



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

December 29, 2017

10 CFR 50.73

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

Browns Ferry Nuclear Plant, Unit 3
Renewed Facility Operating License No. DPR-68
NRC Docket No. 50-296

Subject: **Licensee Event Report 50-296/2017-002-00**

The enclosed Licensee Event Report provides details of a nonconforming condition associated with certain Browns Ferry Nuclear Plant potential transformer (PT) primary fuses, which do not coordinate with the associated PT's secondary fuses. The Tennessee Valley Authority is submitting this report in accordance with Title 10 of the Code of Federal Regulations 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.

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

Respectfully,

A handwritten signature in black ink, appearing to read "S. M. Bono", is written over the typed name and title. The signature is stylized and fluid.

S. M. Bono
Site Vice President

Enclosure: Licensee Event Report 50-296/2017-002-00 – 4kV Shutdown Board Potential Transformer Primary Fuses Do Not Coordinate with Secondary Fuses

cc (w/ Enclosure):

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


ENCLOSURE

**Browns Ferry Nuclear Plant
Unit 3**

Licensee Event Report 50-296/2017-002-00

4kV Shutdown Board Potential Transformer Primary Fuses Do Not Coordinate with Secondary Fuses

See Enclosed

| | | | | | | | | | | | |
|--|--------|---|---------------|--------------------|--|----------------|-----------|--|------------------------------|---|--|
| NRC FORM 366 (04-2017) | | U.S. NUCLEAR REGULATORY COMMISSION | | | APPROVED BY OMB: NO. 3150-0104 | | | EXPIRES: 03/31/2020 | | | |
|  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 the Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by 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 3 | | | | | 2. DOCKET NUMBER 05000296 | | | 3. PAGE 1 OF 5 | | | |
| 4. TITLE 4kV Shutdown Board Potential Transformer Primary Fuses Do Not Coordinate with Secondary Fuses | | | | | | | | | | | |
| 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 | |
| 11 | 01 | 2017 | 2017 | - 002 | - 00 | 12 | 29 | 2017 | N/A | N/A | |
| | | | | | | | | | FACILITY NAME | DOCKET NUMBER | |
| | | | | | | | | | N/A | N/A | |
| 9. OPERATING MODE | | 11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) | | | | | | | | | |
| 1 | | <input type="checkbox"/> 20.2201(b) | | | <input type="checkbox"/> 20.2203(a)(3)(i) | | | <input type="checkbox"/> 50.73(a)(2)(ii)(A) | | <input type="checkbox"/> 50.73(a)(2)(viii)(A) | |
| | | <input type="checkbox"/> 20.2201(d) | | | <input type="checkbox"/> 20.2203(a)(3)(ii) | | | <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)(1) | | | <input type="checkbox"/> 20.2203(a)(4) | | | <input type="checkbox"/> 50.73(a)(2)(iii) | | <input type="checkbox"/> 50.73(a)(2)(ix)(A) | |
| | | <input type="checkbox"/> 20.2203(a)(2)(i) | | | <input type="checkbox"/> 50.36(c)(1)(i)(A) | | | <input type="checkbox"/> 50.73(a)(2)(iv)(A) | | <input type="checkbox"/> 50.73(a)(2)(x) | |
| 100 | | <input type="checkbox"/> 20.2203(a)(2)(ii) | | | <input type="checkbox"/> 50.36(c)(1)(ii)(A) | | | <input type="checkbox"/> 50.73(a)(2)(v)(A) | | <input type="checkbox"/> 73.71(a)(4) | |
| | | <input type="checkbox"/> 20.2203(a)(2)(iii) | | | <input type="checkbox"/> 50.36(c)(2) | | | <input type="checkbox"/> 50.73(a)(2)(v)(B) | | <input type="checkbox"/> 73.71(a)(5) | |
| | | <input type="checkbox"/> 20.2203(a)(2)(iv) | | | <input type="checkbox"/> 50.46(a)(3)(ii) | | | <input type="checkbox"/> 50.73(a)(2)(v)(C) | | <input type="checkbox"/> 73.77(a)(1) | |
| | | <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)(D) | | <input type="checkbox"/> 73.77(a)(2)(i) | |
| | | <input type="checkbox"/> 20.2203(a)(2)(vi) | | | <input type="checkbox"/> 50.73(a)(2)(i)(B) | | | <input type="checkbox"/> 50.73(a)(2)(vii) | | <input type="checkbox"/> 73.77(a)(2)(ii) | |
| | | | | | <input type="checkbox"/> 50.73(a)(2)(i)(C) | | | <input type="checkbox"/> OTHER Specify in Abstract below or in NRC Form 366A | | | |
| 12. LICENSEE CONTACT FOR THIS LER | | | | | | | | | | | |
| LICENSEE CONTACT Baruch Calkin | | | | | | | | TELEPHONE NUMBER (Include Area Code) (256) 614-6713 | | | |
| 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 | | |
| N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | | |
| 14. SUPPLEMENTAL REPORT EXPECTED | | | | | | | | 15. EXPECTED SUBMISSION DATE | | | |
| <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO | | | | | | | | MONTH | DAY | YEAR | |
| | | | | | | | | N/A | N/A | N/A | |
| ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) | | | | | | | | | | | |
| <p>On November 1, 2017, at approximately 1425 Central Daylight Time, during an extent of condition review, a fuse coordination issue was discovered. Four Potential Transformer (PT) 10 amp secondary fuses on Unit 3 4kV Shutdown Boards (SD BD) do not selectively coordinate with upstream 0.5 amp primary fuses for fault currents greater than 30 amps on the 120 V secondary. Cable fire damage could cause an affected SD BD to spuriously disconnect from off-site power, and could cause a spurious, maintained under-voltage trip signal. The under-voltage trip signal would prevent motor load operation on the board whether on off-site power or Emergency Diesel Generator power. If a fire were to occur in fire areas 03-03 or 16, all four Unit 3 4kV SD BDs could be affected. In fire area 21, 4kV SD BDs 3EA and 3EB could be affected.</p> <p>This condition was determined to be a legacy issue dating to the original design of the plant. The most likely cause is lack of rigorous oversight of the vendor during the preparation and subsequent issuance of the fuse evaluation for the four Unit 3 4kV SD BDs. The required coordination studies have since been performed and a vendor oversight process has been added to TVA procedures. Compensatory measures (hourly fire watches) have been put in place for affected fire areas. Additional corrective actions include issuing an Engineering Change Package to replace the Unit 3 4kV SD BDs primary 0.5 amp PT fuses with 1 amp fuses of the same type.</p> | | | | | | | | | | | |

