



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

December 27, 2011

10 CFR 50.73

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
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 50-259/2011-010-00**

The enclosed Licensee Event Report provides details of a latent design error identified during the Browns Ferry Nuclear Plant (BFN) National Fire Protection Association (NFPA) 805 Transition review process. This review identified that non-safety related ammeters were installed in several safety-related battery board circuits without adequate electrical isolation protection. The Tennessee Valley Authority is submitting this report in accordance with 10 CFR 50.73(a)(2)(ii)(B), any event or condition that resulted in the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety.

NUREG 1022, Revision 2 states that an LER is to be submitted within 60 days of the discovery date. If a 60-day period ends on a Saturday, Sunday, or holiday, reports submitted on the first working day following the end of the 60 days are acceptable. The date of discovery was October 25, 2011. The 60 day report was due on Saturday, December 24, 2011. Therefore, this report is being submitted on December 27, 2011, the first working day after December 24, 2011.

There are no new regulatory commitments contained in this letter. Should you have any questions concerning this submittal, please contact J. E. Emens, Jr., Nuclear Site Licensing Manager, at (256) 729-2636.

Respectfully,

K. J. Polson
Vice President

cc: See page 2

IE22
NRR

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Enclosure: Licensee Event Report 259/2011-010-00-DC Ammeter Cables Not
Adequately Isolated

cc (w/ Enclosure):

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

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JEE:PAH:LAJ

Enclosure

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ENCLOSURE

**Browns Ferry Nuclear Plant
Unit 1**

**Licensee Event Report 259/2011-010-00
DC Ammeter Cables Not Adequately Isolated**

See Enclosed

NRC FORM 366 (10-2010)		U.S. NUCLEAR REGULATORY COMMISSION		APPROVED BY OMB NO. 3150-0104		EXPIRES 10/31/2013																																									
LICENSEE EVENT REPORT (LER)				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 FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@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.																																											
1. FACILITY NAME Browns Ferry Nuclear Plant Unit 1				2. DOCKET NUMBER 05000259		3. PAGE 1 of 7																																									
4. TITLE: DC Ammeter Cables Not Adequately Isolated																																															
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9. OPERATING MODE <div style="text-align: center; font-size: 24px;">1</div>			11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) <table style="width:100%; font-size: small;"> <tr> <td><input type="checkbox"/> 20.2201(b)</td> <td><input type="checkbox"/> 20.2203(a)(3)(i)</td> <td><input type="checkbox"/> 50.73(a)(2)(i)(C)</td> <td><input type="checkbox"/> 50.73(a)(2)(vii)</td> </tr> <tr> <td><input type="checkbox"/> 20.2201(d)</td> <td><input type="checkbox"/> 20.2203(a)(3)(ii)</td> <td><input type="checkbox"/> 50.73(a)(2)(ii)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(viii)(A)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(1)</td> <td><input type="checkbox"/> 20.2203(a)(4)</td> <td><input checked="" type="checkbox"/> 50.73(a)(2)(ii)(B)</td> <td><input type="checkbox"/> 50.73(a)(2)(viii)(B)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(i)</td> <td><input type="checkbox"/> 50.36(c)(1)(i)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(iii)</td> <td><input type="checkbox"/> 50.73(a)(2)(ix)(A)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(ii)</td> <td><input type="checkbox"/> 50.36(c)(1)(ii)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(iv)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(x)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(iii)</td> <td><input type="checkbox"/> 50.36(c)(2)</td> <td><input type="checkbox"/> 50.73(a)(2)(v)(A)</td> <td><input type="checkbox"/> 73.71(a)(4)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(iv)</td> <td><input type="checkbox"/> 50.46(a)(3)(ii)</td> <td><input type="checkbox"/> 50.73(a)(2)(v)(B)</td> <td><input type="checkbox"/> 73.71(a)(5)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(v)</td> <td><input type="checkbox"/> 50.73(a)(2)(i)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(v)(C)</td> <td><input type="checkbox"/> OTHER</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(vi)</td> <td><input type="checkbox"/> 50.73(a)(2)(i)(B)</td> <td><input type="checkbox"/> 50.73(a)(2)(v)(D)</td> <td style="font-size: x-small;">Specify in Abstract below or in NRC Form 368A</td> </tr> </table>									<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input checked="" type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 368A
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12. LICENSEE CONTACT FOR THIS LER																																															
FACILITY NAME Paul A. Herrmann III, Licensing Programs Manager									TELEPHONE NUMBER (Include Area Code) 256-729-7479																																						
13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT																																															
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ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)																																															
During a design review in support of the Browns Ferry Nuclear Plant (BFN) Unit 1 transition to National Fire Protection Association 805, a condition was identified that non-safety related ammeters (also called remote ammeters) were installed in several safety-related battery board circuits (i.e. Battery Boards 1, 2, and 3) without electrical isolation protection required by Design Criteria BFN-50-7200C. Design Criteria BFN-50-7200C requires the addition of fuses to provide protection for battery board ammeter circuits. This constitutes a design flaw that has existed from the initial startup and the subsequent re-start of BFN Units 1, 2, and 3 since November, 1995, in all modes and all mode combinations of operation of all three units. The equipment impacted by this condition are Battery Boards 1, 2, and 3, which are credited for Appendix R safe shutdown for a fire event in Fire Area (FA) 16. Corrective actions included preparing a design change to add fuses for the remote ammeter circuits, adding this condition to the BFN Fire Protection Impairment Report, as well as improvements in Engineering technical rigor and human performance.																																															

LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET

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I. PLANT CONDITION(S)

At the time of the discovery of the event, Browns Ferry Nuclear Plant (BFN) Unit 1 was at 50 percent power, BFN Unit 2 was at 100 percent power, and BFN Unit 3 was at 100 percent power.

II. DESCRIPTION OF EVENT

A. Event

During reviews to transition BFN-Unit 1 from Appendix R to National Fire Protection Association (NFPA) 805, it was identified that the control room ammeters [II] (i.e., remote ammeters) for Battery Boards [BYBD] 1, 2, and 3 were electrically connected to the safety related 250 V DC bus at the battery boards without electrical isolation. These ammeters are identified as Quality Related, Non-Class 1E. Local ammeters on Battery Boards 1, 2, and 3 are identified as Safety Related, Class 1E. The local ammeter circuits are not electrically isolated because the ammeters are safety-related and the Class 1E boundary is maintained. In summary, the electrical isolation requirement for in Design Criteria BFN-7200C for the remote ammeters was not maintained. Therefore over-current protection required to ensure that the appropriate boundary between Class 1E and Non-Class 1E devices was not maintained. Isolation in the electrical circuit for the voltmeters [EI] is provided by fuses.

The described scenario involves a remote ammeter located on panel 1-9-8 associated with the 250 V DC [EJ] Power Distribution System (DCPDS). The implication of the remote ammeter is that the circuit for the remote ammeter is routed in multiple Fire Areas (FAs). As such, the condition involves ammeters whose circuits are routed in multiple FAs. Each unit control room has a panel 9-8 that displays ammeters. This condition involves ammeters on panels 1-9-8, 2-9-8, and 3-9-8.

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

There were no inoperable structures, components, or systems that contributed to this event.

C. Dates and Approximate Times of Major Occurrences

July 1970	Drawings were issued. The battery board ammeters were initially designed to be un-fused whereas the battery board voltmeters were designed with fuses.
August 1974	BFN Unit 1 initial startup. Condition (un-fused ammeter circuits) existed during initial BFN Unit 1 startup.
March 1975	BFN Unit 2 initial startup. Condition (un-fused

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ammeter circuits) existed during initial BFN Unit 2 startup.

March 1977

BFN Unit 3 initial startup. Condition (un-fused ammeter circuits) existed during initial BFN Unit 3 startup.

