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

July 15, 2010

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 50-296/2009-003-01**

Reference: Letter from TVA to NRC, "Licensee Event Report 50-296/2009-003-00," dated May 24, 2010

On May 24, 2010, The Tennessee Valley Authority (TVA) submitted Revision 0 of the referenced Licensee Event Report (LER). The LER provided details of a condition prohibited by Technical Specifications due to an event involving an inoperable Reactor Core Isolation Cooling (RCIC) system. Initially, TVA determined that the event was not reportable to the Nuclear Regulatory Commission (NRC) under 10 CFR 50.73. However, as a result of preparing answers to questions from the NRC, on March 25, 2010, TVA concluded that a violation of Technical Specifications had occurred.

Revision 0 of the referenced LER contained the following commitment to the NRC: "By July 15, 2010, TVA will supplement this LER to provide a final summary of the information discussed with the NRC during the March 25, 2010, telephone conference call and provide the NRC with additional information regarding the contributing cause."

TVA has subsequently established March 22, 2006, as the beginning of the period of RCIC inoperability. As a result, TVA must determine when the Unit 3 High Pressure Coolant Injection system was inoperable at the same time that the RCIC system was inoperable. This determination requires additional time to complete. Therefore, TVA is revising the commitment to supplement the LER to September 30, 2010.

JE22
NRR

There are no additional commitments in this letter. Should you have any questions concerning this submittal, please contact Dan Williamson, Acting Site Licensing and Industry Affairs Manager, at (256) 729-2636.

Respectfully,

K. J. Polson
Vice President

cc: See page 3

Enclosure
cc (w/ Enclosure):

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

NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 08/31/2010

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 Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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 5

4. TITLE: Reactor Core Isolation Cooling System Inoperable Longer Than Allowed By the Technical Specifications

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	N/A
03	22	2006	2009	003	01	07	15	2010	FACILITY NAME: N/A	DOCKET NUMBER: N/A

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

NAME	TELEPHONE NUMBER *(Include Area Code)*
Steve Austin, Licensing Engineer	256-729-2070

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

14. SUPPLEMENTAL REPORT EXPECTED

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

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
09	30	2010

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

On August 26, 2009, Browns Ferry Nuclear Plant (BFN) personnel identified an unexpected level of instability in the Reactor Core Isolation Cooling (RCIC) system flow and turbine response following a Unit 3 manual reactor scram that occurred on August 24, 2009. This occurred during a post scram review of the RCIC system operating parameters. During the injection sequence, the RCIC system flow oscillated between approximately 300 and 900 gallons per minute (gpm). BFN personnel evaluated the phenomena and determined the RCIC system was capable of performing its design function and, thus, it was concluded that the RCIC system had been operable. On August 26, 2009, at approximately 1502 hours Central Daylight Time (CDT), Operations personnel entered Mode 2, commencing startup operations. Unit 3 was returned to service on August 28, 2009, at 1833 hours CDT and remained at power until September 12, 2009, when it was removed from service for scheduled maintenance. During the September outage the RCIC Electric Governor-Remote (EG-R) was replaced and successfully tested.

On March 25, 2010, in response to questions from the NRC, the Tennessee Valley Authority (TVA) notified the NRC via conference telephone call that Unit 3 RCIC was inoperable longer than allowed by Technical Specification 3.5.3 during the period of August 26, 2009, through September 12, 2009. BFN also performed a Mode change on August 26, 2009, with the RCIC System inoperable. A failure analysis determined the oscillations were caused by a missing buffer piston and springs within the EG-R. The missing buffer piston and springs are required for stable operation. BFN personnel replaced the Unit 3 RCIC system EG-R hydraulic actuator. Following the replacement of the Unit 3 RCIC system EG-R hydraulic actuator, testing found the actuator exhibited stable turbine speed and flow during the reactor pressure vessel injection at power.

I. PLANT CONDITION(S)

At the time of the event, Browns Ferry Nuclear Plant (BFN) Units 1, 2 and 3 were at approximately 100 percent power.