**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

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 the Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by 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 | 2. DOCKET NUMBER | 3. LER NUMBER | | |
|------------------------------------|------------------|---------------|-------------------|---------|
| | | YEAR | SEQUENTIAL NUMBER | REV NO. |
| Browns Ferry Nuclear Plant, Unit 3 | 05000-296 | 2017 | - 002 | - 00 |

NARRATIVE**I. Plant Operating Conditions Before the Event**

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

II. Description of Event**A. Event Summary**

On November 1, 2017, at approximately 1425 Central Daylight Time (CDT), during an extent of condition review, a fuse [FU] coordination issue was discovered. Four Potential Transformer (PT) [XPT] 10 amp secondary fuses on Unit 3 4kV Shutdown Boards (SD BD) [ECBD] do not selectively coordinate with upstream 0.5 amp primary fuses for fault currents greater than 30 amps on the 120 V secondary. Cable [CBL] fire damage could cause an affected SD BD to spuriously disconnect from off-site power, and could cause a spurious, maintained under-voltage trip signal. The under-voltage trip signal would prevent motor load operation on the board whether on off-site power or Emergency Diesel Generator (EDG) [DG] power [EK]. If a fire were to occur in fire areas 03-03 or 16, all four Unit 3 4kV SD BDs could be affected. In fire area 21, 4kV SD BDs 3EA and 3EB could be affected.

On November 1, 2017, at approximately 2126 CDT, Event Notification (EN) 53049 was made to the NRC.

B. Status of structures, components, or systems that were inoperable at the start of the event and that contributed to the event.

There were no systems, structures, or components inoperable at the time of discovery which contributed to this condition.

C. Dates and approximate times of occurrences

| | |
|-------------------------------|---|
| November 1, 2017, 1425 CDT | Unanalyzed condition discovered during an extent of condition review. |
| November 1, 2017, 2126 CDT | Event Notification 53049 made to the NRC. |

D. Manufacturer and model number of each component that failed during the event

There were no failed components associated with this condition.

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E. Other systems or secondary functions affected

There were no other systems or secondary functions affected.

F. Method of discovery of each component or system failure or procedural error

There were no component failures, system failures, or procedural errors associated with this condition.

G. The failure mode, mechanism, and effect of each failed component

There were no failed components associated with this condition.

