

October 8, 2003

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 (LER) 50-260/2003-005-00**

The enclosed report provides details of an unplanned start of emergency diesel generators A and B.

In accordance with 10 CFR 50.73(a)(2)(iv)(A), TVA is reporting this event as the valid actuation of any of the systems listed in 10 CFR 50.73(a)(2)(iv)(B).

There are no commitments contained in this letter.

Sincerely,

Original signed by:

Ashok S. Bhatnagar

cc: See page 2

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TEA:DTL:PSH:BAB

Enclosure

cc (Enclosure):

A. S. Bhatnagar, PAB 1B-BFN  
M. J. Burzynski, BR 4X-C  
M. D. Skaggs, POB 2C-BFN  
F. C. Mashburn, BR 4X-C  
D. C. Olcsvary, LP 6A-C  
C. L. Root, PAB 1G-BFN  
K. W. Singer, LP 6A-C  
E. J. Vigluicci, ET 11A-K  
R. E. Wiggall, PEC 2A-BFN  
LEREvents@inpo.org  
NSRB Support, LP 5M-C  
[Blk1@nrc.gov](mailto:Blk1@nrc.gov)  
[Law2@nrc.gov](mailto:Law2@nrc.gov)  
EDMS-K

|   |        |   |                      |  |   |                       |  |                          |                                     |  |      |
|---|--------|---|----------------------|--|---|-----------------------|--|--------------------------|-------------------------------------|--|------|
| <b>NRC FORM 366</b><br>(7-2001)   |        | <b>U.S. NUCLEAR REGULATORY COMMISSION</b> |                      |  | <b>APPROVED BY OMB NO. 3150-0104</b>  |                       |  | <b>EXPIRES 7-31-2004</b> |                                     |  |      |
| <b>LICENSEE EVENT REPORT (LER)</b>  |        |   |                      |  | Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@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 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. |                       |  |                          |                                     |  |      |
| <b>1. FACILITY NAME</b><br>Browns Ferry Nuclear Plant Unit 2  |        |   |                      |  | <b>2. DOCKET NUMBER</b><br>05000260   |                       |  | <b>3. PAGE</b><br>1 OF 7 |                                     |  |      |
| <b>4. TITLE</b><br>Unplanned Start of DG A and DG B from Momentary Board Undervoltage   |        |   |                      |  |   |                       |  |                          |                                     |  |      |
| <b>5. EVENT DATE</b>  |        |   | <b>6. LER NUMBER</b> |  |   | <b>7. REPORT DATE</b> |  |                          | <b>8. OTHER FACILITIES INVOLVED</b> |  |      |
| MO  | DAY    | YEAR                                      | YEAR                 | SEQUENTIAL NUMBER  | REV NO  | MO                    | DAY  | YEAR                     | FACILITY NAME                       | DOCKET NUMBER  |      |
| 08  | 10     | 2003                                      | 2003 - 005 - 00      |  |   | 10                    | 08   | 2003                     | BFN Unit 3                          | 05000296   |      |
|   |        |   |                      |  |   |                       |  |                          | FACILITY NAME                       | DOCKET NUMBER  |      |
|   |        |   |                      |  |   |                       |  |                          | None                                | N/A  |      |
| <b>9. OPERATING MODE</b>  |        | 1   |                      | <b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §(Check all that apply)</b> |   |                       |  |                          |                                     |  |      |
|   |        |   |                      | 20.2201(b)   |   | 20.2203(a)(3)(ii)     |  | 50.73(a)(2)(ii)(B)       |                                     | 50.73(a)(2)(ix)(A)                                     |      |
| <b>10. POWER LEVEL</b>  |        | 100                                       |                      | 20.2201(d)   |   | 20.2203(a)(4)         |  | 50.73(a)(2)(iii)         |                                     | 50.73(a)(2)(x)   |      |
|   |        |   |                      | 20.2203(a)(1)  |   | 50.36(c)(1)(i)(A)     |  | X 50.73(a)(2)(iv)(A)     |                                     | 73.71(a)(4)  |      |
|   |        |   |                      | 20.2203(a)(2)(i)   |   | 50.36(c)(1)(ii)(A)    |  | 50.73(a)(2)(v)(A)        |                                     | 73.71(a)(5)  |      |
|   |        |   |                      | 20.2203(a)(2)(ii)  |   | 50.36(c)(2)           |  | 50.73(a)(2)(v)(B)        |                                     | OTHER<br>specify in Abstract below or in NRC Form 366A |      |
