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

December 6, 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
Renewed Facility Operating License No. DPR-52
NRC Docket No. 50-260

Subject: **Licensee Event Report 50-260/2012-006-01**

Reference: Letter from TVA to NRC, "Licensee Event Report 50-260/2012-006-00," dated February 20, 2013

In the reference letter dated February 20, 2013, the Tennessee Valley Authority (TVA) submitted Revision 0 to Licensee Event Report (LER) 50-260/2012-006. After further review of the condition, the causal analysis was revised. These changes are detailed in the enclosed LER. The TVA is submitting this supplemented 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. L. Paul, Nuclear Site Licensing Manager, at (256) 729-2636.

Respectfully,

K. J. Polson
Vice President

Enclosure: Licensee Event Report 50-260/2012-006-01 - Unplanned Automatic Reactor Scram due to Loss of Power to the Reactor Protection System

IE22
NRR

cc (w/ Enclosure):

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

ENCLOSURE

Browns Ferry Nuclear Plant,
Unit 2

Licensee Event Report 50-260/2012-006-01

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

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, Unit 2	05000260	1 of 8

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 -	01	12	06	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)*
Mark Acker, Licensing Engineer	256-729-2669

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 December 22, 2012, at 1152 Central Standard Time (CST), the Browns Ferry Nuclear Plant (BFN), 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, 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. During this event the Reactor Core Isolation Cooling system and the High Pressure Coolant Injection system automatically initiated as designed to restore water level above the initiation set point. All affected safety systems responded as expected for the loss of the RPS buses.

The root cause was that Operations' standards for the use of Error Prevention Tools were not understood nor properly applied by Operations personnel during transient plant conditions.

Corrective actions to prevent recurrence are: to develop and deliver training to provide expected behaviors for leaders and craft that support their roles and responsibilities, to perform paired observations between management and direct reports, from the level of department directors to first line supervisors, in order to verify or establish that the standards possessed by the department leaders are adequate and shared uniformly among the group, and to revise the Training Program Description for License Operator Requalification to specify that Operations Management provide training on standards and expectations for the implementation of the requirements of procedure OPDP-1, Conduct of Operations.

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.

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 in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 50.72(b)(2)(iv)(B) and 10 CFR 50.72(b)(3)(iv)(A).

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 (AOI), 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 (EOI), 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 failure to execute procedure 2-OI-99, Reactor Protection System, without error. Specifically, an operator failed to restore power to the 2B RPS bus and incorrectly deenergized the one remaining RPS bus, which directly led to a reactor trip and closure of the MSIVs.

B. Root Cause

The root cause of this event was determined to be that Operations' standards for the use of Error Prevention Tools were not understood nor properly applied by Operations personnel during transient plant conditions.

The performance of this task was recognized as a high-risk evolution with an additional component of time-sensitivity. However, several opportunities were missed to mitigate that risk by ensuring the usage of the applicable error prevention techniques (specifically, peer check, pre-job brief, 2-minute rule and first check), thereby significantly increasing the probability that 2-OI-99 would not be executed correctly.

C. Contributing Factors

1. Weaknesses in Operator Fundamentals as described in Institute of Nuclear Power Operations (INPO) Event Report (IER) 11-3.
2. Operating Instruction (OI) 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.
3. Failure to fully implement recommendations of Significant Operating Event Reports 10-2 and 96-1.
4. AOI 2-AOI-99, Reactor Protection System (RPS), does not contain steps for restoring the RPS buses.
5. There is a lack of clear guidance for exiting AOIs.

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.

Restoration of the 2B RPS bus was recognized as a high-risk evolution with an additional component of time-criticality. The INPO Model of Excellence in Human Performance cites time pressure as an error trap. The model identifies that barriers such as Error Prevention Tools should be put in place to prevent errors from occurring.

During this event, error prevention tools were not utilized or were not utilized correctly to prevent the error. During the restoration of power to the 2B RPS bus utilizing the 2B RPS Motor Generator (MG) set, the Work Control Coordinator Senior Reactor Operator (SRO) circled the incorrect breaker number in the procedure. Once the incorrect breaker number was selected, the self check of the component could have detected the error, but did not. The operator did not perform the act of self check correctly. When verifying the correct component, the unique identification number was identified, but the noun name was not. This could have prevented the error. In addition, use of first check, pre-job brief, or peer check could have prevented the error. The likelihood of prevention or early detection of a consequential error was reduced when the Unit Supervisor (US) and the Shift Manager directed the performance of the task without ensuring the use of these human performance tools.

Contributing to this event were the following.

Operators demonstrated weakness in Operator Fundamentals as described in INPO IER 11-3. Weaknesses were identified in monitoring plant indications, controlling plant evolutions precisely, operating the plant with a conservative bias, working effectively as a team, and asking questions to obtain necessary information.

USs are still performing certain plant manipulations instead of the Unit Operators (UO) and Assistant Unit Operators (AUO). USs, who are SROs, are performing certain plant manipulations instead of supervising those manipulations. The main function of an SRO is to supervise plant operations, not manipulating the equipment. The SROs do not have the same practice at performing equipment manipulations as the UOs and AUOs, and are not as proficient at performing those actions. Additionally, not all SROs have had the experience of being AUOs and UOs at BFN. Therefore, some SROs have less experience in operating plant equipment, which was the case in this event. The SROs are qualified to operate the equipment through an approved accredited training program. SRO's qualifications to operate the equipment are not in question. Infrequent operation of plant equipment by the SROs leads to less proficiency at using the human performance tools when performing plant equipment manipulations.

The procedure methodology of having both RPS 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 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 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.

Additionally, the AOI used for the loss of power to one of the RPS busses does not direct the operator to exit the procedure. The only guidance for exiting the procedure is contained in the procedure lesson plan, which states that the operator should continue in the AOI until directed to exit by the procedure. The AOI does not direct the operator when to exit the procedure.

V. ASSESSMENT OF SAFETY CONSEQUENCES

This event reduced 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 pre-job briefs, 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

1. Established initial and continuing training requirements, and developed and delivered training to provide expected behaviors for leaders and craft that support their roles and responsibilities.
2. Department directors and managers in Operations, Engineering, Safety and Licensing, Training, Projects and Modifications, Maintenance, Work Control, Radiation Protection, and Chemistry conducted paired observations with direct reports to verify or establish that the standards possessed by the department leaders are adequate and shared uniformly among the group.
3. Conducted paired observations between department directors and managers' direct reports and their respective first line supervisors to verify or establish that the standards possessed by the department leaders are adequate and shared uniformly among the group.
4. Revise Training Program Description for License Operator Requalification to specify that Operations Management provide training on standards and expectations for the implementation of the requirements of procedure OPDP-1, Conduct of Operations.

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.

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Browns Ferry Nuclear Plant, Unit 2	05000260	2012	-- 006	-- 01	8 of 8

NARRATIVE

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 documents for this report are PERs 660862 and 740259.

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.