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

December 26, 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-50, DPR-52, and DPR-68
NRC Docket Nos. 50-259, 50-260, and 50-296

Subject: **Licensee Event Report 50-259/2012-003-01**

Reference: Letter from TVA to NRC, "Licensee Event Report 50-259/2012-003-00," dated April 9, 2012.

In the reference letter dated April 9, 2012, the Tennessee Valley Authority (TVA) submitted a Licensee Event Report (LER) containing details of a condition associated with the lack of physical separation between 120 volt alternating current lighting circuitry and the Reactor Protection System. This supplemented LER is revised to reflect that the condition is not considered a safety system functional failure. This condition does not affect the ability of safety-related structures, systems, and components, required by Technical Specifications, to perform their intended function of mitigation of the consequences of an accident as discussed in Chapters 5, "Containment," 6, "Emergency Core Cooling Systems," and 14, "Plant Safety Analysis," of the Browns Ferry Nuclear Plant Final Safety Analysis Report. Therefore, TVA is submitting this supplemented report in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 50.73(a)(2)(ii)(B).

IE22
NRR

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,

S. Bono
By direction for
K. Polson

K. J. Polson
Vice President

Enclosure: Licensee Event Report 50-259/2012-003-01 – Reactor Protection System Circuit Could Potentially Remain Energized During An Appendix R Fire

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 50-259/2012-003-01

Reactor Protection System Circuit Could Potentially Remain Energized During An Appendix R Fire

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See Attached

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 10/31/2013

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.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Browns Ferry Nuclear Plant (BFN), Unit 1	05000259	1 of 6

4. TITLE: Reactor Protection System Circuit Could Potentially Remain Energized During An Appendix R Fire

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
									BFN Unit 2	05000260
02	08	2012	2012	- 003 -	01	12	26	2012	FACILITY NAME: BFN Unit 3	DOCKET NUMBER: 05000296

9. OPERATING MODE

1

10. POWER LEVEL

100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☒ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☐ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER — Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

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

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

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
N/A	N/A	N/A

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

On February 8, 2012, as a result of the National Fire Protection Association 805 transition reviews, a 10 CFR 50 Appendix R non-conforming condition associated with the 120 Volt (V) lighting (utility) circuit feed to Reactor Protection System (RPS) cabinets 9-15 and 9-17 on all three Browns Ferry Nuclear Plant (BFN) units was identified. Due to lack of physical separation with 120 V Alternating Current (AC) lighting circuitry, the RPS circuit could remain energized due to a postulated hot short during a fire which could prevent the control rods from inserting into the reactor. The 120V lighting circuit is normally energized and routed in the subject cabinets in a manner that could result in hot short(s) following a fire event to the 120V AC RPS circuit. The 120V AC RPS circuit is required to be de-energized to initiate a scram in accordance with BFN Safe Shutdown Instructions in the event of a serious fire. The potential hot short(s) as a result of a fire in Fire Area 16 could cause the RPS circuit to remain energized and the RPS would fail to initiate a scram. Compensatory actions in the form of fire watches to mitigate this condition are in place in accordance with the BFN Fire Protection Report.

The cause of this issue is engineers' lack of technical rigor during the initial review to verify conformance with 10 CFR 50 Appendix R Section III.G.2.

Corrective actions include implementing a design change to provide separation of the 120V lighting (utility) circuit feed to the cabinet lights and duplex receptacles in the RPS cabinets 9-15 and 9-17 on all three BFN units, and conducting additional training of engineering personnel.

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Browns Ferry Nuclear Plant, Unit 1	05000259	2012	-- 003	-- 01	2 of 6

NARRATIVE

I. PLANT CONDITION(S)

At the time of discovery, Browns Ferry Nuclear Plant (BFN), Units 1, 2, and 3, were in Mode 1 at approximately 100 percent rated thermal power.

II. DESCRIPTION OF EVENT

A. Event:

On February 8, 2012, at 1335 Central Standard Time (CST), the National Fire Protection Association (NFPA) 805 transition review identified a 10 CFR 50 Appendix R non-conforming condition associated with the 120 Volt (V) lighting (utility) circuit feed to Reactor Protection System (RPS) [JD] cabinets [CAB] 9-15 and 9-17 on all three BFN units. This 120V Alternating Current (AC) lighting circuit provides power to the cabinets' internal lights and duplex receptacles. The current configuration is the result of the original design. BFN Units 1, 2 and 3 began operation with this design in 1974, 1975, and 1977, respectively. 10 CFR 50 Appendix R became effective in 1981.

