

September 19, 2005

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop OWFN, P1-35
Washington, D. C. 20555-0001

10 CFR 50.73

Dear Sir:

**TENNESSEE VALLEY AUTHORITY - BROWNS FERRY NUCLEAR PLANT (BFN) -
UNIT 2 - DOCKET 50-260 - FACILITY OPERATING LICENSE
DPR-52 - LICENSEE EVENT REPORT 50-260/2005-006-00**

The enclosed report provides details of a plant condition which involved low voltage readings measured during the conduct of a surveillance test on two battery cells on a 4-kV Shutdown Board Battery. At the time, a second direct current subsystem was inoperable due to scheduled maintenance activities. This resulted in an entry into Limiting Condition for Operation 3.0.3 for a short period of time.

In accordance with 10 CFR 50.73(a)(2)(i)(B), TVA is reporting this event as condition prohibited by Technical Specifications.

There are no commitments contained in this letter.

Sincerely,

Original signed by:

Brian O'Grady

cc: See page 2

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Enclosure

cc (Enclosure):

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Enclosure

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NRC FORM 366 (6-2004)		U.S. NUCLEAR REGULATORY COMMISSION		APPROVED BY OMB NO. 3150-0104		EXPIRES 06/30/2007	
<h2 style="margin: 0;">LICENSEE EVENT REPORT (LER)</h2> <p style="margin: 10px 0;">(See reverse for required number of digits/characters for each block)</p>							
1. FACILITY NAME Browns Ferry Unit 2				2. DOCKET NUMBER 05000260		3. PAGE 1 OF 6	
4. TITLE Low Voltage on Shutdown Battery Cells Results in Condition Prohibited By Technical Specifications							
5. EVENT DATE			6. LER NUMBER			7. REPORT DATE	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY
07	22	2005	2005-006-00			09	19
8. OTHER FACILITIES INVOLVED			9. OPERATING MODE 1				
FACILITY NAME U3			DOCKET NUMBER 05000296				
FACILITY NAME none			DOCKET NUMBER N/A				
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)	
20.2201(d)			20.2203(a)(3)(ii)			50.73(a)(2)(ii)(A)	
20.2203(a)(1)			20.2203(a)(4)			50.73(a)(2)(ii)(B)	
20.2203(a)(2)(i)			50.36(c)(1)(i)(A)			50.73(a)(2)(iii)	
20.2203(a)(2)(ii)			50.36(c)(1)(ii)(A)			50.73(a)(2)(iv)(A)	
20.2203(a)(2)(iii)			50.36(c)(2)			50.73(a)(2)(v)(A)	
20.2203(a)(2)(iv)			50.46(a)(3)(ii)			50.73(a)(2)(v)(B)	
20.2203(a)(2)(v)			50.73(a)(2)(i)(A)			50.73(a)(2)(v)(C)	
20.2203(a)(2)(vi)			X 50.73(a)(2)(i)(B)			50.73(a)(2)(v)(D)	
12. LICENSEE CONTACT FOR THIS LER							
NAME B. C. Morris, Senior Licensing Engineer				TELEPHONE NUMBER (Include Area Code) 256-729-7909			
13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT							
CAUSE	SYSTEM	COMPONENT	MANU- FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT
X	EI	BY	C173	Y			
14. SUPPLEMENTAL REPORT EXPECTED <input type="checkbox"/> YES (if yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO					15. EXPECTED SUBMISSION DATE		
					MONTH	DAY	YEAR
<p>ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)</p> <p>On July 22, 2005, during performance of a quarterly surveillance of 4-kV Shutdown Board Battery A, the associated 250 VDC subsystem was declared inoperable due to low cell voltage for two battery cells not meeting Technical Specifications (TS) acceptance criteria. Concurrently, a second DC subsystem was inoperable in support of scheduled maintenance activities. The concurrent inoperability of two DC subsystems resulted in an unplanned entry of Unit 2 into TS Limiting Condition for Operation (LCO) 3.0.3 at 0220 hours CDT. Unit 2 commenced shutdown activities at 0316 in accordance with TS. At 0450, the DC subsystem that was inoperable for maintenance was returned to service. Unit 2 then exited TS LCO 3.0.3, shutdown activities were terminated, and the unit was returned to full power.</p> <p>The cause of the low voltage condition on the two Battery A cells was determined to be battery plate material shedding. This can cause microshorts due to scale bridging between the positive and negative plates on individual cells, which lowers cell voltage. The condition is associated with battery aging and is fixed by replacing the affected cells or temporarily remedied by high level equalizing, single cell charging, or agitation. Although the condition results in lower measured voltages for individual cells, it does not appreciably affect the overall capacity of the battery. TVA plans to replace the entire battery by December 2005 after procurement of new cells. In the meanwhile, the battery has been placed on an accelerated surveillance schedule to monitor the condition of the battery.</p> <p>In accordance with 10 CFR 50.73(a)(2)(i)(B), this report is being made as a condition prohibited by TS.</p>							

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

I. PLANT CONDITION(S)

At the time the condition was identified, Unit 2 and 3 were in Mode 1 at 100% power. Unit 1 was shutdown and defueled. When the battery problem was identified, Unit 3 entered a 7-day Limiting Condition for Operation (LCO) related to ventilation systems supported by related electrical systems. Otherwise, Unit 3 was unaffected by this event.

