TENNESSEE VALLEY AUTHORITY

Post Office Box 2000, Decatur, Alabama 35609-2000

July 3, 2024

10 CFR 50.73
10 CFR 50.4(a)

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

Browns Ferry Nuclear Plant, Units 1, 2, and 3
Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68
NRC Docket Nos. 50-259, 50-260, and 50-296

Subject: **Licensee Event Report 50-259/2024-001-01**

Reference: Letter from TVA to NRC, "Licensee Event Report 50-259/2024-001-00," dated April 11, 2024 (ML24102A279)

The enclosed Licensee Event Report provides details of an inoperability of a Unit 3 Diesel Generator. 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)(i)(B), as any operation or condition which was prohibited by the plant's Technical Specifications.

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

Respectfully,

By Delegation for
Daniel A. Komm
BFN Site Vice President

Enclosure: Licensee Event Report 50-259/2024-001-01 – Inoperability of Unit 3 Diesel Generator due to Relay Failure

cc (w/ Enclosure):
NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant
NRC Project Manager - Browns Ferry Nuclear Plant

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 7

4. Title

Inoperability of Unit 3 Diesel Generator due to Relay 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
12	14	2022	2024	- 001 -	01	07	03	2024	Browns Ferry Nuclear Plant, Unit 2	05000260
									Facility Name	Docket Number
									Browns Ferry Nuclear Plant, Unit 3	05000296

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)
Denzel Housley, Licensing Engineer	256-729-7643

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	EK	RLY	G080	Y		N/A	N/A	N/A	N/A	N/A

4. 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 February 14, 2024, while performing Surveillance Procedure 3-SR-3.8.1.9(3D OL), “Diesel Generator 3D Emergency Load Acceptance Test with Unit 3 Operating,” the Unit 3 D Emergency Diesel Generator (DG) did not start on an undervoltage condition on its associated safety bus as expected. BFN-3-RLY-082-D/SUDR (Single Unit Defeat Relay) contacts 3 and 4 are designed as normally closed but were found electrically open in the normal state causing the Diesel fast start circuit to not be made up.

The apparent cause of the misalignment of the SUDR relay contacts was the lack of effective Preventative Maintenance (PM). Improved PM Strategy to provide more detailed relay inspections /testing requirements for DG starting logic relays that have critical functions will be implemented.

During this event, the 3D DG would have continued to support the safety function of starting on the receipt of an accident signal as designed. Although the 3D DG would not have automatically started during a loss of offsite power, operators are directed to immediately ensure DGs are started and tied to their respective safety busses.

NARRATIVE

I. Plant Operating Conditions before the Event

At the time of this event on December 14, 2022, Browns Ferry Nuclear Plant (BFN) Unit 1 was in Mode 1 at approximately 100 percent power, Unit 2 was in Mode 1 at approximately 100 percent power, and Unit 3 was in Mode 1 at approximately 96 percent power.

II. Description of Event

A. Event Summary

On February 14, 2024, while performing Surveillance Procedure 3-SR-3.8.1.9(3D OL), “Diesel Generator 3D Emergency Load Acceptance Test with Unit 3 Operating,” the Unit 3 D Emergency Diesel Generator (DG) [EK] did not start on an undervoltage condition on its associated safety bus [EB] as expected. Troubleshooting identified that the DG did not start due to a failure (open circuit) of Single Unit Defeat Relay (SUDR) [RLY] normally closed contacts (3-4). The relay was repaired and the surveillance test was reperformed satisfactorily on February 15, 2024. A past operability evaluation was performed by engineering that determined that the relay had been inoperable since December 14, 2022 when the 3D EDG started slower than expected during the performance of Surveillance Procedure 3-SR-3.8.1.1(3D), “Diesel Generator 3D Monthly Operability Test.” It was not originally recognized that the slower than expected DG start time could be an indication of the inability of the DG to start on a loss of voltage signal.

Unit 3 Technical Specifications (TS) 3.8.1, “AC Sources - Operating,” and 3.8.2, “AC Sources - Shutdown,” requires the Unit 3 DGs to be operable in MODES 1, 2, 3, 4 and 5, and during movement of irradiated fuel assemblies in the secondary containment. Units 1 and 2 TSs 3.8.1 and 3.8.2 require the Unit 3 DGs associated with AC Boards needed to support equipment required for Units 1 and 2 to be Operable in Modes 1, 2, 3, 4, and 5, and during movement of irradiated fuel assemblies in the secondary containment. Because the 3D DG was inoperable from December 14, 2022, until February 15, 2024, the associated TS Actions were not complied with. Additionally, Mode changes were made with the 3D DG inoperable which is prohibited by TS 3.0.4.

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)(i)(B), as any operation or condition which was prohibited by the plant’s TSs.

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.

C. Dates and approximate times of occurrences

DATE AND APPROXIMATE TIMES (times are Central Time)	OCCURRENCE
December 14, 2022, at 09:30	Performance of 3-SR-3.8.1.1(3D) identified slower than expected start time for the 3D EDG. It was not recognized that this could be an indication of the inability of the DG to start on a loss of voltage signal.
February 14, 2024, at 11:49	During performance of 3-SR-3.8.1.9(3D OL), 3D DG did not start on an undervoltage condition on its associated safety bus as expected. Troubleshooting identified that the DG did not start due to a failure (open circuit) of SUDR normally closed contacts (3-4).
February 15, 2024, at 07:00	The SUDR relay was repaired and DG testing was reperformed satisfactorily. 3D DG declared operable.
March 7, 2024	A past operability evaluation was completed by engineering that determined that the relay had been inoperable since December 14, 2022.

