TENNESSEE VALLEY AUTHORITY

Post Office Box 2000, Decatur, Alabama 35609-2000

June 24, 2024

10 CFR 50.73

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

Browns Ferry Nuclear Plant, Unit 1
Renewed Facility Operating License No. DPR-33
NRC Docket No. 50-259

Subject: **Licensee Event Report 50-259/2024-002-00 – Reactor Scram due to Generator Step-Up Transformer Failure**

The enclosed Licensee Event Report provides details of the Reactor Scram due to Generator Step-Up Transformer Failure on Browns Ferry Nuclear Plant Unit 1. 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), as an automatic actuation of the Reactor Protection System, Primary Containment Isolation System, the High-Pressure Coolant Injection System, and the Reactor Core Isolation Cooling System.

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

Respectfully,

Manu Sivaraman
BFN Site Vice President

Enclosure: Licensee Event Report 50-259/2024-002-00 – Reactor Scram due to Generator Step-Up Transformer Failure

Cc (w/ Enclosure):

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

ENCLOSURE

Browns Ferry Nuclear Plant
Unit 1

Licensee Event Report 50-259/2024-002-00

Reactor Scram due to Generator Step-Up Transformer Failure

See Enclosed

NRC FORM 366 (04-02-2024) | U.S. NUCLEAR REGULATORY COMMISSION | APPROVED BY OMB: NO. 3150-0104 | EXPIRES: 04/30/2027

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)
(See NUREG-1022, R.3 for instruction and guidance for completing this form
http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. Facility Name		52. Docket Number	3. Page
Browns Ferry Nuclear Plant, Unit 1	☒ 050 ☐ 052	00259	1 OF 6

4. Title

Reactor Scram due to Generator Step-Up Transformer Failure

5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved	
Month	Day	Year	Year	Sequential Number	Revision No.	Month	Day	Year	Facility Name	Docket Number
04	24	2024	2024	- 002 -	00	06	24	2024	N/A	05000N/A
									Facility Name	Docket Number
									N/A	05000N/A

9. Operating Mode	10. Power Level
1	100

11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*

10 CFR Part 20	☐ 20.2203(a)(2)(vi)	**10 CFR Part 50**	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)	☐ 73.1200(a)
☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)	☐ 73.1200(b)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)	☐ 73.1200(c)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.36(c)(2)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)	☐ 73.1200(d)
☐ 20.2203(a)(2)(i)	**10 CFR Part 21**	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(A)	**10 CFR Part 73**	☐ 73.1200(e)
☐ 20.2203(a)(2)(ii)	☐ 21.2(c)	☐ 50.69(g)	☐ 50.73(a)(2)(v)(B)	☐ 73.77(a)(1)	☐ 73.1200(f)
☐ 20.2203(a)(2)(iii)		☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(2)(i)	☐ 73.1200(g)
☐ 20.2203(a)(2)(iv)		☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(ii)	☐ 73.1200(h)
☐ 20.2203(a)(2)(v)		☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)		

☐ **OTHER** (Specify here, in abstract, or NRC 366A).

12. Licensee Contact for this LER

Licensee Contact	Phone Number (Include area code)
Justin Garner, Licensing Engineer	256-729-7955

13. Complete One Line for each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable to IRIS	Cause	System	Component	Manufacturer	Reportable to IRIS
X	EL	XFMR	AB06	Y	N/A	N/A	N/A	N/A	N/A

14. Supplemental Report Expected		15. Expected Submission Date	Month	Day	Year
☒ No	☐ Yes (If yes, complete 15. Expected Submission Date		N/A	N/A	N/A

16. Abstract (Limit to 1326 spaces, i.e., approximately 13 single-spaced typewritten lines)

On April 24, 2024, at 2215 Central Daylight Savings Time, while Unit 1 was at 100 percent rated thermal power, Browns Ferry Nuclear Plant Unit 1 experienced an automatic reactor scram due to a fault within the 1B Main Transformer. All plant equipment responded as expected, and Unit 1 was transitioned to Mode 4.

The cause of the transformer failure is currently under investigation. The root cause of the transformer failure will not be known until a forensic tear down is complete.

This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A), as an automatic actuation of the Reactor Protection System, Primary Containment Isolation System, the High-Pressure Coolant Injection System, and the Reactor Core Isolation Cooling System.

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. FACILITY NAME		2. DOCKET NUMBER	3. LER NUMBER		
			YEAR	SEQUENTIAL NUMBER	REV NO.
Browns Ferry Nuclear Plant, Unit 1	☒ 050 ☐ 052	00259	2024	- 002	- 00

NARRATIVE

I. Plant Operating Conditions before the Event

At the time of discovery of this event on April 24, 2024, Browns Ferry Nuclear Plant (BFN) Unit 1 was in Mode 1 at approximately 100 percent Rated Thermal Power (RTP).

II. Description of Event

A. Event Summary

On April 24, 2024, at 2215 Central Daylight Savings Time (CDT), while Unit 1 was at 100 percent RTP, Browns Ferry Nuclear Plant (BFN) Unit 1 experienced an automatic reactor scram from a turbine control valve (TCV) [XCV] fast closure signal due to a fault within the 1B Main Transformer [XFMR]. All plant equipment responded as expected, and Browns Ferry Unit 1 was transitioned to Mode 4.

Primary Containment Isolation Systems (PCIS) [JM] Groups 2, 3, 6, and 8 isolation signal reactor water level (RWL) Level 3 (+2") was received. Upon receipt of this signal, all components actuated as required. Following the reactor scram, due to reactor water level reaching Level 2 (-45"), reactor recirculation pumps tripped as expected and both High Pressure Coolant Injection (HPCI)[BJ] and Reactor Core Isolation Cooling (RCIC) [BN] initiation signals were received, and both systems initiated as designed. All safety systems operated as expected. At no time was public health and safety at risk.

