

September 5, 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) -  
UNITS 2 and 3 - DOCKETS 50-260 AND -296 - FACILITY OPERATING  
LICENSES DPR - 52 AND DPR - 68 - LICENSEE EVENT REPORT (LER)  
50-260/2003-004-00**

The enclosed report provides details of an electrical cable separations design error which potentially affected the plants' Appendix R safe-shutdown capability.

In accordance with 10 CFR 50.73(a)(2)(ii)(B), TVA is reporting this event as an unanalyzed condition that could have significantly degraded plant safety.

There are no commitments contained in this letter.

Sincerely,

Original signed by M. D. Skaggs, for:

Ashok S. Bhatnagar

cc: See page 2

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Page 2  
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TEA:DTL:PSH:BAB

Enclosure

cc (Enclosure):

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<b>NRC FORM 366</b> (7-2001)			<b>U.S. NUCLEAR REGULATORY COMMISSION</b>			<b>APPROVED BY OMB NO. 3150-0104</b> <small>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, NEOF-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.</small>			<b>EXPIRES 7-31-2004</b>		
<b>LICENSEE EVENT REPORT (LER)</b> (See reverse for required number of digits/characters for each block)											
<b>1. FACILITY NAME</b> Browns Ferry Nuclear Plant Units 2 and 3						<b>2. DOCKET NUMBER</b> 05000260			<b>3. PAGE</b> 1 OF 6		
<b>4. TITLE</b> Cable Separations Design Error Related to Appendix R requirements											
<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	
07	07	2003	2003 - 004 - 00			09	05	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)		X	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)			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 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 Paul S. Heck, Nuclear Engineer, Licensing and Industry Affairs								TELEPHONE NUMBER (Include Area Code) 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>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) During review and validation of Appendix R-related calculations associated with the restart of BFN Unit 1, it was noted that some associated circuits of certain 4 kV electrical distribution boards and loads were not adequately evaluated in the Unit 2 and Unit 3 calculations.  As physically configured, control power cables which affect power circuit breaker control are routed within 20 feet of the power cables being fed by these same breakers. The plant loads affected are the Unit 2 variable frequency drives and the Unit 3 recirculation motor-generator sets which provide power to drive the reactor recirculation pumps. As a result of this cable routing, fires in certain zones of the BFN plant could result in electrical faults on power cables which could not be de-energized by automatic breaker operation. Such faults could result in cable insulation fires being initiated in fire areas other than the area where the original fire occurred, thus creating an associated circuit of concern.  The apparent cause was an historical design error. Compensatory measures were implemented in accordance with the fire protection plan. The plant will be modified to correct the condition.											

# LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
Browns Ferry Nuclear Plant Units 2 and 3	05000260	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 6
		2003	-- 004	-- 00	

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

## I. PLANT CONDITION(S)

At the time of the condition's discovery, Unit 2 and Unit 3 were in Mode 1 at 100 percent reactor power (approximately 3458 megawatts thermal). Unit 1 was shutdown and defueled, and therefore it was not affected by this condition.

## II. DESCRIPTION OF EVENT

### A. Event:

During review and validation of Appendix R-related calculations associated with the restart of BFN Unit 1, it was noted that some associated circuits of certain 4 kV electrical distribution boards and loads were not adequately evaluated in the Unit 2 and Unit 3 calculations. This condition was entered into the corrective action program, and an impact evaluation was undertaken. On July 7, 2003, it was determined that electrical cable routing associated with the Unit 2 and Unit 3 recirculation pump boards was not in compliance with Appendix R requirements. At that time, an Appendix R limiting condition for operation (LCO) was entered, and roving fire watches were established in accordance with the BFN Fire Protection Program.

As physically configured, control power cables which affect power circuit breaker control are routed within 20 feet of the power cables being fed by these same breakers. The plant loads affected are the Unit 2 variable frequency drives (VFDs) and the Unit 3 recirculation motor-generator (MG) sets which provide power to drive the reactor recirculation pumps. As a result of this cable routing, fires in certain zones of the BFN plant could result in electrical faults on power cables which could not be de-energized by automatic breaker operation. Such faults could result in cable insulation fires being initiated in fire areas other than the area where the original fire occurred, thus creating an associated circuit of concern.