> 10 CFR 50 Appendix R Section III.G.2 requires, where cables or equipment, including associated non-safety circuits that could prevent operation or cause maloperation due to hot shorts, open circuits, or shorts to ground, of redundant trains of systems necessary to achieve and maintain hot shutdown conditions, are located in the same fire area outside of primary containment, that specific means of ensuring one of the redundant trains is free of fire damage be provided.

Previous reviews of the BFN design for 10 CFR 50 Appendix R compliance, documented in NEDC-31119, "10 CFR 50 Appendix R Submittal – Fire Protection and Safe Shutdown Systems Analyses Report for Browns Ferry Nuclear Plant, Tennessee Valley Authority," dated January 1986, failed to address this non-conformance.

The 9-15 and 9-17 cabinets are both in Fire Area (FA) 16 (Control Building). The 120V lighting circuit is normally energized and routed in the subject cabinets in a manner that could result in hot short(s) following a fire event to the 120V AC RPS circuit. The 120V AC RPS circuit is required to be de-energized to initiate a scram in support of a safe shutdown in accordance with BFN Safe Shutdown Instructions (SSIs). When the RPS circuit is de-energized, Scram Solenoid Pilot Valve (SSPV) [V] Groups 1, 2, 3, and 4 are activated to insert the control rods. The potential hot short(s) as a result of a fire in FA 16 could cause the RPS circuit to remain energized and the RPS would fail to initiate a scram.

Compensatory actions in the form of fire watches to mitigate this condition are in place in accordance with the BFN Fire Protection Report.

This condition was reported to the NRC in accordance with 10 CFR 50.72(b)(3)(ii)(B) on February 8, 2012, at 1831 CST.

NARRATIVE

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:

August 1, 1974	BFN Unit 1 began commercial operation with the current configuration for the 120V AC lighting circuit feed to the internal lights and duplex receptacles in the RPS cabinets 1-9-15 and 1-9-17.
March 1, 1975	BFN Unit 2 began commercial operation with the current configuration for the 120V AC lighting circuit feed to the internal lights and duplex receptacles in the RPS cabinets 2-9-15 and 2-9-17.
March 1, 1977	BFN Unit 3 began commercial operation with the current configuration for the 120V AC lighting circuit feed to the internal lights and duplex receptacles in the RPS cabinets 3-9-15 and 3-9-17.
February 19, 1981	Initial issue of 10 CFR 50 Appendix R became effective.
February 8, 2012, at 1335 CST	NFPA 805 review identified a potential 10 CFR 50 Appendix R non-conforming condition associated with the 120V lighting circuit feed to RPS cabinets 9-15 and 9-17 on all three BFN units.
February 8, 2012, at 1831 CST	TVA reported condition to NRC.

D. Other Systems or Secondary Functions Affected

There were no other systems or secondary functions affected.

E. Method of Discovery

The issue was identified during the 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 of this issue is cables located in cabinets 9-15 and 9-17 of all three BFN units are non-conforming to Appendix R due to the possibility of a hot short associated with 120V AC RPS circuits causing RPS circuit to remain energized.

B. Root Cause

The cause of this issue is engineers' lack of technical rigor during the initial review to verify conformance with 10 CFR 50 Appendix R Section III.G.2. This resulted in the failure to identify the potential for hot short(s) between the 120V lighting circuit feed to the cabinet lights and duplex receptacles and the 120V AC RPS circuit to the Control Rod Drive (CRD) [AA] scram valves.

C. Contributing Factors

A contributing factor to this issue was the 120V lighting circuit feed to the cabinet lights and duplex receptacles were not identified as an associated circuit because a portion of the definition of an associated circuit was omitted from the definition in the BFN Fire Protection Report. The omitted portion of the definition for an associated circuit is, "An associated circuit of concern to post-fire safe-shutdown may include any circuit or cable that is not needed to support proper operation of required shutdown equipment (i.e., a non-essential circuit), but could adversely affect the plant's ability to achieve and maintain safe-shutdown conditions."

IV. ANALYSIS OF THE EVENT

TVA is submitting this report in accordance with 10 CFR 50.73(a)(2)(ii)(B), any event or condition that results in the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety.