II. DESCRIPTION OF EVENT

A. Event:

On August 26, 2009, BFN Plant Engineering personnel identified an unexpected level of instability in the Reactor Core Isolation Cooling [BM] (RCIC) system flow and turbine response following a Unit 3 manual reactor scram that occurred on August 24, 2009. This occurred during a post scram review of the RCIC system operating parameters. During the injection sequence, the RCIC system flow oscillated between approximately 300 and 900 gallons per minute (gpm). BFN Engineering personnel evaluated the phenomena and determined the RCIC system was capable of performing its design function and, thus, it was determined that the RCIC system had been operable.

Specific details of the Unit 3 manual reactor scram can be found in Licensee Event Report 50-296/2009-001, "Reactor Scram Due to Loss of Condensate Booster Pumps," submitted to the Nuclear Regulatory Commission (NRC) on October 23, 2009.

On August 26, 2009, at approximately 1502 hours Central Daylight Time (CDT), Operations personnel placed the Unit 3 mode switch in startup position and entered Mode 2, commencing startup operations. Unit 3 was returned to the service on August 28, 2009, at 1833 hours CDT and remained at power until September 12, 2009, when it was removed from service for scheduled maintenance activities not associated with the RCIC system. During the September outage the RCIC Electric Governor-Remote (EG-R) was replaced and successfully tested.

On March 25, 2010, in response to questions from the Nuclear Regulatory Commission (NRC), the Tennessee Valley Authority (TVA) notified the NRC via conference telephone call that Unit 3 RCIC was inoperable longer than allowed by Technical Specification 3.5.3 during the period of August 26, 2009, through September 12, 2009. The RCIC system was inoperable because the flow rate did not meet the minimum requirements of BFN Technical Specification (TS) Surveillance Requirement 3.5.3.3. TS Surveillance Requirement 3.5.3.3 states, "Verify, with reactor pressure less than or equal to 1040 psig and greater than or equal to 950 psig, the RCIC pump can develop a flow rate greater than or equal to 600 GPM against a system head corresponding to reactor pressure." During this time period, the RCIC system flow rate oscillated at values above and below 600 gpm. The flow rate is required to be maintained greater than or equal to 600 gpm.

The Applicability statement for BFN TS Limiting Condition for Operation 3.5.3 requires the RCIC system be operable when the reactor is in Mode 1, and in Modes 2 and 3 when reactor dome pressure is greater than 150 psig. TS 3.5.3 Condition A, Required Actions A.1 and A.2, require the immediate verification by administrative means that the High Pressure Coolant Injection System (HPCI) is operable and the restoration of the RCIC System to operable status in 14 days. These Required Actions were not met. During the period RCIC was inoperable, August 26, 2009 to September 12, 2009, the HPCI system was operable. BFN also performed a Mode change (from Mode 4 to Mode 3 with the steam dome pressure greater than 150 psig) on August 26, 2009, with the RCIC System inoperable.

NARRATIVE *(If more space is required, use additional copies of NRC Form 366A) (17)*

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

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

None

C. Dates and Approximate Times of Major Occurrences:

August 24, 2009	Unit 3 Operations personnel insert a manual scram on Unit 3.
August 26, 2009	BFN personnel noted an unexpected level of instability during reactor pressure vessel (RPV) RCIC injection on August 24, 2009.
August 26, 2009, 1502 hours CDT	BFN Operations personnel commence restart activities on Unit 3. Place the mode switch in Startup position.
September 12, 2009	RCIC EG-R replaced and RCIC successfully tested.
March 25, 2010	TVA informs NRC that RCIC was inoperable longer than allowed by TS during a period from August 26, 2009, to September 12, 2009.

D. Other Systems or Secondary Functions Affected

None

E. Method of Discovery

BFN personnel found the instability in RCIC system operation during a post scram review of the RCIC system operating parameters.

F. Operator Actions

None

G. Safety System Responses

None

III. CAUSE OF THE EVENT

A. Immediate Cause

The immediate cause for the inoperable RCIC pump was the EG-R actuator malfunctioned and reduced the stability of the RCIC governor control system during RPV injection.

B. Root Cause

A failure analysis performed by Engine Systems Incorporated (ECI) determined the oscillations were caused by a missing buffer piston and springs within the EG-R. The missing buffer piston and springs are required for stable operation and the fact these were missing was not detectable by routine surveillance testing of the RCIC system. ECI's investigation concluded that:

"Based on the investigation it appears that the buffer plug had not been removed after the unit was painted because the paint had not been disturbed around the snap ring and base bore. This would lead one to believe that the components were either omitted by Woodward during the original 1998 build-up or during an undocumented repair performed by others after the EG-R was shipped from Woodward."

