



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

July 31, 2012

10 CFR 50.73

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Browns Ferry Nuclear Plant, Units 1, 2, and 3
Facility Operating License Nos. DPR-33, DPR-52, and DPR-68
NRC Docket Nos. 50-259, 50-260, and 50-296

Subject: **Licensee Event Report 50-259/2012-007-00**

The enclosed Licensee Event Report provides details of a cable routing error that would result in failure of direct current control power to credited 4kV Shutdown Board 3EA during an Appendix R event. The Tennessee Valley Authority is submitting this report in accordance with 10 CFR 50.73(a)(2)(ii)(B), as any event or condition that resulted in the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety, and 10 CFR 50.73(a)(2)(v)(A), as any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to shut down the reactor and maintain it in a safe shutdown condition.

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

Enclosure: Licensee Event Report 50-259/2012-007-00 - Cable Routing Error
Would Result In Failure Of Direct Current Control Power To Credited
4kV Shutdown Board 3EA During An Appendix R Event

cc: See Page 2

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NRR

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cc (w/ Enclosure):

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

ENCLOSURE

**Browns Ferry Nuclear Plant
Units 1, 2, and 3**

Licensee Event Report 50-259/2012-007-00

**Cable Routing Error Would Result In Failure Of Direct Current Control Power To
Credited 4kV Shutdown Board 3EA During An Appendix R Event**

See Attached

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 (BFN), Unit 1	2. DOCKET NUMBER 05000259	3. PAGE 1 of 6
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4. TITLE: Cable Routing Error Would Result In Failure Of Direct Current Control Power To Credited 4kV Shutdown Board 3EA During An Appendix R Event

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
06	01	2012	2012	007	00	07	31	2012	BFN, Unit 2	05000260
									FACILITY NAME	DOCKET NUMBER
									BFN, Unit 3	05000296

9. OPERATING MODE 1	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)										
	<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)							
10. POWER LEVEL 100	<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 checked="" 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)	<small>Specify in Abstract below or in NRC Form 368A</small>								

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME Eric Bates, Licensing Engineer	TELEPHONE NUMBER (Include Area Code) 256-614-7180
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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

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO		N/A	N/A	N/A

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

On June 1, 2012, at 0900 Central Daylight Time (CDT), during the National Fire Protection Association 805 transition review, it was discovered that a cable routing error would result in failure of direct current (DC) control power to credited 4kV Shutdown Board 3EA during an Appendix R fire in Fire Area (FA) 23.

Cable 3B181 provides alternate DC control power to the 4kV Shutdown Board 3EA from Battery Board 2 and is routed in FA 23. However, cable 3B181 is not identified as being in FA 23 in the Browns Ferry Nuclear Plant (BFN) Appendix R computerized separation analysis. This error allowed the analysis to credit alternate DC control power to the 4kV Shutdown Board 3EA. The normal DC control power to 4kV Shutdown Board 3EA via cable 3B180 would not be available for a FA 23 Appendix R fire because cable 3B180 is also routed through FA 23. Therefore, the separation analysis error results in the credited 4kV Shutdown Board 3EA being unable to perform its function for FA 23 Appendix R fires and could result in a loss of power to the credited safe shutdown equipment which would challenge the ability to provide adequate core cooling during the performance of the BFN Safe Shutdown Instructions.

The root cause was determined to be the lack of an effective program for technical human performance tools during the performance of the Appendix R separation analysis.

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NARRATIVE

I. PLANT CONDITION(S)

At the time the condition was identified, Browns Ferry Nuclear Plant (BFN), Units 1 and 2, were in Mode 1 at approximately 100 percent power. The BFN, Unit 3, was in Mode 4 at zero percent power.

II. DESCRIPTION OF EVENT

A. Event

On June 1, 2012, at 0900 Central Daylight Time (CDT), during the National Fire Protection Association (NFPA) 805 transition review, it was discovered that a cable routing error would result in failure of direct current (DC) control power to credited 4kV Shutdown Board 3EA during an Appendix R fire in Fire Area (FA) 23.