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

The SUDR relay was a General Electric Part Number 12HFA151A2H.

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

The relay failure was discovered during troubleshooting activities.

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

Relay BFN-3-RLY-082-D/SUDR contacts 3 and 4 are designed as normally closed but were found electrically open in the normal state causing the Diesel fast start circuit to not be made up.

NARRATIVE

The component failure analysis report was minimally helpful since the removed SUDR relay was severely damaged while shipping for a failure analysis. The analysis did conclude the contacts had been burnished and were generally clean.

H. Operator actions

None.

I. Automatically and manually initiated safety system responses

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

III. Cause of the event

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

BFN-3-RLY-082-D/SUDR contacts 3 and 4 are designed as normally closed but were found electrically open in the normal state causing the Diesel fast start circuit to not be made up.

The apparent cause of the misalignment of the SUDR relay contacts was the lack of effective Preventative Maintenance (PM). The PM did not have periodic “calibration” activities (e.g., contact burnishing, finger binding checks, contact wipe and gap inspections, pickup voltage tests, contact resistance checks, and checks for no visual bends in contact arms) as recommended by EPRI and TVA Fleet guidance. Implementing the “calibration” activities would reduce the likelihood of the normally closed contacts becoming misaligned and open circuited.

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

A contributing cause of extending the length of time the SUDR relay contacts were non-functional was the untimely action for reworking or replacing the relay. This was based on an incorrect mental model of the importance of the seal-in circuit which relies on the normally closed contacts of the SUDR relay. Engineers responsible for concluding that the failure of the seal-in did not affect operability of the DG were not prepared adequately for understanding the complex DG start logic.

IV. Analysis of the event

On December 14, 2022, during the performance of 3-SR-3.8.1.1(3D) a slower than expected start time (but within acceptance criteria) was experienced for the 3D DG. An assessment at the time did not identify any concerns with the operability of the DG. Following the failure of the 3D DG to start on bus undervoltage during the performance of 3-SR-3.8.1.9(3D OL) on February 14, 2024,

engineering determined that the previously identified cause of the slower than expected starts (i.e., failure of the seal-in circuit from the SUDR relay and Fast Start Relay No. 1 (ASRD-1) contacts) would also explain the failure to start on undervoltage. Therefore, the failure of the SUDR relay is considered to have existed since December 14, 2022.

The failure of the SUDR relay resulted in the failure of the 3D DG to start on loss of bus voltage but would not have resulted in the failure of the DG to start on an accident signal. Additionally, the SUDR relay failure would not have prevented the DG from being started manually by the control room operator. The first Immediate Action of 0-AOI-57-1A, “Loss of Offsite Power (161 and 500 KV)/Station Blackout,” is to ensure the DGs have started and tied to their respective 4-kV Shutdown Boards.

V. Assessment of Safety Consequences

The safety objective of the Standby AC Power System is to provide a self-contained, highly reliable source of power, as required for the Engineered Safeguards System, so that no single credible event can disable the core standby cooling functions or their supporting auxiliaries.

During this event, the 3D DG would have continued to support the safety function of starting on the receipt of an accident signal as designed. Although the 3D DG would not have automatically started during a loss of offsite power, operators are directed to immediately ensure DGs are started and tied to their respective safety busses. With the fast start circuit seal-in nonfunctional, the operator’s ability to select the mode of DG operation through use of the 3D Mode Select switches (for paralleling with other units, for paralleling to the offsite system, or for single unit operation) and the ability to manually raise or lower the DG’s voltage or frequency, would not have been defeated. This condition is of very low to no safety significance and would not have adversely affected the health and safety of the public.

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

The Unit 3 standby AC supply and distribution system consists of four diesel generators (3A, 3B, 3C, and 3D), four 4-kV shutdown boards, two 480-V shutdown boards, one 480-V heating, ventilation, and air conditioning board, five motor operated valve boards, two 480-V diesel auxiliary boards, one 480-V control bay vent board, and the Standby Gas Treatment system board. In addition to its other functions, the system serves as the alternate supply to one condensate demineralizer board. For flexibility of operation, provisions have been made for the interconnection of 4-kV shutdown board A (Units 1 and 2) with 4-kV shutdown board 3EA (Unit 3). Similar interconnections have been provided between boards B and 3EB, C and 3EC, and D and 3ED. The interconnections are through manually controlled circuit breakers.

NARRATIVE

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

During this period of inoperability when not out of service for planned maintenance or testing, the 3D DG would have started as designed for an accident signal and was otherwise available to be started manually by the control room operator.

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

As assessed by the past operability evaluation, the SUDR relay was inoperable from December 14, 2022, until February 15, 2024.

VI. Corrective Actions

Corrective Actions are being managed by the TVA's corrective action program under Condition Report (CR) 1910087.

A. Immediate Corrective Actions

The failed SUDR relay was repaired and 3D DG was returned to Operable status on February 15, 2024.

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

Improved PM Strategy to provide more detailed relay inspections /testing requirements for DG starting logic relays that have critical functions will be implemented. Additionally, EDG start logic training will be provided to system engineers who can lead EDG start logic troubleshooting.

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.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].