

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,

Wert

R. G. West Vice President

cc: See page 2



U.S. Nuclear Regulatory Commission Page 2 October 30, 2009

Enclosure cc (Enclosure):

NRC Regional Administrator - Region II

NRC Senior Resident Inspector - Browns Ferry Nuclear Plant

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

## 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 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.

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	В.	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	Operatio	ons perso	onnel received	indications	that the					
		•		EĊCS E	Division I	1 250V DC Inv	erter tripped							
		September 1, 2009 1614 hours			Operatio	ons perso	onnel declare t	the HPCI Sys	stem					
				inoperal	ole.									
		September 1, 2009	CDT	Browns	Ferry Nu ergency	iclear Plant pe report per 10 (	rsonnel mad	e an 8-hour $(3)(y)(B)$ and						
					(D).									
		September 3, 2009	0357 hours CI		Followir	ig compl	etion of the re	pair activities	s, Operations					
					personn	tel placed the ECCS Division II 250V DC inverter								
		Sontombor 2, 2000												
		September 3, 2009 0500 nours			operable.									
	D.	Other Systems or S	econdary Fu	nctio	ons Affeo	ted								
		None.												
	Е.	E. <u>Method of Discovery</u>												
		Operations personnel received a main control room alarm indicating the failure of the ECCS												
		Division II 250V DC i	Division II 250V DC inverter.											
	F.	<b>Operator Actions</b>												
		None.												
	G.	Safety System Resp	<u>oonses</u>											
		None.												
111.	CA													
	Α.	Immediate Cause												
		The immediate cause for this event was a failure of Unit 1 ECCS Division II 250V DC Inverter.												
	в.	Root Cause												
		The cause for this ev	The cause for this event was a catastrophic failure of the metal oxide varistor installed as a surge											
		suppressor between	the positive a	nd ne	egative le	gs of the	power supply.	The failure	mode for the					
		metal oxide varistor	was a short, w	/hich	tripped th	ne 250V	DC supply bre	aker.						
	C.	2. <u>Contributing Factors</u>												
		None.												

NRC FORM 366A (9-2007)		U.S. NUCLEAR REGULATORY COMMISSION					
LICENSE	E EVENT R	EPORT	(LER)				
FACILITY NAME (1)	DOCKET (2)	L	ER NUMBER (6	)	PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
Browns Ferry Nuclear Plant Unit 1	05000259	2009	006	00	4 of 5		

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. <u>Corrective Actions to Prevent Recurrence</u>

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

NRC FORM 366A U.S. NUCLEAR REGULATORY COMMISSION (9-2007) LICENSEE EVENT REPORT (LER) FACILITY NAME (1) DOCKET (2) LER NUMBER (6) PAGE (3) REVISION SEQUENTIAL YEAR NUMBER NUMBER Browns Ferry Nuclear Plant Unit 1 05000259 2009 -- 006 -- 00 5 of 5 NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17) 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** Α. **Failed Components** The metal oxide varistor installed as a surge suppressor on 250V DC power supply to the inverter. В. **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. Ε. **Scram With Complications Consideration:** This event was not a complicated scram according to NEI 99-02. **VIII. COMMITMENTS** None.