Because this design error resulted in the plant being in an unanalyzed condition that significantly degraded plant safety, it is reportable in accordance with 10 CFR 50.73 (a) (2) (ii) (B).

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

None

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

July 7, 2003	1500 hours CST	Operations was notified that an Appendix R analysis error existed which affected Unit 2 and Unit 3. Roving fire watches were established in accordance with Fire Protection Report requirements
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# LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
Browns Ferry Nuclear Plant Units 2 and 3	05000260	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	3 OF 6
		2003	-- 004	-- 00	

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

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

None

**E. Method of Discovery**

Design basis calculations and design configurations common to all three BFN units were being reviewed as part of the Unit 1 restart activities. During a review of Appendix R related design documents, this error was identified.

**F. Operator Actions**

No specific operator response was required for this design deficiency. Appropriate Appendix R limiting conditions for operation were entered as required by the BFN Fire Protection Report, and fire watches were established as compensatory measures.

**G. Safety System Responses**

The nature of this event was such that no safety-system responses were required.

## III. CAUSE OF THE EVENT

**A. Immediate Cause**

The immediate cause of the plant being in an unanalyzed condition was an error in Appendix R analysis.

**B. Root Cause**

The event apparent cause was a lack of attention to detail when the subject calculations were performed prior to the restarts of Unit 2 (1991) and Unit 3 (1995). The common vulnerabilities to damage from a single fire of the control and power circuits for the recirculation pump drives (VFDs on Unit 2 and MG sets on Unit 3) was not properly evaluated when the Appendix R calculations were originally performed.

**C. Contributing Factors**

None

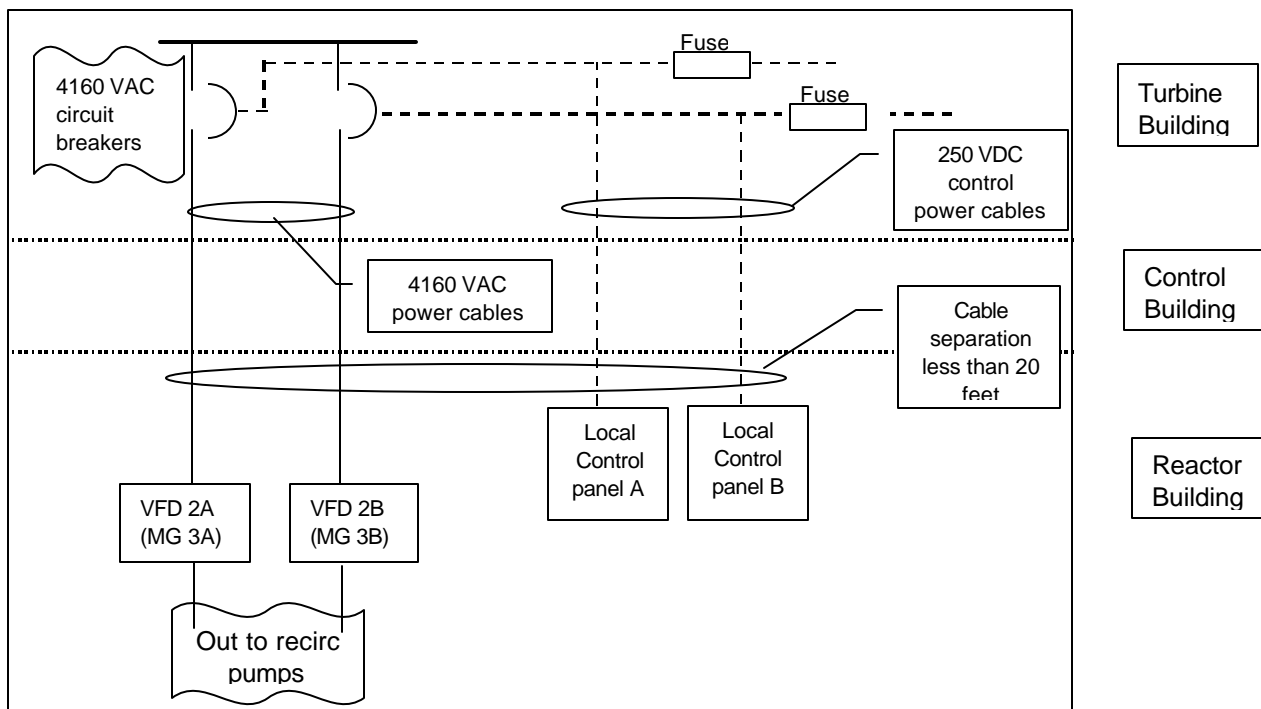
# LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
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NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)