|   |        |   |                      | 20.2203(a)(2)(iii)   |   | 50.46(a)(3)(ii)       |  | 50.73(a)(2)(v)(C)        |                                     |  |      |
|   |        |   |                      | 20.2203(a)(2)(iv)  |   | 50.73(a)(2)(i)(A)     |  | 50.73(a)(2)(v)(D)        |                                     |  |      |
|   |        |   |                      | 20.2203(a)(2)(v)   |   | 50.73(a)(2)(i)(B)     |  | 50.73(a)(2)(vii)         |                                     |  |      |
|   |        |   |                      | 20.2203(a)(2)(vi)  |   | 50.73(a)(2)(i)(C)     |  | 50.73(a)(2)(viii)(A)     |                                     |  |      |
|   |        |   |                      | 20.2203(a)(3)(i)   |   | 50.73(a)(2)(ii)(A)    |  | 50.73(a)(2)(viii)(B)     |                                     |  |      |
| <b>12. LICENSEE CONTACT FOR THIS LER</b>  |        |   |                      |  |   |                       |  |                          |                                     |  |      |
| NAME<br>Paul S. Heck, Nuclear Engineer, Licensing and Industry Affairs  |        |   |                      |  |   |                       | TELEPHONE NUMBER (Include Area Code)<br>256-729-3624 |                          |                                     |  |      |
| <b>13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT</b>  |        |   |                      |  |   |                       |  |                          |                                     |  |      |
| CAUSE   | SYSTEM | COMPONENT                                 | MANU-FACTURER        | REPORTABLE TO EPIX   | CAUSE   | SYSTEM                | COMPONENT  | MANU-FACTURER            | REPORTABLE TO EPIX                  |  |      |
| B   | EA     | BKR                                       | Siemens              | Y  |   |                       |  |                          |                                     |  |      |
| <b>14. SUPPLEMENTAL REPORT EXPECTED</b>   |        |   |                      |  |   |                       | <b>15. EXPECTED SUBMISSION DATE</b>                  |                          | MONTH                               | DAY  | YEAR |
| YES (if yes, complete EXPECTED SUBMISSION DATE)   |        |   |                      |  |   |                       | X NO   |                          |                                     |  |      |
| <b>16. ABSTRACT</b> (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)  |        |   |                      |  |   |                       |  |                          |                                     |  |      |
| <p>On August 10, 2003, 4 kV Shutdown Bus (SB) 1 alternate supply breaker 1622 failed to automatically close when normal supply breaker 1612 was manually opened during electrical board switching activities. The operator performing the switching recognized that breaker 1622 had failed to close, and normal supply breaker 1612 was then reclosed. SB 1 was de-energized for less than 5 seconds. SB 1 is the normal power supply to 4 kV Shutdown Boards A and B, and relays on these boards sensed the undervoltage condition and automatically started Diesel Generators (DGs) A and B. Because of the actions by the operator to quickly reclose the normal supply breaker and restore off-site power to SB 1, and thereby to 4 kV Shutdown Boards A and B, it was not necessary for the DGs to connect to their respective boards. The temporary de-energization of 4 kV Shutdown Boards A and B resulted in the actuation of additional equipment. No turbine trip or reactor trip setpoints were approached.</p> <p>The root cause was the existence of a faulty breaker internal connection. Corrective actions include improved plant staff training and evaluation of the connection style for improvements.</p> |        |   |                      |  |   |                       |  |                          |                                     |  |      |

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| Browns Ferry Nuclear Plant Unit 2 | 05000260   | YEAR           | SEQUENTIAL NUMBER | REVISION NUMBER | 2 OF 7   |
|                                   |            | 2003           | -- 005            | -- 00           |          |

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

**I. PLANT CONDITION(S)**

At the time of the event, Unit 2 was in Mode 1 at 100 percent reactor power (approximately 3458 megawatts thermal). Unit 3 was also at 100 percent reactor power (approximately 3458 megawatts thermal), and it was not significantly affected by this event. Unit 1 was shutdown and defueled, and it also was not significantly affected by this event.