During the NFPA 805 transition review, a 10 CFR 50 Appendix R non-conforming condition associated with the 120V lighting (utility) circuit feed to RPS cabinets 9-15 and 9-17 on all three BFN units was identified. Inside of the RPS Panels 9-15 and 9-17 located in the auxiliary instrument room, there are portions of the RPS circuit that are vulnerable to non-RPS electrical hot shorts. There are three cases that could result in RPS scram failure due to an internal fire in cabinets 9-15 and 9-17.

Case 1: An internal cabinet fire could induce electrical shorts around the scram relay contacts which would keep 1 of 4 groups of control rods energized by RPS power.

Case 2: The manual scram function could be defeated by internal cabinet fire induced electrical shorts in the location between the manual scram pushbuttons and the 5A-K15 RPS trip channel relays.

Case 3: The automatic scram function could be defeated by an internal cabinet fire that induces electrical shorts in the location between the protective trip relays and the 5A-K14 RPS trip channel relays.

In all three cases, SSIs for FA 16 contain actions to open the RPS breakers to ensure power is removed from the scram valves to protect against these concerns. However, an additional hot short with the non-RPS powered lighting circuit could spuriously energize the RPS bus in non-protected portions of the circuit rendering the prior action ineffective.

For multiple hot shorts to occur without scram, the electrical short(s) between the RPS 120V AC power supply and the lighting circuit would have to occur prior to the SSI action to scram takes place, and the circuits would have to be synchronized to the extent that it would prevent clearing the fuses or tripping the breaker of the lighting circuit, when the electrical short(s) occur. Any contact of the cables with ground through conduits or cabinets will result in clearing of the fuses or tripping the breaker of the lighting circuit and de-energizing the circuit and initiating scram. In addition, specific conductors must come in contact at the exclusion of others.

Extent of Condition

Other circuits or conductors/cables in the RPS cabinets could potentially result in hot short(s) to the 120V AC RPS circuit. Therefore, the wiring diagrams/drawings for RPS cabinets 9-15 and 9-17 on all three BFN units were reviewed to determine if hot shorts from other circuits or conductors/cables in the RPS cabinets could prevent a scram.

V. ASSESSMENT OF SAFETY CONSEQUENCES

In the event of a serious fire requiring entry into the SSIs, reactor manual scram is one of the immediate operator actions. Once a scram is initiated and control rods have inserted (within approximately five seconds), reactivity control is accomplished and the scram function is no longer required. Given this short mission time, it is extremely unlikely that the specific combination of electrical short(s) necessary could occur. The potential fire frequency for each unit was determined to be below 1E-5/yr.

Based on this analysis, this condition is of low safety significance and posed little risk to public health and safety.

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

A. Immediate Corrective Actions

1. The RPS cabinets 9-15 and 9-17 have been isolated from their utility feeds powered from lighting cabinets LC-105-20B, LC-205-9 and LC-305-9 [FF]. This interim compensatory action ensures that hot short(s) from the 120V AC utility circuit will not occur.

B. Corrective Actions

1. Implement design change to provide separation of the 120V lighting (utility) circuit feed to the cabinet lights and duplex receptacles in RPS cabinets 9-15 and 9-17 on all three BFN units and any other circuits identified from the review of wiring for these cabinets that could result in a hot short due to a fire.
2. Revised BFN Fire Protection Report to incorporate the full definition of an associated circuit.
3. Conducted the following training of engineering personnel:
   (i) Technical Conscious Training
   (ii) Technical Human Performance Training
   (iii) Design Input Training

VII. ADDITIONAL INFORMATION

A. Failed Components

There were no failed components.

B. Previous Similar Events

A search of BFN LERs for Units 1, 2, and 3, for approximately the past five years did not identify any similar events. However, LERs 50-259/2012-001-00 and 50-259/2012-002-00 were submitted as a result of conditions that were discovered during NFPA 805 transition reviews.

A search was performed on the BFN corrective action program. Previous similar Problem Evaluation Reports (PERs) include Nonconformance Report BFNEEB8413, PER 422371, and PER 452185.

C. Additional Information

The corrective action documents for this report are detailed in PER 503304.

D. Safety System Functional Failure Consideration:

This condition is not considered to be a safety system functional failure in accordance with NEI 99-02.

E. Scram With Complications Consideration:

This condition did not include a reactor scram.

VIII. COMMITMENTS

There are no commitments.