C. Contributing Factors

Routine RCIC tuning and calibration checks are performed with the system in the Condensate Storage Tank [SD] to Condensate Storage Tank mode of operation. This test method did not detect the potential for instability in the Unit 3 RCIC system governor control system during RPV injection.

IV. ANALYSIS OF THE EVENT

On August 24, 2009, following the Unit 3 reactor scram, the RCIC system, along with the High Pressure Coolant Injection [BJ] (HPCI) system, auto-initiated and injected into the RPV restoring water level. Both the RCIC and HPCI systems auto-stopped as expected on high RPV water level. Subsequent review of the RCIC System operating flow parameters revealed an unexpected level of instability in the RCIC system flow and turbine control system response. The instability was not noted by the BFN Operations personnel in the main control room due to the short time the system operated (approximately 2.5 minutes).

The RCIC system is required to deliver a minimum of 600 gpm to the RPV. During the injection event on August 24, 2009, BFN Engineering personnel, using a polynomial second order least squared fit of the flow rate during a 2 minute 29 second injection time, removing initial startup and shutdown rate, determined the RCIC pump provided an average flow rate of approximately 620 gpm to the RPV during the injection event which appeared to demonstrate that the RCIC system would deliver a minimum TS flow rate of 600 gpm.

Another flow rate estimate using a flow totalization method, obtained an estimated average flow rate of 630 gpm. For this method, BFN Engineering has determined flow rate loop indication is not calibrated above 700 gpm and is not as accurate as when the flow rate is below 700 gpm. However, the high flow rate indications are representative of actual flow rate. The actual numbers provided by the flow loop were used in the calculations previously described. The calculation indicates that while the flow rate oscillations were greater than desired, the average flow rate was approximately 630 gpm.

During RCIC testing activities, perturbations are introduced into the control system during the Condensate Storage Tank to Condensate Storage Tank mode of operation by operating the system with the flow controller in the manual mode and then placing the controller in the automatic mode with a flow setpoint different than the existing system flow rate. This method limits the severity of the perturbation. Additionally, due to the hydraulic difference between the Condensate Storage Tank to Condensate Storage Tank mode of operation and injection into the RPV, the instability on the Unit 3 governor control system during vessel injection was not detected until the RPV injection occurred.

V. ASSESSMENT OF SAFETY CONSEQUENCES

The safety consequences of this event were not significant. During the period of time the RCIC system was inoperable, it was functional. That is, the RCIC System was capable of starting and

injecting into the RPV delivering an average flow rate greater than or equal to 600 gpm to the RPV. Additionally, during the time RCIC was inoperable HPCI was operable.

During the RPV injection on August 24, 2009, the RCIC system along with the HPCI system only injected for approximately 2.5 minutes. For long term operation such as maintaining water level with the RPV isolated, Operating Instruction, 3-OI-71, Reactor Core Isolation Cooling System, provides instructions for operating the RCIC system in a manual mode upon malfunction of flow controller. Therefore, TVA concludes that there was no significant reduction in the protection of the public by this event.

A final summary of the information discussed with the NRC during the March 25, 2010, telephone conference call will be included in a revision to this LER

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

On September 14, 2009, BFN replaced the Unit 3 RCIC system EG-R hydraulic actuator. The hydraulic actuator that was in place during the August 24, 2009, reactor scram was sent to the vendor for failure analysis and refurbishment.

B. Corrective Actions to Prevent Recurrence

Following the replacement of the Unit 3 RCIC system EG-R hydraulic actuator, a RPV injection test was conducted on September 21, 2009. The hydraulic actuator exhibited stable turbine speed and flow during the RPV injection.

VII. ADDITIONAL INFORMATION

A. Failed Components

None

B. PREVIOUS LERS ON SIMILAR EVENTS

None

C. Additional Information

Corrective action document for this report is Problem Evaluation Report 200183.

D. Safety System Functional Failure Consideration:

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

E. Scram With Complications Consideration:

This LER does not describe a complicated scram according to NEI 99-02.

VIII. COMMITMENTS

By September 30, 2010, TVA will supplement this LER to provide a final summary of the information discussed with the NRC during the March 25, 2010, telephone conference call with NRC and provide additional information regarding the contributing cause.