Cable [CBL] 3B181 provides alternate DC control power to the 4kV Shutdown Board 3EA from Battery Board [BYBD] 2 and is routed in FA 23. However, cable 3B181 is not identified as being in FA 23 in the BFN Appendix R computerized separation analysis. This error allowed the analysis to credit alternate DC control power to the 4kV Shutdown Board 3EA. The normal DC control power to 4kV Shutdown Board 3EA via cable 3B180 would not be available for a FA 23 Appendix R fire because cable 3B180 is also routed through FA 23. Therefore, the separation analysis error results in the credited 4kV Shutdown Board 3EA being unable to perform its function for FA 23 Appendix R fires and could result in a loss of power to the credited safe shutdown equipment which would challenge the ability to provide adequate core cooling during the performance of the BFN Safe Shutdown Instructions (SSIs).

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

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

C. Dates and Approximate Times of Major Occurrences

1987 to 1991	Appendix R separation analysis performed for BFN, Unit 2.
1991 to 1995	Appendix R separation analysis performed for BFN, Unit 3, which included BFN, Unit 2, Appendix R separation analysis.
2003 to 2007	Appendix R separation analysis performed for BFN, Unit 1, which included BFN, Units 2 and 3, Appendix R separation analysis.
June 1, 2012, at 0900 CDT	A cable routing error was identified that would result in failure of DC control power to credited 4kV Shutdown Board 3EA during an Appendix R fire in FA 23.
June 1, 2012, at 1626 CDT	The BFN reported the event to the NRC.

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D. Other Systems or Secondary Functions Affected

There were no other systems or secondary functions affected.

E. Method of Discovery

This condition was discovered during a NFPA 805 transition review.

F. Operator Actions

There were no operator actions.

G. Safety System Responses

There were no safety system responses.

III. CAUSE OF THE EVENT

A. Immediate Cause

The immediate cause was an error within the 4kV Shutdown Board cable block diagram that was created for Appendix R analyses.

B. Root Cause

The root cause was the lack of an effective program for technical human performance tools during the performance of the Appendix R separation analysis.

C. Contributing Factors

There were no contributing factors.

IV. ANALYSIS OF THE EVENT

The Tennessee Valley Authority (TVA) is submitting this report in accordance with 10 CFR 50.73(a)(2)(ii)(B), as any event or condition that resulted in the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety, and 10 CFR 50.73(a)(2)(v)(A), as any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to shut down the reactor and maintain it in a safe shutdown condition.

The inadequate separation of the normal and alternate DC control power cables in FA 23 may result in the 4kV Shutdown Board 3EA potentially becoming unable to fulfill its function in the event of an Appendix R fire in this area. The DC control power allows for remote operation of various breakers [BKR] required for safe shutdown, including the emergency diesel generator feeder breaker and the residual heat removal pump breakers. If the DC control power is lost during an Appendix R fire in FA 23, there is no assurance that the 4kV Shutdown Board 3EA will be able to be connected to provide power to the required loads. To mitigate the potential chances of this potential unavailability, a continuous fire watch has been stationed in FA 23 in order to reduce the probability that a fire has the opportunity to grow into an Appendix R event.

From 1987 to 1991, the Appendix R separation analysis for BFN, Unit 2, was conducted using manual evaluations/drawings for cable separation analysis. The Appendix R separation analysis for BFN, Unit 3, was conducted from 1991 to 1995 and was

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prepared using block diagrams and a computer program. This BFN, Unit 3, Appendix R separation analysis also incorporated the previous BFN, Unit 2, Appendix R separation analysis. The BFN, Unit 1, Appendix R separation analysis was conducted from 2003 to 2007 using the System Assurance and Fire Protection Engineering (SAFE) program and the Integrated Cable and Raceway Design System (ICRDS) for cable routing data and combined BFN, Units 1, 2, and 3, data into the SAFE program.

