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

February 20, 2013

10 CFR 50.73

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

Browns Ferry Nuclear Plant, Unit 2
Facility Operating License No. DPR-52
NRC Docket No. 50-260

Subject: **Licensee Event Report 50-260/2012-006-00**

The enclosed Licensee Event Report provides details of an unplanned automatic reactor scram due to the loss of power to the Reactor Protection System buses. The Tennessee Valley Authority is submitting this report in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 50.73(a)(2)(iv)(A) and 10 CFR 50.73(a)(2)(iv)(B).

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 50-260/2012-006-00 - Unplanned Automatic Reactor Scram due to Loss of Power to the Reactor Protection System

cc (w/ Enclosure):

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

IE22
NRR

**ENCLOSURE**

**Browns Ferry Nuclear Plant,**
**Unit 2**

**Licensee Event Report 50-260/2012-006-00**

**Unplanned Automatic Reactor Scram due to Loss of Power to the Reactor Protection System**

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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 |
|---|---|
| **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 | 2. DOCKET NUMBER | 3. PAGE |
|---|---|---|
| Browns Ferry Nuclear Plant, Unit 2 | 05000260 | 1 of 7 |

4. TITLE: Unplanned Automatic Reactor Scram due to Loss of Power to the Reactor Protection System

| 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 |
| | | | | | | | | | N/A | 05000 |
| 12 | 22 | 2012 | 2012 | - 006 - | 00 | 02 | 20 | 2013 | FACILITY NAME N/A | DOCKET NUMBER 05000 |

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

**12. LICENSEE CONTACT FOR THIS LER**

| FACILITY NAME | TELEPHONE NUMBER *(Include Area Code)* |
|---|---|
| Christopher Bennett, Licensing Engineer | 256-729-2475 |

**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 |
|---|---|---|---|---|---|
| ☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* | ☒ NO | | N/A | N/A | N/A |


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

On December 22, 2012, at 1152 Central Standard Time (CST), the Browns Ferry Nuclear Plant, Unit 2, reactor automatically scrammed due to actuation of the Reactor Protection System (RPS) from loss of power to both RPS buses. At 1134 CST, eighteen minutes prior to the scram, during the performance of post maintenance testing for the 3D Emergency Diesel Generator paralleling circuitry, the 4kV Shutdown Board D unexpectedly de-energized resulting in the loss of power to the RPS 2B bus. While attempting to re-energize the RPS 2B bus, the RPS 2A bus was inadvertently de-energized resulting in the BFN, Unit 2, automatic reactor scram. All affected safety systems responded as expected for the loss of the RPS buses.

The root cause was determined to be a failure to fully implement the recommendations of the Institute of Nuclear Power Operations Significant Operating Event Reports 10-2 and 96-1, which state that supervisors should ensure that they remain in a supervisory role and refrain from performing plant manipulations.

The corrective action to prevent recurrence is to develop and implement a change management plan to transition the performance of plant manipulations that are currently being performed by the Unit Supervisors to the Unit Operators and Assistant Unit Operators.

NARRATIVE

## I. PLANT CONDITION(S)

At the time of the event, the Browns Ferry Nuclear Plant (BFN), Unit 2, was in Mode 1 at approximately 100 percent rated thermal power.

## II. DESCRIPTION OF EVENT

### A. Event

On December 22, 2012, at 1134 Central Standard Time (CST), during the performance of post maintenance testing for the 3D Emergency Diesel Generator (EDG) [DG] paralleling circuitry, the 4kV Shutdown Board [EB] D unexpectedly de-energized resulting in the loss of power to the Reactor Protection System (RPS) [JC] 2B bus. Primary Containment Isolation System (PCIS) [JM] groups 2, 3, 6, and 8 isolations were received along with automatic initiation of Standby Gas Treatment (SBGT) [BH] subsystems A, B, and C and Control Room Emergency Ventilation (CREV) [VI] subsystem A due to loss of power to the RPS 2B bus. At 1152 CST, while attempting to re-energize the RPS 2B bus, the RPS 2A bus was inadvertently de-energized resulting in an automatic scram of the BFN, Unit 2, reactor.