December 1988

NRC issues Safety Evaluation Report for the Fire Protection Report (FPR) for BFN Unit 2 operation. Non-conforming condition (un-fused ammeter circuits) should have been identified in support of BFN Unit 2 recovery efforts that involved the initial acceptance and application of Appendix R requirements.

November 1995

FPR revised for BFN Units 2 and 3 operations. Non-conforming condition (un-fused ammeter circuits) should have been identified in support of BFN Unit 3 recovery efforts that involved the program review of Appendix R for BFN Unit 3 and application of Appendix R requirements for BFN Units 2 and 3 operations. This was a missed opportunity to have identified the latent design error.

May 2007

FPR revised for BFN Units 1, 2, and 3 operations. Non-conforming condition (un-fused ammeter circuits) should have been identified in support of BFN Unit 1 recovery efforts that involved the program review of Appendix R for BFN Unit 1 and application of Appendix R requirements for BFN Units 1, 2, and 3 operations. This was a missed opportunity to have identified the latent design error.

October 25, 2011

During a review of the Appendix R design basis used for compliance for all three units at BFN in support of the transition from the deterministic approach to fire safe shutdown as prescribed by 10 CFR 50 Appendix R, to the probabilistic approach defined under NFPA 805, a hot short condition was identified. This condition was caused by a postulated fire event on the remote ammeter circuits to the battery boards which

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could propagate from the control bay into the battery board rooms and could jeopardize the availability of the battery boards. This application of the use of human performance tools currently practiced at BFN succeeded in identifying the latent design error.

D. Other Systems or Secondary Functions Affected

There were no other systems or secondary functions affected.

E. Method of Discovery

During a design review in support of the NFPA 805 project, it was identified that the control room ammeters (also called remote ammeters; which are not safety related) for Battery Boards 1, 2, and 3 were electrically connected to the safety related 250 V DC bus at the battery boards without electrical isolation. Each unit control room has a panel 9-8 that contains such ammeters. As such, this condition involves ammeters located on panels 1-9-8, 2-9-8, and 3-9-8. The remote ammeters have circuits routed in multiple FAs.

F. Operator Actions

At the time of discovery, fire watches were already in place and will remain in place until, at a minimum, the identified condition is resolved.

III. CAUSE OF THE EVENT

A. Immediate Cause

The immediate cause of this event was that the original plant design contained a latent design error related to wiring and isolation that constituted a fire protection program deficiency. This deficiency could adversely affect the ability to achieve and maintain safe shutdown of the plant in the unlikely event of a control room fire.

B. Apparent Cause

The most probable cause for this event were human performance errors related to self checking and peer checking that failed to identify a latent design error. The latent design error was made during plant construction and was not identified during the design review for 10 CFR 50 Appendix R Section III.G (fire protection of safe shutdown capability).

The barriers that failed during BFN Units 1, 2, and 3 recovery efforts were human performance based, such as self checking, peer checking, and other organizational reviews.

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IV. ANALYSIS OF THE EVENT

During design review in support of the BFN Unit 1 transition to NFPA 805, it was discovered that control room ammeters for Battery Boards 1, 2, and 3 were electrically connected to the safety related 250 V DC bus at the battery boards without electrical isolation. These ammeters (also called remote ammeters) are identified as Quality Related, Non-Class 1E. Similar ammeters located on Battery Boards 1, 2, and 3 are Safety Related, Class 1E. As discussed above, these circuits are not electrically isolated from one-another. As such, the electrical isolation requirements in Design Criteria BFN -7200C were not maintained. Therefore, over-current protection required to ensure that the appropriate boundary between Class 1E and Non-Class 1E devices was not maintained.

The design deficiency associated with the remote ammeters was evaluated to be reportable in accordance with 10 CFR 50.73(a)(2)(ii)(B), any event or condition that resulted in the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety.

