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

October 30, 2009

10 CFR 50.73

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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 50-259/2009-006**

The enclosed Licensee Event Report (LER) provides details of the inoperability of the Unit 1 High Pressure Coolant Injection Pump due to failure of the associated Emergency Core Cooling System Inverter.

The Tennessee Valley Authority is submitting this report in accordance with 10 CFR 50.73(a)(2)(v)(B) and (D), as any event or condition that could have prevented the fulfillment of a safety function of structures or systems that are needed to remove residual heat and 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 F. R. Godwin, Site Licensing and Industry Affairs Manager, at (256) 729-2636.

Respectfully,

R. G. West
Vice President

cc: See page 2

IE22
NRR

Enclosure
cc (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)

(See reverse for required number of

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

4. TITLE: Inoperable High Pressure Coolant Injection Pump due to Emergency Core Cooling System Inverter 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	FACILITY NAME	DOCKET NUMBER
									N/A	N/A
09	01	2009	2009	006	00	10	30	2009	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
X	FJ	SPP	A363	Y					

14. SUPPLEMENTAL REPORT EXPECTED

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

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
N/A	N/A	N/A

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

On September 1, 2009, at 1614 hours Central Daylight Time (CDT), Browns Ferry Nuclear Plant Operations personnel received indications that the Emergency Core Cooling System (ECCS) Division II 250V DC Inverter had tripped. The trip of the Unit 1 ECCS Division II 250V DC Inverter resulted in the inoperability of the Unit 1 High Pressure Coolant Injection (HPCI) System. The HPCI System was declared inoperable and Technical Specifications (TS) 3.5.1 Actions, Condition C, was entered. The Unit 1 Core Spray (CS) System Loop II had previously been declared inoperable due to the inoperability of the associated air handling unit and TS 3.5.1 Actions, Condition A, had been entered. The combination of the HPCI System being inoperable and TS 3.5.1 Actions, Condition A, being entered also resulted in TS 3.5.1, Actions, Condition D being entered. Required Actions D.1 and D.2 of TS 3.5.1 Actions, Condition D, require either restoration of the low pressure ECCS injection/spray subsystem or the HPCI System to operable status within 72 hours. On September 2, 2009, at 1741 hours CDT, following completion of required work activities, restoration, and post maintenance testing, Operations personnel declared CS Loop II operable and exited TS 3.5.1, Actions, Condition D. Following completion of the repair activities, restoration, and post maintenance testing on the Division II ECCS inverter, the HPCI System was declared operable and TS 3.5.1 Actions, Condition C, was exited on September 3, 2009, at 0500 hours CDT. As a result of the HPCI System inoperability, Tennessee Valley Authority is submitting this report in accordance with 10 CFR 50.73(a)(2)(v)(B) and (D) as any event or condition that could have prevented the fulfillment of a safety function of structures or systems that are needed to remove residual heat and mitigate the consequences of an accident.

I. PLANT CONDITION(S)

Prior to the event, Unit 1 was at 100 percent power. The Unit 1 Core Spray (CS) [BM] System Loop II had previously been declared inoperable due to the inoperability of the associated air handling unit and Technical Specification (TS) 3.5.1 Actions, Condition A, had been entered, which required the Core Spray System loop to be restored to operable status within 7 days. Unit 2 was at 100 percent power and not affected by the event. Unit 3 was at 94 percent power and not affected by the event.

II. DESCRIPTION OF EVENT

A. Event:

On September 1, 2009, at 1614 hours Central Daylight Time (CDT), Operations personnel received indications that the Emergency Core Cooling System (ECCS) Division II 250V DC Inverter [EJ] had tripped. The trip of the Unit 1 ECCS Division II 250V DC Inverter resulted in the inoperability of the Unit 1 High Pressure Coolant Injection (HPCI) [BJ] System. The HPCI System was declared inoperable and TS 3.5.1 Actions, Condition C, was entered. Operations personnel immediately verified by administrative means that the Reactor Core Isolation Cooling (RCIC) [BO] System was operable in accordance with TS 3.5.1 Actions, Condition C, Required Action C.1.

Previously on September 1, 2009, at 1210 hours CDT, Operations personnel declared CS System Loop II inoperable due to high vibrations in the associated CS Loop II air handling unit [VA] and entered TS 3.5.1 Actions, Condition A. TS 3.5.1 Actions, Condition A, Required Action A.1, requires with one low pressure ECCS injection /spray subsystem inoperable, the low pressure ECCS injection/spray subsystem (in this case CS System Loop II) be restored to operable status in 7 days. The combination of the HPCI System being inoperable and TS 3.5.1 Actions, Condition A, being entered also resulted in TS 3.5.1, Actions, Condition D being entered on September 1, 2009, at 1614 hours CDT. Required Actions D.1 and D.2 of TS 3.5.1 Actions, Condition D, require, with the HPCI System inoperable and Condition A entered (e.g., one low pressure ECCS injection/spray subsystem inoperable), either restoration of the low pressure ECCS injection/spray subsystem or restoration of the HPCI System to operable status within 72 hours.

On September 2, 2009, at 1741 hours CDT, following completion of work activities and post maintenance testing on the CS System Loop II air handling unit, Operations personnel declared CS Loop II operable and exited TS 3.5.1 Actions, Condition A, and Condition D. However, due to the remaining inoperability of the HPCI System, TS 3.5.1 Actions, Condition C, remained applicable and Required Action C.2 required the HPCI system to be restored to operable status within 14 days.