All affected safety systems responded as expected for the loss of the RPS buses. Due to the loss of the RPS buses, the Main Steam Isolation Valves (MSIVs) closed. Reactor pressure did not rise to the automatic initiation set point for Safety Relief Valve (SRV) [SB] actuation. The Reactor Core Isolation Cooling System (RCIC) [BN] and the High Pressure Coolant Injection System (HPCI) [BJ] reactor water level initiation setpoint of -45 inches (low low) was reached and the RCIC system and the HPCI system automatically initiated as designed to restore water level above the initiation set point. Both recirculation pumps also tripped on a reactor water level of -45 inches. Reactor pressure control was established by manually operating the SRVs and water level control was established with RCIC system. The HPCI system was returned to standby readiness. The scram was reset, MSIVs were opened, and the Main Condenser [SG] was established as a heat sink.

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

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

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

| | |
|---|---|
| December 22, 2012, at 1134 CST | The 4kV Shutdown Board D unexpectedly de-energized during the 3D EDG paralleling testing that resulted in the loss of power to the RPS 2B bus. |

NARRATIVE

| | |
|---|---|
| December 22, 2012, at 1152 CST | While attempting to restore the RPS 2B bus, the RPS 2A breaker [BKR] was opened inadvertently resulting in a BFN, Unit 2, automatic scram and closure of the MSIVs. |
| December 22, 2012 at 1230 CST | The RPS 2A and 2B buses were restored. |
| December 22, 2012 at 1458 CST | The MSIVs were re-opened. |
| December 22, 2012 at 1539 CST | The BFN reported the event to the NRC. |

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

There were no other systems or secondary functions affected by this event.

**E. Method of Discovery**

This condition was identified when the BFN, Unit 2, reactor was automatically scrammed due to the inadvertent de-energization of the RPS 2A bus.

**F. Operator Actions**

Operations personnel responded to the reactor scram and MSIV closure in accordance with Abnormal Operating Instructions, 2-AOI-100-1, Reactor Scram, and 2-AOI-99-1, Loss of Power to One RPS Bus. Operations personnel also entered Emergency Operating Instructions, 2-EOI-1, RPV Control, due to reactor water level less than +2 inches and 2-EOI-2, Primary Containment Control, due to suppression pool water level greater than -1.0 inch and suppression pool temperature greater than 95 degrees Fahrenheit.

**G. Safety System Responses**

All affected safety systems responded as expected for the loss of the RPS buses. Due to the loss of the RPS 2B bus, PCIS groups 2, 3, 6, and 8 isolations were received along with automatic initiation of SBGT subsystems A, B, and C and CREV subsystem A. Due to the subsequent loss of power to the RPS 2A bus, the MSIVs closed. Reactor pressure did not rise to the automatic initiation set point for SRV actuation. The RCIC system and the HPCI system reactor water level initiation setpoint of -45 inches was reached and both automatically initiated as designed to restore water level above the initiation set point. Both recirculation pumps also tripped on a reactor water level of -45 inches.

## III. CAUSE OF THE EVENT

**A. Immediate Cause**

The immediate cause of the event was the inadvertent opening of the RPS 2A breaker.

**B. Root Cause**

The root cause was determined to be failure to fully implement the recommendations of the Institute of Nuclear Power Operations Significant Operating Event Report (SOER) 10-2, Engaged, Thinking Organizations, and SOER 96-1, Control Room Supervision, Operational Decision-Making, and Teamwork, in that a supervisor was directed to perform a plant manipulation.

**C. Contributing Factors**

1. Failure to use, or weaknesses in the use of, Human Performance Tools. To address this contributing factor, the individual involved was coached on the use of Human Performance error prevention tools and the BFN will determine if the current operations philosophy regarding pre-job briefs (PJB) and peer checks during transients is within industry standards.
2. Operating Instruction 2-OI-99, Reactor Protection System, contains both divisions of RPS equipment within the same step, requiring the Operator performing the evolution to select which component to manipulate. To address this contributing factor, the BFN will perform a review of operating instructions to determine if they need to be revised to sectionalize the different divisions of components and equipment.
3. Abnormal Operating Instruction 2-AOI-99-1, Loss of Power to One RPS Bus, does not contain steps for restoring the RPS buses [BU]. This procedure refers the user to 2-OI-99 to restore power to the RPS bus. To address this contributing factor, the BFN will review abnormal operating instructions to identify those that need to be revised to include steps for restoration of equipment instead of referencing the operator to a different operating instruction.