The Tennessee Valley Authority (TVA) is submitting this report in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 50.73(a)(2)(iv)(A), as an automatic actuation of the Reactor Protection System (RPS) [JC], the Primary Containment Isolation System (PCIS) [JM], the High-Pressure Coolant Injection (HPCI) [BJ] System, and the Reactor Core Isolation Cooling (RCIC) [BN] System.

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 structures, systems, or components (SSCs) whose inoperability contributed to this event.

NARRATIVE

C. Dates and approximate times of occurrences

DATE AND APPROXIMATE TIMES (times are Central Time)	OCCURRENCE
April 24, 2024, at 2215 CDT	Browns Ferry Unit 1 experienced an automatic reactor scram due to a fault within the 1B Main Transformer.
April 25, 2024, at 0122 CDT	U1 Event Notification (EN# 57090) was made to the Nuclear Regulatory Commission (NRC).
May 5, 2024	The Unit 1 & 2 Spare Main Bank Transformer was tested and placed into service.

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

The 1B Main Bank Transformer (500-22 KV) was made by ABB, part number XV12089004-B (Serial No. 12089-001).

E. Other systems or secondary functions affected

No other systems or secondary functions were affected.

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

On April 24, 2024, at 2215 CDT, the Browns Ferry 1B Main Bank Transformer experienced an internal fault. Unit 1, operating at 100% power at the time of the transformer failure, received an automatic reactor scram following transformer protective relay actuation. All plant equipment responded as expected and Browns Ferry Unit 1 was transitioned to Mode 4.

Initial engineering walkdowns revealed that the transformer tank itself did not experience any structural damage and there was no collateral damage to adjacent structures.

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

The primary mode of failure cannot be identified until the transformer is removed and an in-depth inspection of the internals is performed. Initial internal inspection reveals that the fault was most likely to have originated in the left winding assembly and core limb.

NARRATIVE

H. Operator actions

Operations personnel stabilized the plant following the reactor and turbine trip and subsequently initiated a plant cooldown to Mode 4.

I. Automatically and manually initiated safety system responses

PCIS Groups 2, 3, 6, and 8 isolation signals were received. Upon receipt of these signals, all components actuated as required. Following the reactor scram, both HPCI and RCIC initiation signals were received, and both initiated as designed. All safety systems operated as expected.

III. Cause of the event

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

The primary mode of failure cannot be identified until the transformer is removed, and an in-depth inspection of the internals is performed. Initial internal inspection reveals that the fault was most likely to have originated in the left winding assembly and core limb.

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

There were no human performance related root causes.

IV. Analysis of the event

On April 24, 2024, at 2215 CDT, the Browns Ferry 1B Main Bank Transformer experienced an internal fault, resulting in a loss of the transformer. Unit 1, operating at 100% power at the time of the transformer failure, received an automatic reactor scram following plant protective relay actuation. All plant equipment responded as expected and Browns Ferry Unit 1 was transitioned to Mode 4. An NRC Event Notification (EN# 57090) was made on April 25, 2024, at 0122 CDT.

Initial engineering walkdowns revealed that the transformer tank itself did not experience any structural damage and there was no collateral damage to adjacent structures.

The TVA System Protection and Analysis group performed an event analysis on the 1B Main Bank Transformer trip that shows that the trip came from the transformer differential (187T) relay via 186TX auxiliary relay at 22:15:48 CDT. The 187TF GSU #1 feeder differential relay shots indicate that the fault was external to the feeder differential zone.

NARRATIVE

Review of the pre-event system monitoring information, which includes temperature and oil system parameters, oil samples, and Serveron data, did not indicate any degrading trends prior to failure. Internal inspections of the failed 1B transformer identified damage, which precluded near term recovery of the transformer.

Unit 1 and Unit 2 share a spare main bank transformer that physically resides between the two units. The 1/2 Spare Main Bank Transformer was tested and placed into service on May 5, 2024, and received increased monitoring for the first 72 hours of energization.

V. Assessment of Safety Consequences

The plant responded as designed, while maintaining defense-in-depth for nuclear safety. All Nuclear safety systems functions as designed. This event was of very low nuclear safety significance. At no time was the health and safety of the public at risk.

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

Generator step-up (GSU) transformers have no alternate line-up or redundant components available while the transformers are in service. All reactor safety mitigating systems performed as expected.

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

There were no safety systems rendered inoperable.

VI. Corrective Actions

Corrective Actions are being managed by the TVA corrective action program under condition reports (CRs) 1926807 and 1926812.

NARRATIVE

A. Immediate Corrective Actions

- Engineering developed support/refute matrix to identify the cause of the transformer failure. The cause was unable to be determined but was narrowed down to an internal winding fault or core fault.
- Hitachi Energy performed an initial internal inspection on the 1B transformer.
- 1A, 1B, and 1C transformer oil samples were sent off for evaluation.
- Unit 1 Generator was inspected to ensure no damage occurred during the fault.
- Unit 1/2 spare GSU transformer testing was performed to ensure health before placing into service.
- Additional monitoring was placed on the Unit 1/2 spare GSU transformer for the first 72 hours of energization.

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

The failed transformer has been isolated and will be forensically disassembled preventing it from any future service. Any significant findings from the forensic disassembly that result in substantial changes to the corrective action plan will be reported in a revised LER.

VII. Previous Similar Events at the Same Site

A search of LERs from BFN, Units 1, 2, and 3 over the last five years identified no similar events.

VIII. Additional Information

There is no additional information.

IX. Commitments

There are no new commitments.