Subsequent to the time periods of the performance of the BFN Appendix R separation analyses, lessons learned have been implemented throughout the industry on the use of technical human performance tools to mitigate/prevent documentation errors. In 2005, the Institute of Nuclear Power Operations (INPO) released INPO 05-002, Human Performance Tools for Engineers and Other Knowledge Workers, and INPO 05-006, Engineering Organization Success Factors. These two documents incorporated industry lessons learned to provide guidance for technical human performance tools.

The BFN has implemented human performance program improvements to ensure that human errors are minimized. The station maintains a human performance program and individuals are trained on the use of human performance tools.

Extent of Condition

The extent of condition is limited to all Appendix R Safe Shutdown Boards normal and alternate DC control power feeds as well as the normal and alternate AC power feeds.

Extent of Cause

The extent of cause was determined to include other programs/calculations that are dated, knowledge intensive, and comparable to the significance of the Appendix R separation analysis.

V. ASSESSMENT OF SAFETY CONSEQUENCES

The normal and alternate DC control power to the 4kV Shutdown Board 3EA are both routed in FA 23. An Appendix R fire in FA 23 would result in the unavailability of 4kV Shutdown Board 3EA, which impacts the operator's ability to shutdown the plant using the credited components in the BFN Appendix R SSIs. The total ignition frequency for the fires for the scenarios of interest is 1.31E-3/year. However, this fire ignition frequency is based on time to damage of the closest target to the source. Consideration of the plant cable routing configuration of the subject cable allows credit for additional mitigation of fire damage effects. In accordance with the guidance provided in NUREG/CR-6850, Fire Probabilistic Risk Assessment Methods Enhancements, dated September 2010, these mitigation factors include fire propagation time due to the location of the associated cable tray in the cable tray stack relative to the postulated fire source and the probability of manual suppression success. In addition, the probability of manually aligning normal control power, which is not impacted by the fires of interest, to the shutdown board was also considered. Inclusion of these additional mitigation factors reduces the fire impacts to below 1.00E-4/year, which is less than the defined threshold for a scenario of interest.

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For the above condition, a continuous fire watch has been established in order to decrease the probability of a serious fire.

VI. CORRECTIVE ACTIONS - The corrective actions are being managed by TVA's corrective action program.

A. Immediate Corrective Actions

A continuous fire watch in FA 23 was established.

B. Corrective Actions

1. A design change will be implemented to correct the routing of the normal and alternate DC control power cables that are both routed through FA 23.
2. A comprehensive cable routing verification of the normal and alternate control power for the Safe Shutdown Board feeds will be performed.
3. An assessment will be performed to determine the overall condition of the programs/calculations.

C. Corrective Actions to Prevent Recurrence

Implement a technical human performance procedure for knowledge worker human performance tools for all programs/calculations performed by engineering.

VII. ADDITIONAL INFORMATION

A. Failed Components

There were no failed components.

B. Previous Similar Events

A search of BFN, Units 1, 2, and 3, LERs for approximately the past five years did identify LER 50-259/2010-001-00, Unit 1, 2, and 3 Appendix R Safe Shutdown Instruction Procedures Contain Incorrect Operator Manual Actions, and LER 50-259/2012-003-00, Reactor Protection System Circuit Could Potentially Remain Energized During An Appendix R Fire, as similar events that were discovered during NFPA 805 transition.

A search was performed on the BFN corrective action program. The previous problem evaluation reports (PERs) associated with the similar LERs are PERs 243955 and 503304. The similar PERs related to this condition are PERs 358612, 405118, 409312, 422371, 493807, and 499047.

C. Additional Information

The corrective action document for this report is PER 561101.

D. Safety System Functional Failure Consideration

In accordance with NEI 99-02, this condition is considered a safety system functional failure for BFN, Units 1, 2, and 3, because it could challenge the ability to provide adequate core cooling during the performance of the BFN SSIs.

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E. Scram With Complications Consideration

This condition did not include a scram.

VIII. COMMITMENTS

There are no commitments.