## IV. ANALYSIS OF THE EVENT

The Tennessee Valley Authority (TVA) is submitting this report in accordance with 10 CFR 50.73(a)(2)(iv)(A), as any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph 10 CFR 50.73(a)(2)(iv)(B), including:

1. The RPS including reactor scram or reactor trip.
2. General containment isolation signals affecting multiple MSIVs.
3. The emergency core cooling system for boiling water reactors including the HPCI system.
4. The boiling water reactor RCIC system.

All affected safety systems responded as expected for the loss of the RPS buses. Due to the loss of the RPS buses, the MSIVs closed. Reactor pressure did not rise to the automatic initiation set point for SRV actuation. The RCIC system and the HPCI system reactor water level initiation setpoint of -45 inches was reached and both automatically initiated as designed to restore water level above the initiation set point. Both recirculation pumps also tripped on a reactor water level of -45 inches. Reactor pressure control was established by manually operating the SRVs and water level control was established with the RCIC system. The HPCI system was returned to standby readiness. The scram was reset, MSIVs were opened, and the Main Condenser was established as a heat sink.

NARRATIVE

There was a sense of urgency in restoring the RPS bus that led to a failure to use human performance tools that may have prevented this event. The Main Steam Vault (MSV) booster fan [FAN] breaker tripped during the event which contributed to an increase in the rise of MSV temperature. The Group 1 PCIS isolation setpoint for MSV temperature is 189 degrees Fahrenheit. At the time the Senior Reactor Operator (SRO) was directed to perform this activity and dispatched from the control room, the temperature rise from the control room indication was approximately 2 degrees Fahrenheit per minute and the current temperature was at 156 degrees Fahrenheit.

The root cause was determined to be failure to fully implement the recommendations of the Institute of Nuclear Power Operations SOER 10-2, Engaged, Thinking Organizations and SOER 96-1, Control Room Supervision, Operational Decision Making, and Teamwork, in that a supervisor was directed to perform a plant manipulation.

The Institute of Nuclear Power Operations SOER 10-2 specifically analyzes supervisor oversight role, stating that supervisors are stepping out of their oversight roles. The Institute of Nuclear Power Operations SOER 96-1 recommends frequent evaluation of senior licensed supervisors in the control room to ensure they remain in a supervisory role and refrain from manipulating plant equipment.

In this event, the SRO, who is part of the supervisory staff, was not working in the control room, but was called to the control room and directed to perform the manipulation of the RPS equipment.

Based on the review of an operations snapshot self assessment, it was determined that the BFN Unit Supervisors (USs) are still performing certain plant manipulations instead of the Unit Operators (UO) and Assistant Unit Operators (AUO). The USs, who are SROs, are performing certain plant manipulations instead of supervising those manipulations. This practice is inconsistent with the Institute of Nuclear Power Operations SOER recommendations. The main function of an SRO is to supervise plant operations, providing supervisory oversight, not manipulating plant equipment. The SROs do not have the same practice at performing equipment manipulations as do the UOs and AUOs, and are not as proficient at performing those actions.

Contributing to this event were the following.

Several opportunities existed to prevent this event using the BFN Fundamental Human Performance Tools. Using self check and the two minute rule before manipulating the RPS equipment may have prevented this event, but they were not properly performed due to perceived time pressure.

The BFN Conditional Human Performance Tools, PJB and peer check, were not utilized during the restoration of the RPS 2B bus due to BFN, Unit 2, being in a transient condition. Current guidance for the use of these tools during transient situations states to perform a PJB and use a peer check as time and resources allow. First check could have also prevented the error, but was not utilized because there was no phone in battery board room 2.