**II. DESCRIPTION OF EVENT**

**A. Event:**

On August 10, 2003, at 2331 hours CDT, 4 kV Shutdown Bus 1 [EA] alternate supply breaker 1622 failed to automatically close when normal supply breaker 1612 was manually opened during electrical board switching activities being performed in preparation for maintenance work. The operator [utility – licensed] performing the switching recognized that breaker 1622 had failed to close, and normal supply breaker 1612 was then reclosed. Shutdown Bus 1 was de-energized for less than 5 seconds. Shutdown Bus 1 is the normal power supply to 4 kV Shutdown Boards A and B [EB], and relays on these boards sensed the undervoltage condition and automatically started Diesel Generators (DGs) [EK] A and B. Because of the actions by the operator to quickly reclose the normal supply breaker and restore off-site power to Shutdown Bus 1, and thereby to 4 kV Shutdown Boards A and B, it was not necessary for the DGs to connect to their respective boards.

The temporary de-energization of 4 kV Shutdown Boards A and B and the lower voltage distribution boards which they in-turn supply resulted in the actuation of additional equipment. See section II.D below for a description of these actuations. No turbine trip or reactor trip setpoints were approached.

This event is reportable in accordance with 10 CFR 50.73 (a) (2) (iv) (A) because it resulted in the unplanned, automatic initiation of DGs A and B.

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

None

**C. Dates and Approximate Times of Major Occurrences:**

|                 |              |   |
|-----------------|--------------|---|
| August 10, 2003 | 2331 hours   | Shutdown Bus 1 de-energized during the switching activity, DG's start, Control Room Emergency Ventilation (CREV) and Standby Gas Treatment (SGT) systems actuate due to a failed radiation monitor power supply |
| August 10, 2003 | ~ 2331 hours | Shutdown Bus 1 re-energized after less than 5 seconds by operator action  |
| August 10, 2003 | 2357 hours   | DG's returned to standby readiness  |

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

August 11, 2003      0351 hours      Restoration of plant systems to normal alignments completed with the exception of Unit 1 ventilation systems

August 11, 2003      0351 hours      Eight hour telephone report made to NRC

**D. Other Systems or Secondary Functions Affected**

With regard to noteworthy plant loads affected by this event, power to the Reactor Building Closed Cooling Water (RBCCW) [CC] pump 2A was temporarily interrupted, and the resulting reduction in system pressure caused the automatic isolation of non-essential cooling loads. Reactor Water Clean-Up (RWCU) [CE] Pump 2A tripped. Steam Jet Air Ejector (SJAE) [SH] 2A isolated and had to be restarted. During this interval, main condenser vacuum decreased and main generator electrical output decreased in a corresponding manner. Power to various other plant equipment was interrupted which required operator action for return to normal. Restoration of this equipment to normal service was accomplished in accordance with operating procedures with no significant complications. See section II.G below for additional details on safety system actuations.

**E. Method of Discovery**

This event was self-revealing to the operator performing the switching operation by breaker status indication and to the rest of the control room staff via numerous control room indications. An internal wiring problem found in breaker 1622 was discovered during the troubleshooting process following the event.

**F. Operator Actions**

When Shutdown Bus 1 alternate supply breaker 1622 failed to close when commanded, the operator performing the switching promptly reclosed normal supply breaker 1612. The actions taken to secure actuated equipment (listed in II.D above and II.G below) were performed in accordance with operating instructions. All operator actions were appropriate for this event.

**G. Safety System Responses**

The short term (less than 5 second duration) undervoltage condition on 4 kV Shutdown Boards A and B resulted in a start signal to the associated DGs A and B. Both of these DGs properly started and ran. Due to the timely operator action, the board undervoltage condition did not persist long enough to require connection of the diesels to their respective shutdown boards. A Unit 1 refuel zone radiation monitor [IL] power supply failed as a result of the transient. This failure resulted in a partial primary containment isolation system (PCIS) [JM] logic actuation on Unit 1. This logic isolated the Unit 1 reactor zone ventilation and refuel zone ventilation, the Unit 2 and Unit 3 refuel zone ventilation, and initiated Standby Gas Treatment (SGT) [BH] trains A, B, and C and Control Room Emergency Ventilation (CREV) [VI] train A. The Unit 2 Reactor Zone ventilation also was isolated due to the short-term loss of Instrument and Controls (I&C) [EF] Bus 2A.