II. DESCRIPTION OF EVENT**A. Event:**

On July 5, 2005, while performing the surveillance procedure (Weekly Check for Shutdown Board A and B Batteries) for Technical Specifications (TS) surveillance requirement (SR) 3.8.4.1, the pilot cell # 8 voltage for the 4-kV Shutdown Board A Battery [EJ] was measured at 2.11 V, which is less than the required TS Table 3.8.6.1 value of 2.13 V for pilot cells. As a result, the 250 V Shutdown Battery A (SB-A) quarterly SR for TS SR 3.8.6.2 (verify battery cell parameters) was performed, which showed that the voltage on several cells were slightly below the TS Table 3.8.6.1 Category A values (2.13 V) and that cell 43 was below the Category C value (2.07 V). This SR measures the battery cell parameters for all 120 individual battery cells. SB-A was declared inoperable and was placed on a low voltage equalizing charge for approximately 48 hours. The quarterly SR was then reperformed to determine the need to replace individual cells or to perform single cell charging. Following completion of the SR, four cells, including cell 43, were replaced. The quarterly SR was again performed, and the battery was declared operable on July 9, 2005. The battery was subsequently put on an accelerated (weekly) schedule for the performance of the quarterly SR to monitor the condition of the battery.

On July 18, 2005, in support of Unit 1 maintenance activities, the normal charger for 4-kV Shutdown Board Battery C (SB-C) was removed from service and the battery placed on its spare charger. This required that the DC subsystem for 4-kV Shutdown Board C be declared inoperable. As noted above, SB-A was on an accelerated (weekly) schedule for the SR which measures the cell parameters for all cells. The July 22, 2005, SR performance identified 2 battery cells (8 and 115), which did not meet TS Table 3.8.6.1 Category C voltage requirements. This required SB-A be declared inoperable in accordance with TS 3.8.6.B and likewise that the associated DC subsystem be declared inoperable. The concurrent inoperability of two DC subsystems resulted in an unplanned entry of Unit 2 into TS LCO 3.0.3 at 0220 hours CDT and Unit 2 commenced shutdown activities at 0316. Activities were promptly initiated to return the SB-C DC subsystem into normal alignment. These actions were successfully completed by 0449 hours and LCO 3.0.3 exited. Unit 2 resumed full power operation shortly thereafter. The two battery cells which exhibited low voltage were replaced on July 25, 2005, and following further testing, SB-A was declared operable on July 26, 2005.

In accordance with 10 CFR 50.73(a)(2)(i)(B), TVA is reporting this event as a condition prohibited by TS.

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

None

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NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)**C. Dates and Approximate Times of Major Occurrences:**

July 22, 2005 0220 hours CDT Maintenance personnel reported low voltage (2.06 V) on cells 8 and 115 on 4-kV SB-A during the performance of the surveillance procedure for TS SR 3.8.6.2 (verify battery cell parameters). With two cells below the TS Table 3.8.6-1 Category C criteria (2.07 V), TS required the battery be declared inoperable. At the time, the 250 VDC subsystem for 4-kV Shutdown Board C was inoperable to support scheduled maintenance. With two DC subsystems inoperable at the same time, Unit 2 entered LCO 3.0.3.

July 22, 2005 0316 hours CDT Unit 2 shutdown commenced in accordance with LCO 3.0.3

July 22, 2005 0449 hours CDT DC subsystem for 4-kV Shutdown Board C was returned to operable status and LCO 3.0.3 exited

July 22, 2005 0531 hours CDT Full power operation resumed

D. Other Systems or Secondary Functions Affected

Unit 3 TS 3.8.7 also required that Standby Gas Treatment system A and Control Bay Emergency Ventilation system A be declared inoperable when the SB-A DC subsystem was declared inoperable.

E. Method of Discovery

The low battery cell voltage condition was discovered during the performance of a planned battery surveillance test.

F. Operator Actions

Operator action in response to this condition was appropriate. Operations personnel took prompt action to return the DC subsystem for 4-kV Shutdown Board C to operable status, which allowed an exit from LCO 3.0.3.

G. Safety System Responses

N/A

III. CAUSE OF THE EVENT**A. Immediate Cause**

The immediate cause of this event was low voltage on two battery cells, which resulted in a DC distribution subsystem being declared inoperable concurrent with a subsystem previously made inoperable for planned maintenance.

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B. Root Cause

The cause of the low voltage condition on the SB-A cells was determined to be battery plate material shedding, which causes scale bridging between plates. Scale bridging can create microshorts between cells, which reduces the cell voltage.

The scale bridging condition is age-related, however, it was not observed on several like batteries (battery model KCR-11, manufactured by C & D Technologies) of similar service age. The scale bridging on individual cells can often be temporarily remedied by high level equalizing, single cell charging, or agitation. However, the condition is expected to worsen with age, so replacement of the battery is prudent.