The procedure methodology of having both RPS Motor Generator (MG) set output breakers in the same step contributed to the event. Listing both the RPS 2A and 2B MG

output breakers in the same step forces the operator to decide on which breaker is the correct one to operate. This decision is a critical step, but is not annotated as such in the procedure.

The abnormal operating instruction (AOI) used for the loss of power to one of the RPS busses does not contain the step to actually restore the RPS bus. The procedure refers the operator to a different operating instruction (OI) in order to restore power to the RPS bus. The transition to this OI requires additional time and actions to be taken to restore power to the RPS bus.

## V. ASSESSMENT OF SAFETY CONSEQUENCES

This event had the potential to reduce the defense in depth to nuclear safety. The loss of the 4kV Shutdown Board D created the half scram condition, which reduces the defense in depth to a plant scram and associated plant transient. The human performance error de-energized the second RPS buses and caused the full scram. However, during the event, all affected safety systems responded as expected to the loss of the RPS buses. Due to the loss of RPS 2B, PCIS groups 2, 3, 6, and 8 isolations were received along with automatic initiation of SBGT subsystems A, B, and C and CREV subsystem A. Due to the subsequent loss of power to the RPS 2A bus, the MSIVs closed. Reactor pressure did not rise to the automatic initiation set point for SRV actuation. The RCIC system and the HPCI system reactor water level initiation setpoint of -45 inches was reached and both automatically initiated as designed to restore water level above the initiation set point.

Therefore, TVA concluded that there was no significant impact to the health and safety of the public.

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

### A. Immediate Corrective Actions

The BFN Operations Department issued a standing order, which includes the following actions:

1. During PJBs, Operator fundamentals will be reviewed with a focus on which fundamental will be applied to ensure error free outcome of the evolution.
2. Planned evolutions will be reviewed by a supervisor to ensure that critical steps are identified and proper verification practices are being used.
3. During transient responses that require the use of procedures (other than EOIs, Safe Shutdown Instructions, or AOIs) if the evolution has to be performed by a single individual, the supervisor of the evolution will determine what specific tool should be used to ensure an error free outcome.
4. Until guidelines are developed, when AOIs are entered, the operator should continue execution of the AOI until the symptoms are no longer present, unless the procedure cannot or should not be performed based on plant conditions.

**B. Corrective Actions to Prevent Recurrence**

The corrective action to prevent recurrence is to develop and implement a change management plan to transition the performance of plant manipulations that are currently being performed by the USs to the UOs and AUOs.

## VII. ADDITIONAL INFORMATION

**A. Failed Components**

There were no failed components.

**B. Previous Similar Events**

A search of the BFN Licensee Event Reports (LERs) for Units 1, 2, and 3 for approximately the past five years identified LER 50-296/2012-003-01, Browns Ferry Nuclear Plant, Unit 3, Automatic Reactor Scram Due To De-Energization of Reactor Protection System From Actuation of 3A Unit Station Service Transformer Differential Relay, as a similar event involving a reactor scram due to the loss of power to the RPS buses. The similar event involved de-energization of both RPS buses and subsequent reactor scram due to the actuation of a differential relay which was installed with incorrect design calculation settings. The event contained in this report was different in that it was due to the loss of one RPS bus from post maintenance testing and the loss of the second RPS bus from a human error during restoration of the first RPS bus.

A search was performed on the BFN corrective action program. The previous problem evaluation reports (PERs) associated with the above similar LER are PERs 484548, 543131, 505709, and 555573.

Additional similar PERs related to the condition reported in this LER are PERs 76599, 135161, and 456197.

A review of the corrective action for these PERs concluded that the corrective actions associated with these PERs would not have prevented this event.

**C. Additional Information**

The corrective action document for this report is PER 660862.

**D. Safety System Functional Failure Consideration**

In accordance with NEI 99-02, this condition is not considered a safety system functional failure.

**E. Scram With Complications Consideration**

In accordance with NEI 99-02, this event is considered an Unplanned Scram with Complications due to the reactor pressure being controlled by SRVs.

## VIII. COMMITMENTS

There are no commitments.