On September 3, 2009, at 0357 hours CDT, following completion of the repair activities, Operations personnel placed the ECCS Division II 250V DC inverter in service. Although available for service, the HPCI System was not declared operable until completion of post maintenance testing on the ECCS Division II 250V DC inverter. At 0500 hours CDT, the HPCI System was declared operable and TS 3.5.1 Actions, Condition C, was exited.

As a result of the HPCI System inoperability, the Tennessee Valley Authority is submitting this report in accordance with 10 CFR 50.73(a)(2)(v)(B) and (D) as any event or condition that could have prevented the fulfillment of a safety function of structures or systems needed to remove residual heat and mitigate the consequences of an accident.

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

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

None.

C. Dates and Approximate Times of Major Occurrences:

September 1, 2009	1614 hours CDT	Operations personnel received indications that the ECCS Division II 250V DC Inverter tripped.
September 1, 2009	1614 hours CDT	Operations personnel declare the HPCI System inoperable.
September 1, 2009	2001 hours CDT	Browns Ferry Nuclear Plant personnel made an 8-hour non-emergency report per 10 CFR 50.72(b)(3)(v)(B) and (D).
September 3, 2009	0357 hours CDT	Following completion of the repair activities, Operations personnel placed the ECCS Division II 250V DC inverter in service.
September 3, 2009	0500 hours CDT	Operations personnel declare the HPCI System operable.

D. Other Systems or Secondary Functions Affected

None.

E. Method of Discovery

Operations personnel received a main control room alarm indicating the failure of the ECCS Division II 250V DC inverter.

F. Operator Actions

None.

G. Safety System Responses

None.

III. CAUSE OF THE EVENT

A. Immediate Cause

The immediate cause for this event was a failure of Unit 1 ECCS Division II 250V DC Inverter.

B. Root Cause

The cause for this event was a catastrophic failure of the metal oxide varistor installed as a surge suppressor between the positive and negative legs of the power supply. The failure mode for the metal oxide varistor was a short, which tripped the 250V DC supply breaker.

C. Contributing Factors

None.

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

IV. ANALYSIS OF THE EVENT

Trouble shooting by Browns Ferry Nuclear Plant personnel identified a catastrophic failure of the metal oxide varistor installed between the positive and negative legs of the inverter's 250V DC supply. The metal oxide varistor was installed as a surge suppressor to protect the inverter from voltage spikes on the 250V DC power source. The metal oxide varistor failure mode was a short and thus, tripped the supply breaker. The metal oxide varistor was replaced and further static testing of the inverter did not find any additional issues.

The inverter involved in this event along with two more of the six 250V DC inverters, the Unit 1 Division I and the Unit 3 Division I inverters have a similar design for surge suppression and may be vulnerable to a comparable failure mechanism. The cause for the failure of the metal oxide varistor could not be established. The failure of the metal oxide varistor occurred early in its operating life and there is no accurate method to predict remaining life through testing. The failure also cannot be attributed to a particular manufacturing lot so restricting the source of replacement parts would not provide any recurrence control for the two similar design inverters.

V. ASSESSMENT OF SAFETY CONSEQUENCES

The consequences of this event were not significant. Unit 1 TSs allow continued power operation for up to 72 hours with the HPCI System inoperable and one low pressure ECCS injection /spray subsystem (in this case CS System Loop II) inoperable. During the time HPCI and the CS System Loop II were inoperable, all other required ECCS equipment and the RCIC System remained operable. The ECCS subsystems, including the Automatic Depressurization System (ADS), are designed to ensure, in the event of a design basis accident and a worst case single failure, that adequate core cooling is maintained. The redundant capacity of the ECCS is consistent with assumption used in the accident analyses. With any one low pressure ECCS injection/spray subsystem inoperable in addition to an inoperable HPCI System, adequate core cooling is ensured by the operability of the ADS and the remaining low pressure ECCS subsystems.

Additionally, although safety analyses do not take credit for the Feedwater System [SJ] and the Condensate System [SD], these systems remained available. Also, while not credited in the safety analyses, the RCIC System was operable during this event, as discussed above.

Therefore, TVA concludes that there was no significant reduction in protection to the public by this event.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

Operations personnel declared the Unit 1 HPCI System inoperable and entered the appropriate TS Actions.

Maintenance personnel repaired the CS system Loop II air handling unit and returned it to service.

B. Corrective Actions to Prevent Recurrence

The corrective actions to prevent recurrence are being managed by BFN's corrective action program.

The failed metal oxide varistor was replaced and the ECCS Division II 250V DC inverter was returned to service. Further action to be taken to prevent recurrence includes performing an

evaluation of the design of the surge suppression features on the affected inverters and, if necessary, pursue a design change to the surge suppression network to prevent a shorted varistor from tripping the ECCS 250V DC inverter input.

VII. ADDITIONAL INFORMATION

A. Failed Components

The metal oxide varistor installed as a surge suppressor on 250V DC power supply to the inverter.

B. PREVIOUS LERS ON SIMILAR EVENTS

None.

C. Additional Information

Corrective action document for this report is Problem Evaluation Report 200863.

D. Safety System Functional Failure Consideration:

This event is a safety system functional failure according to NEI 99-02.

E. Scram With Complications Consideration:

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

VIII. COMMITMENTS

None.