The logic for the refueling zone ventilation isolation on all three units, the SGT system actuation, and the CREV system actuation was sealed in due to the problem with the Unit 1 radiation monitor. After physical repairs were completed on the radiation monitor, the Unit 1 PCIS logic was reset, and the

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

SGT and CREV systems were returned to standby readiness and the normal Unit 2 and Unit 3 refuel zone ventilation systems were returned to service. Since Unit 1 is shutdown and defueled, and its ventilation system is not required, the Unit 1 normal ventilation systems were left isolated pending completion of formal post-maintenance testing of the radiation monitor.

**III. CAUSE OF THE EVENT**

**A. Immediate Cause**

The immediate cause of the DG start was the failure of Shutdown Bus 1 alternate supply breaker 1622 to close when called upon during a routine switching activity.

**B. Root Cause**

1. The connection at switch 52 SMLS, LS-9, internal to breaker 1622 came loose. This breaker is a Siemens model 5-3AF.

**C. Contributing Factors**

None

**IV. ANALYSIS OF THE EVENT**

Routine switching was being carried out to align the in-plant electrical distribution to support maintenance on plant switchyard components. As part of this process, the auto/manual control switch for Shutdown Bus 1 was placed into manual. The Shutdown Bus supply breaker logic circuits are designed such that, in the manual mode and in the absence of various lock-out conditions, the alternate supply breaker will close immediately upon the opening of the normal supply breaker if the alternate breaker's control switch is in the CLOSE position. During this event, however, the alternate supply breaker did not close, and with the normal supply breaker having been manually opened, Shutdown Bus 1 was left with no power supply.

Undervoltage relays on 4 kV Shutdown Boards A and B sensed that the boards were deenergized. Contacts from these relays completed the start logic for DG A and DG B. These DGs properly started and ran, though their respective output breakers did not close to connect them to the shutdown boards. Connection was not necessary, since these boards were re-energized from off-site power via Shutdown Bus 1 when its normal supply breaker 1612 was reclosed by operator action.

Post-event troubleshooting identified that a connector internal to breaker 1622 had come off its termination point (see section VII.A below for additional details on this component). On these type Siemens breakers, the amber light on the breaker front panel is used to indicate that the breaker closing spring is properly charged, but this open connection in the breaker internal electrical circuitry prevented it from illuminating. The extinguished amber light on breaker 1622 had been identified by plant staff, and an open work document existed to address it. It had not been recognized, however, that this same open connection also prevented current flow through the breaker closing coil, thus preventing closure of the breaker.

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

**V. ASSESSMENT OF SAFETY CONSEQUENCES**

The safety consequences of this event were not significant. No turbine trip or reactor trip setpoints were approached as a result of this electrical distribution system transient. All safety systems responded per the plant design. The failed power supply on the Unit 1 radiation monitor resulted in an extended interval where an abnormal plant ventilation alignment existed, however, this alignment was conservative with regard to the plant operating state, and it caused no significant operational difficulties.

**VI. CORRECTIVE ACTIONS**

**A. Immediate Corrective Actions**

Shutdown Bus 1 Normal supply breaker 1612 was reclosed, thus reenergizing Shutdown Bus 1.

**B. Corrective Actions to Prevent Recurrence<sup>(1)</sup>**

1. The vendor has been notified of the condition and will be consulted for possible actions to be taken to improve the reliability of the SMLS terminal connections.
2. All plant 4 kV boards were walked down to verify that the amber light was illuminated on all breakers racked into the connect position.
3. Applicable Operations and Electrical Maintenance procedures and training materials will be revised to address the relationship between the amber light circuit current path and the breaker closing coil circuit current path.