## IV. ANALYSIS OF THE EVENT

It was identified that the control power cables associated with the recirculation pump breakers and the power cables from these breakers to the recirculation pump drives (VFDs on Unit 2 and MG sets on Unit 3) are routed such that a single fire event could potentially damage both types of cabling. Should the control power cables be damaged in such an event, it would then be impossible to remotely operate the recirculation pump drive breakers. Given the current cable routing, it is also possible that the same fire could subsequently damage the recirculation pump drive power cables. With the control power already hypothetically failed by the fire, the recirculation pump drive breakers would not automatically trip to isolate such a fault on the power cables. Under such circumstances, high fault currents could flow uninterrupted along the cable's entire length. As a result, the cable insulation could ignite in other fire areas along the cable run. A fire in a reactor building fire zone could therefore spread to another reactor building fire zone or to a control building fire zone via this propagation mechanism. See the sketch below:



Following identification of the vulnerability, roving fire watches were established to enhance the fire detection capability already in place. The fire watch presence improves the probability that any fire which might start would be rapidly identified, and the probability of its quick suppression maximized. Existing fire protection program attributes make the initiation probability of a fire in the plant small.

# **LICENSEE EVENT REPORT (LER)**

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
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**NARRATIVE** (If more space is required, use additional copies of NRC Form 366A) (17)

## **V. ASSESSMENT OF SAFETY CONSEQUENCES**

While the condition being reported herein could hypothetically occur, it requires a series of low probability events to occur in a specific order. These events are listed here:

- A fire of unspecified origin must begin in the reactor building in the vicinity of the recirculation pump drive power and control power cables. While it is possible for a such fire to occur, the plant design, operating practices, and the BFN fire protection program all contribute to making the probability of such a fire low.
- Given that a fire has been started in the vicinity of the related electrical cables, the fire must become sufficiently severe to damage the cables. Existing fire detection and suppression equipment would operate to minimize this possibility.
- Damage to these electrical cables must occur in the proper sequence. Damage to both power and control cables must occur, and the control power cable damage must occur first. The DC control power circuit is normally ungrounded, so the fire must damage both the positive and negative conductors such that they are shorted to one another or both are shorted to ground. A single conductor shorting to ground would not fail the circuit. If the control power cables remain intact when the drive power cables sustain damage, proper electrical isolation of the faulted cables would occur per plant design. Also, damage to the control power cables alone would not cause any fire propagation, since these cables are protected by fuses which would isolate any fault currents, thus preventing upstream cable insulation overheating.
- Once the cable damage has occurred in the necessary sequence, uninterrupted fault current of a magnitude sufficient to ignite cable insulation along the upstream cable routing must occur. Other factors, such as destructive effects from the fault current itself, could act to reduce or even interrupt the current path.

The above factors were evaluated, and the risk value is considered low.

## **VI. CORRECTIVE ACTIONS**

### **A. Immediate Corrective Actions**

Compensatory fire watches were established in accordance with the BFN Fire Protection Report and the Appendix R program.

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

1. Design changes will be developed to remove the common vulnerability problem.
2. These design changes will be physically implemented on BFN Units 1, 2, and 3

<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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Browns Ferry Nuclear Plant Units 2 and 3	05000260	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	6 OF 6
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NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)

## VII. ADDITIONAL INFORMATION

### A. Failed Components

None

### B. Previous LERs on Similar Events

260/94-002  
260/96-01 R1

### C. Additional Information

None

### D. Safety System Functional Failure Consideration:

The event under consideration did not involve an actual failure of any plant equipment, but rather it was a condition which, under certain postulated conditions, could have resulted in the failure of plant equipment. While certain postulated fire scenarios could have resulted in equipment losses beyond those previously analyzed, the loss of a safety system function was not specifically threatened.

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