of the instrument line break and subsequent reactor pressure vessel (RPV) cool down and depressurization sequence. For a radiological material release directly to the secondary containment with the primary containment initially intact, a failure of an EFCV would be bounded by the Main Steam Line Break analysis as

NARRATIVE

described in the BFN Updated Final Safety Analysis Report, Section 14.6, "Analysis of Design basis Accidents - Uprated."

The operational impact of an EFCV failing to close during the rupture of an instrument line connected to the RPV boundary is based on environmental effects of a steam release in the vicinity of the instrument racks. The environmental impact of the failure of instrument lines connected to the RPV pressure boundary is the released steam into the reactor building. The magnitude of a release through an instrument line would be within the pressure control capacity of reactor building ventilation systems and the integrity and functional performance of secondary containment following an instrument line break would be met. The BFN analysis confirmed that an instrument line rupture outside primary containment will not result in over pressurizing secondary containment. The separation of instrument lines and equipment in the reactor building is expected to minimize the operational impact of an instrument line break on other equipment due to jet impingement. The BFN analysis assumes plant shutdown and cool down occur after the line break.

Because the failure of an EFCV associated with an instrument line break has been analyzed and its consequences have been found to be radiologically bounded and environmentally manageable, TVA concludes that there was no significant reduction in the protection of the public as a result of this event.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

Each of the five EFCVs that did not meet the SR acceptance criteria was physically removed from the instrument line and visually inspected. The EFCVs that failed SR 3.6.1.3.8 were replaced. Post installation, the replacement EFCVs were retested satisfactorily using procedure 3-SR-3.6.1.3.8(3), "Instrument Line Excess Flow Check Valve Operability Test," and were demonstrated to meet the acceptance criteria of TS SR 3.6.1.3.8.

In order to provide reasonable assurance that the overall reliability of the EFCVs is maintained, five additional EFCVs (about 10 percent of the untested population) were randomly selected, physically removed from the instrument lines, visually inspected, and tested using an equivalent alternate testing method. One of these valves was mishandled at removal, so two additional valves were inspected and tested. Each of the additional EFCVs was successfully bench tested to meet the TS SR 3.6.1.3.8 acceptance criteria. In addition, the seven EFCVs that were removed for the additional testing were replaced with new EFCVs that had been bench tested and demonstrated to meet the acceptance criteria of TS SR 3.6.1.3.8 prior to installation.

B. Corrective Actions to Prevent Recurrence

In accordance with the implementation of the Maintenance Rule (10 CFR 50.65) the BFN Units 1, 2, and 3 EFCVs have been placed in Maintenance Rule a(1) status.

The BFN Corrective Action Program has implemented actions to improve reliability of the EFCVs. The following corrective actions are documented in Problem Evaluation Report (PER) 241921:

1. Send debris from failed EFCV for analysis and document the results.

NARRATIVE

2. Consider replacing each of the instrument line EFCVs with an orifice.
3. Expanded EFCV testing scope for the Unit 2 refueling outage 16 to include 2-SR-3.6.1.3.8(1) and 2-SR-3.6.1.3.8(2). Additionally, 2-SR-3.6.1.3.8(3) was already scheduled for performance during the refueling outage.
4. Expand EFCV testing scope for the Unit 3 refueling outage 15 to include 3-SR-3.6.1.3.8(2) and 3-SR-3.6.1.3.8(5). Additionally, 3-SR-3.6.1.3.8(1) is already scheduled for performance during the refueling outage.
5. Initiate frequency revision in Maximo to administratively revise each Unit's SR-3.6.1.3.8 series to change performance frequency from 120 months to 72 months.
6. Revise Preventative Maintenance for replacement of failed EFCVs during performances of each Unit's SR-3.6.1.3.8 series to ensure failed EFCVs that are replaced are retained for analysis or evaluation.
7. Trend performances of each Unit's SR-3.6.1.3.8 series over the next three cycles.

VII. ADDITIONAL INFORMATION

A. Failed Components

The failed components were the EFCVs that were on the High Pressure Coolant Injection System [BJ] and the Reactor Recirculation System [AD]. These EFCVs were manufactured by Marotta Scientific Controls, Inc.

B. Previous Similar Events

None

C. Additional Information

The corrective action documents for this report are PER 222850, PER 223215, and PER 241921.

D. Safety System Functional Failure Consideration

This event is not a safety system functional failure according to NEI 99-02.

E. Scram With Complications Consideration

This event did not include a reactor scram.

VIII. COMMITMENTS

None