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

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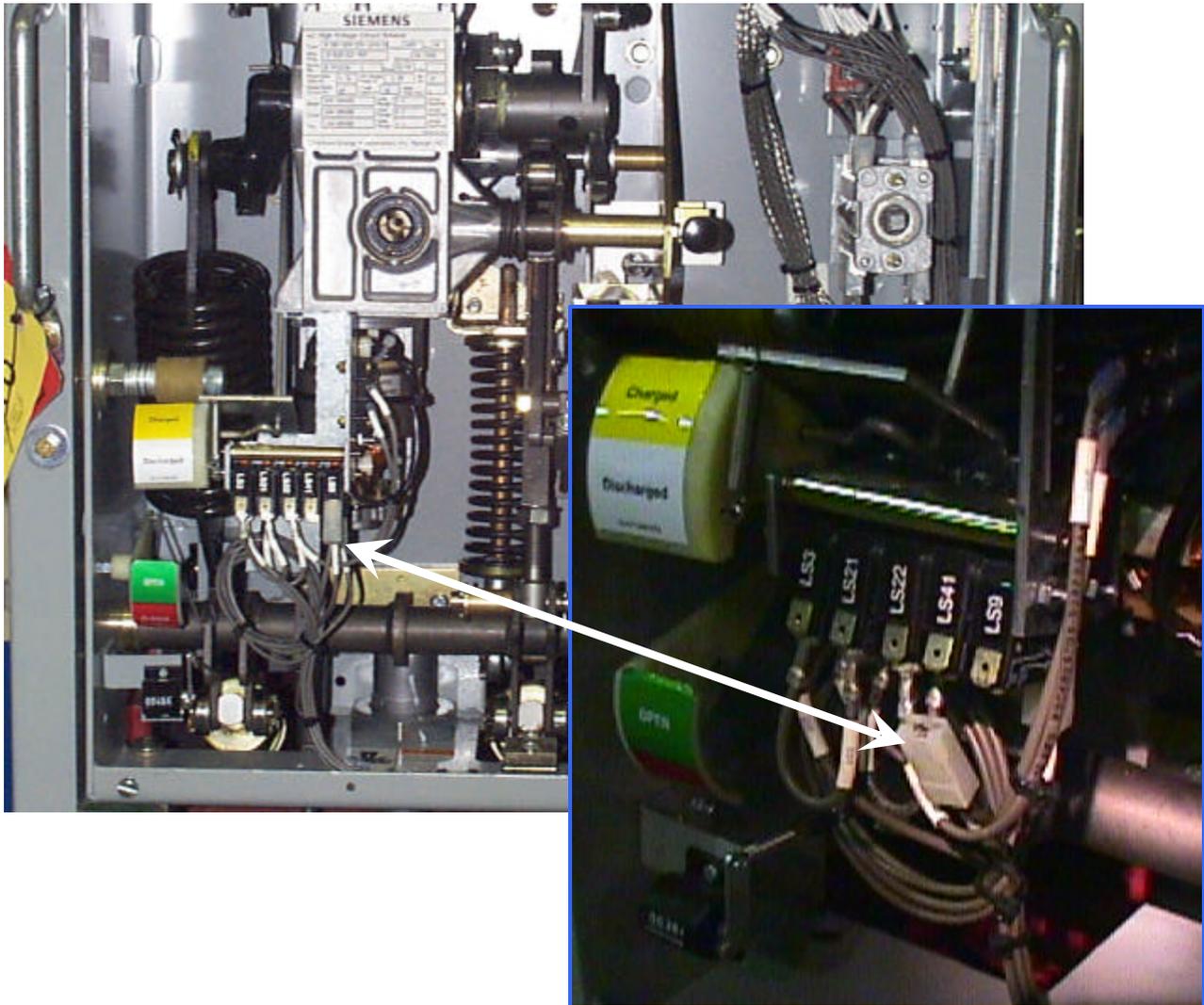
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NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)

#### VII. ADDITIONAL INFORMATION

##### A. Failed Components

Shutdown Bus 1 alternate supply breaker 1622 is a Siemens model 5-3AF. In the larger picture below, a Siemens breaker identical to 1622 is shown. The inset picture shows the as-found condition of breaker 1622 when it was inspected following this event. The white arrow points to the example of the properly connected lug in the larger picture and to the same lug, found disconnected from LS-9, on breaker 1622 during post-event troubleshooting. Breaker 1622 was initially placed in service at BFN in March 1999.



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

**B. Previous LERs on Similar Events**

None

**C. Additional Information**

None

**D. Safety System Functional Failure Consideration:**

The alternate supply breaker is not a safety-related component. No safety system functions were lost in the plant's response to the event. Therefore, this condition does not constitute a safety system functional failure as referenced in 10 CFR 50.73(a)(2)(v), and it will not be included in Performance Indicator reporting performed in accordance with NEI 99-02.

**E. Loss of Normal Heat Removal Consideration:**

N/A This event did not involve a reactor scram.

**VIII. COMMITMENTS**

None