H. Operator actions

There were no operator actions associated with this condition.

I. Automatically and manually initiated safety system responses

There were no automatic or manual safety system responses associated with this condition.

III. Cause of the event

The cause of this event was the failure to perform a PT fuse coordination study to confirm that the primary and secondary fuses could coordinate. This condition was determined to be a legacy issue dating to the original design of the plant. The most likely cause is lack of rigorous oversight of the vendor during the preparation and subsequent issuance of the fuse evaluation for 4kV SD BDs A, B, C, D, 3EA, 3EB, 3EC, and 3ED, which was first issued by EBASCO in 1988. This may have resulted in failure of the vendor to perform a coordination study for the primary and secondary PT fuses.

A. Cause of each component or system failure or personnel error

There were no component failures, system failures, or known personnel errors associated with this condition as it was determined to be a legacy issue.

B. Cause(s) and circumstances for each human performance related root cause

The most likely cause is lack of rigorous oversight of the vendor during the preparation and subsequent issuance of the fuse evaluation for 4kV SD BDs A, B, C, D, 3EA, 3EB, 3EC, and 3ED, first issued by the vendor in 1988. This may have resulted in failure of the vendor to perform a coordination study for the primary and secondary PT fuses.

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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 results in the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety.

The basic function of the normal auxiliary electrical power system is to provide power for plant auxiliaries during startup, operation, and shutdown, and to provide highly reliable power sources for plant loads which are important to its safety.

For 4kV SD BD 3EA, PT secondary fuses are 10 amp fuses and do not selectively coordinate with upstream primary fuses, which are 0.5 amp fuses, for fault currents greater than approximately 30 amps on the 120V secondary. Cables tapping off from the PT secondary fuse route external to the board to the Main Control Room. A fire induced fault on an affected cable could clear two of the PT primary fuses, resulting in de-energizing of the A-phase secondary leg. Clearing of the two PT primary fuses would result in de-energization of undervoltage and degraded voltage relays [RLY]. The combination of de-energized undervoltage and degraded voltage relays would result in spurious energization of degraded voltage auxiliary relays. This would result in 4kV motor load sheds, tripping of normal and off-site power breakers [BKR], starting of the DG, and closing of the DG breaker (provided these functions did not have separate unrelated fire damage). If the DG successfully connected to the 4kV SD BD, due to the cleared PT fuse condition, the degraded voltage signal would not reset. This condition could result in a loss of power to plant loads which are important to plant safety. Similar conditions exist on 4kV SD BDs 3EB, 3EC, and 3ED.

V. Assessment of Safety Consequences

This condition, if left uncorrected, could result in a loss of power to plant loads which are important to plant safety during postulated fire damage. However, a probabilistic risk analysis performed by TVA concluded that the risk significance of this condition is very low, with a maximum change in Core Damage Frequency and Large Early Release Frequency of less than 1E-06 for the affected unit. Based on this analysis, there was no significant increase in risk to the health and safety of the public or to plant personnel resulting from this condition.

A. Availability of systems or components that could have performed the same function as the components and systems that failed during the event

No components or systems failed due to this event.

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B. For events that occurred when the reactor was shut down, availability of systems or components needed to shutdown the reactor and maintain safe shutdown conditions, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident

This event did not occur when the reactor was shut down.

C. For failure that rendered a train of a safety system inoperable, estimate of the elapsed time from discovery of the failure until the train was returned to service

This condition did not result in the inoperability of any safety systems.

VI. Corrective Actions

Corrective Actions are being managed by TVA's Corrective Action Program under Condition Report 1354129. The required fuse coordination studies have since been performed, and a vendor oversight process has been added to TVA procedures since this legacy event.

A. Immediate Corrective Actions

- EN 53049 was made to the NRC in accordance with 10 CFR 50.72(b)(3)(ii)(B).
- Hourly fire watches were put in place for the affected fire areas (FPIP# 17-332).

B. Corrective Actions to Prevent Recurrence or to reduce the probability of similar events occurring in the future

- Issue an Engineering Change Package to replace Unit 3 4KV SD BD primary 0.5 amp PT fuses with 1 amp fuses of the same type.

VII. Previous Similar Events at the Same Site

A review of the BFN CAP and Licensee Event Reports (LERs) for Units 1, 2, and 3 found no instances within the past five years of degraded or unanalyzed conditions related to coordination of PT fuses.

VIII. Additional Information

There is no additional information.

IX. Commitments

There are no new commitments.