The battery vendor indicates that the battery service life should be approximately 20 years. SB-A was fabricated in 1992 and installed in 1994, so it has been in service for approximately 11 years. An evaluation of environmental conditions, maintenance, and operating history of the battery did not yield a definitive explanation for the shortened service life being seen on this battery bank. The same model KCR-11 batteries used for four other battery banks, of approximately the same service age, are not demonstrating this behavior.

C. Contributing Factors

SB-A has been on an increased battery discharge test cycle since 2001 (annual versus semi-annual) as a result of decreasing measured capacity. An increased duty cycle can be a contributing factor to a shortened battery life.

IV. ANALYSIS OF THE EVENT

BFN has eight 250 VDC subsystems, which provide control power for the eight 4-kV shutdown boards, as well as some other logic circuits. Four of the 4-kV shutdown boards (A, B, C, and D) primarily serve Units 1 and 2 and the other four primarily serve Unit 3 (3EA, 3EB, 3EC, and 3ED). Three of the 4-kV shutdown boards (3EA, 3EC, and 3ED) are supplied by three Unit 250 VDC DC subsystems (unit batteries), and the remaining five 4-kV shutdown boards are supplied by their own 250 VDC shutdown board subsystem. Each Unit DC subsystem has a battery, battery charger, spare charger, an alternate supply, and switching capability. The shutdown board batteries share a portable spare charger. The two subsystems in this report (Shutdown Board 250 V DC subsystems A and C) involve two of the latter five subsystems.

Problems with low cell voltages on SB-A were first observed on July 5, 2005, during a weekly battery surveillance test; and after testing and analysis of field data, several cells were replaced. The battery was returned to operable status and put on an accelerated surveillance schedule (weekly performance of quarterly battery check surveillance) to monitor the battery performance. This quarterly surveillance was successfully performed on July 9.

On July 18, 2005, 480 VAC Reactor Motor Operated Valve (MOV) Board 1B was removed from service for scheduled maintenance of several days. This reactor MOV board is the normal power supply for the battery charger for 250 V SB-C. The spare charger was placed in service, however, the 250 VDC subsystem C is considered inoperable in this configuration. As previously discussed, on July 22, 2005, during the performance of the (accelerated) surveillance, SB-A was also declared inoperable as a result of low voltage on two cells. The inoperability of these two shutdown batteries led to the entry into

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LCO 3.0.3, since TS do not address actions for the concurrent inoperability of two Unit 1 and 2 4-kV Board shutdown batteries. At that time, it was determined that 250 VDC subsystem C could be returned to service more quickly than replacement of the two low reading cells on Battery A could be accomplished. Accordingly, SB-C was restored to operable status in a prompt manner and LCO 3.0.3 exited.

A review of past operating experience at TVA and other plants, consultations with the battery vendor, and testing and physical examination of the SB-A cells indicates the battery is suffering from an age-related phenomenon referred to as plate shedding. In this condition, battery plate material sheds, which results in the creation of microshorts (scale bridging) between the positive and negative plates on individual cells, lowering cell voltage. The condition is generally associated with battery aging and is best fixed by replacing the affected cells, though it can often be temporarily remedied by high level equalizing, single cell charging, or agitation. Although the condition results in lower measured voltages for individual cells, it does not appreciably affect the overall capacity of the battery. This fact is supported by the vendor and was confirmed by a battery capacity test that was conducted on SB-A on July 24, 2005, and by past battery capacity tests.

V. ASSESSMENT OF SAFETY CONSEQUENCES

Although low voltage was observed on two cells of SB-A with respect to TS Table criteria, the degraded condition does not have an appreciable effect on the overall capacity of the battery in meeting its design function. SB-A was in service and SB-C, though on its spare charger, was also in service. Therefore, there was no adverse safety impact caused by this event, and there was no effect on the health and safety of the public.

VI. CORRECTIVE ACTIONS**A. Immediate Corrective Actions**

The DC subsystem that was declared inoperable for maintenance was restored to operable status promptly to allow exit from LCO 3.0.3.

B. Corrective Actions to Prevent Recurrence⁽¹⁾

Pending procurement of new cells and replacement of SB-A, the battery will remain on an accelerated surveillance schedule to monitor the condition. In the interim, additional cells showing low voltage will be replaced or remedied by single cell charging. Replacement of the entire battery is scheduled by December 2005 following receipt of a full complement of battery cells.

VII. ADDITIONAL INFORMATION**A. Failed Components**

Individual cells on SB-A showed low voltage. This battery is a C&D Technologies, model KCR-11 battery, and has 120 cells.

B. Previous LERs on Similar Events

None

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- (1) TVA does not consider these corrective actions regulatory commitments. The completion of these actions will be tracked in TVA's Corrective Action Program.

C. Additional Information

Browns Ferry corrective action document PER 85316.

D. Safety System Functional Failure Consideration:

This event does not involve a safety system functional failure which would be reported in accordance with NEI 99-02. Although two individual SB-A cells measured low voltage, the battery capacity remained such that it would have performed its design function.

E. Loss of Normal Heat Removal Consideration:

N/A. This condition being reported did not involve a reactor scram.

VIII. COMMITMENTS

None