Extent of Condition

The described condition involves a remote ammeter located on panel 9-8 associated with the 250 V DCPDS. Each unit control room has a panel 9-8 that displays ammeters. As such, the condition involves ammeters on panels 1-9-8, 2-9-8, and 3-9-8 that have circuits that are routed from FA 16 to another FA. A review of drawing history found that the fuses for the voltmeters were part of the original design of the 250 V DCPDS as shown on the initial issue versions of drawings; however, there were no fuses in the circuits for the described ammeters.

DC circuits must use a resistive network to indicate amperes. An AC circuit can use a resistive network, but typically utilize current transformers that are not electrically connected to the circuit being measured. Either way, vendor recommendations on the installation of ammeter circuits do not contain the requirement for over-current protection. As such, the condition involves ammeters for both AC and DC circuits.

In addition to the ammeters on panel 9-8, the ammeters associated with 4 kV Unit Boards for BFN Units 1, 2, and 3 [1A, 1B, 1C, 2A, 2B, 2C, 3A, 3B, and 3C] required additional review. These boards are non-class 1E so there is no requirement for electrical isolation from the main bus. Calculation EDQ099920030037 Appendix G was reviewed. Notes in Appendix G identify that the 4kV Unit Boards were removed from the calculation as no Appendix R required equipment failed as a result of the loss of the Unit Boards. As such, no further analysis is required for these ammeters.

V. ASSESSMENT OF SAFETY CONSEQUENCES

10 CFR 50 Appendix R required that BFN perform an evaluation to ensure that safe shutdown capability could be maintained during and after a fire. The Appendix R program at BFN performed that evaluation to ensure that the required safe shutdown equipment

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was maintained in proper condition and if the equipment was not available, appropriate actions/compensations were established in order to ensure safe shutdown. This issue involves non-compliance with requirements of Appendix R in accordance with NRC Inspection Manual Part 9900.

There are three levels of defense in depth related to Fire Protection.

- 1) Prevent fires from starting with administrative controls. Administrative controls are in place to control and track combustibles at BFN.
- 2) Identify and extinguish those fires that do start. At a minimum all FAs have detection and the majority of areas have suppression systems. In addition, BFN has a full-time Fire Department to respond to any fires.
- 3) For all FAs and Fire Zones, ensure that a train of safe shutdown equipment is free of fire damage in the event of an Appendix R fire. The Appendix R safe shutdown instructions have been walked down to verify their feasibility and reliability and, in addition, training is provided on a regular basis.

The immediate cause of this event was that the original plant design contained a latent design error related to wiring and isolation of the remote ammeters that constituted a fire protection program deficiency. This condition could adversely affect the ability to achieve and maintain safe shutdown of the plant in the unlikely event of a control room fire.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

As an interim action, the identified condition associated with the remote ammeters was added to existing Fire Protection Impairment Permit 09-1920, which established fire watches in all FAs to provide increased defense in depth to ensure that if a general fire were to occur, that the fire would be detected at its incipient stage. As such, at the time of discovery, fire watches were already in place and will remain in place until the condition identified in PER 452185 is resolved.

A design change was issued to resolve the electrical isolation issue by adding fuses to the electrical circuits. A PER Action also exists to track the installation of the fuses.

B. Corrective Actions

1. Site engineering instituted an internal challenge board review on all critical engineering external correspondence and provides guidance on Quality Review Team expectations to engineering leadership.
2. Modify Engineering Corrective Actions Review Board to improve focus on documentation of critical thinking.
3. Verify Engineering Block Training Lesson Plan, ESP 111.004 titled, "Technical Evaluations, Technical Justifications, and Design Inputs", addresses the errors.

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VII. ADDITIONAL INFORMATION

A. Failed Components

There were no failed components.

B. Previous Similar Events

There were no previous similar events.

C. Additional Information

The corrective action document for this report is PER 452185.

D. Safety System Functional Failure Consideration:

This event was not a safety system functional failure in accordance with NEI 99-02.

E. Scram With Complications Consideration

This event did not involve in a scram.

VIII. COMMITMENTS

There are no commitments.