



Post Office Box 2000, Decatur, Alabama 35609-2000

November 22, 2021

10 CFR 50.73

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

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

Subject: **Licensee Event Report 50-259/2021-001-00**

The enclosed Licensee Event Report (LER) provides additional details of the 480 Volt Load Shed Logic Inoperable Longer than Allowed by Technical Specifications (TS) due to Failed Relay. The Tennessee Valley Authority is submitting this report in accordance with Title 10 of the Code of Federal Regulations 50.73(a)(2)(i)(B), as any operation or condition which was prohibited by the plant's TSs and 50.73(a)(2)(v), as any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to (A) shut down the reactor and maintain it in a safe shutdown condition; (B) remove residual heat, (C) control the release of radioactive material; and (D) mitigate the consequences of an accident.

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

Respectfully,

A handwritten signature in black ink, appearing to read 'M. Rasmussen', with a long horizontal flourish extending to the right.

Matthew Rasmussen  
Site Vice President

Enclosure: Licensee Event Report 50-259/2021-001-00 – 480 Volt Load Shed Logic Inoperable Longer than Allowed by Technical Specifications due to Failed Relay

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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  
Units 1 and 2**

**Licensee Event Report 50-259/2021-001-00**

**480 Volt Load Shed Logic Inoperable Longer than Allowed by  
Technical Specifications due to Failed Relay**

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**See Enclosed**



**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 FOIA, Library, and Information Collections Branch T-6 A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk ail: oira\_submission@omb.eop.gov. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

<b>1. Facility Name</b> Browns Ferry Nuclear Plant, Unit 1	<b>2. Docket Number</b> 05000259	<b>3. Page</b> 1 OF 6
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**4. Title**  
480 Volt Load Shed Logic Inoperable Longer than Allowed by Technical Specifications due to Failed Relay

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
03	03	2021	2021	- 001 -	00	11	22	2021	Browns Ferry Nuclear Plant, Unit 2	05000260
									Facility Name	Docket Number
									N/A	N/A

<b>9. Operating Mode</b> 1	<b>10. Power Level</b> 100
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**11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: (Check all that apply)**

<input type="checkbox"/> 10 CFR Part 20	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(A)	<b>10 CFR Part 73</b>
<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.69(g)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(4)
<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> 73.71(a)(5)
<input type="checkbox"/> 20.2203(a)(2)(i)	<b>10 CFR Part 21</b>	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> 73.77(a)(1)
<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 21.2(c)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 73.77(a)(2)(i)
<input type="checkbox"/> 20.2203(a)(2)(iii)	<b>10 CFR Part 50</b>	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	<input type="checkbox"/> 73.77(a)(2)(ii)
<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)	
<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)	

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

**12. Licensee Contact for this LER**

Licensee Contact Denzel Housley, Licensing Engineer	Phone Number (Include area code) 256-729-7643
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**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

<b>14. Supplemental Report Expected)</b>			<b>15. Expected Submission Date</b>		
<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (If yes, complete 15. Expected Submission Date)		Month	Day	Year
			N/A	N/A	N/A

**16. Abstract** (Limit to 1560 spaces, i.e., approximately 15 single-spaced typewritten lines)

On September 23, 2021 at 02:00 CDT (Central Daylight Time), the Units 1 and 2 480 Volt (V) Load Shed Logic, Division I was declared inoperable during the performance of surveillance testing. During the performance of this surveillance procedure, relay 0-RLY-231-00A7 would not have energized when required due to an open circuit in the coil. The relay was replaced and the Units 1 and 2 480 V Load Shed Logic, Division I was declared operable on September 25, 2021 at 22:30 CDT.

An engineering evaluation of the relay failure was completed on October 28, 2021. This evaluation determined that 0-RLY-231-00A7 was likely inoperable since the last time it had been energized during testing on March 3, 2021. Additionally, the Units 1 and 2 480 V Load Shed Logic, Division II was out of service twice during this time period to support testing on March 4, 2021 and May 19, 2021.

Examination of the relay determined that the relay failed due to an internal failure of the coil with no external damage seen.

The relay will be sent to the manufacturer for additional review for potential reportability under Title 10 of the Code of Federal Regulations Part 21.



**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 FOIA, Library, and Information Collections Branch (T-6 A10M), U. S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to [Infocollects.Resource@nrc.gov](mailto:Infocollects.Resource@nrc.gov), and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk Officer for the Nuclear Regulatory Commission, 725 17th Street NW, Washington, DC 20503; e-mail: [oir\\_submission@omb.eop.gov](mailto:oir_submission@omb.eop.gov). The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Browns Ferry Nuclear Plant, Unit 1	05000-259	2021	- 001	- 00

**NARRATIVE**

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

At the time of discovery, Browns Ferry Nuclear Plant (BFN) Units 1 and 2 were in Mode 1 at approximately 100 percent power.

**II. Description of Event**

**A. Event Summary**

On September 23, 2021, at 02:00 CDT (Central Daylight Time), the Units 1 and 2 480 Volt (V) Load Shed Logic, Division I [EIS: EK] was declared inoperable during the performance of 0-SR-3.8.1.8(I), "480V Load Shedding Logic System Function Test (Division I)." During the performance of this surveillance procedure, relay [EIS: RLY] 0-RLY-231-00A7 would not have energized when required due to an open circuit in the coil. BFN Units 1 and 2 Technical Specifications (TS) 3.8.1, "AC Sources - Operating," Limiting Condition for Operation (LCO) C was entered for the inoperability of one division of 480 V load shed logic which required restoration of the required division 480 V load shed logic within 7 days. The relay was replaced and the Units 1 and 2 480 V Load Shed Logic, Division I was declared operable on September 25, 2021, at 22:30 CDT.

An engineering evaluation of the relay failure was completed on October 28, 2021. This evaluation determined that 0-RLY-231-00A7 was likely inoperable since the last time it had been energized during testing on March 3, 2021. Therefore, the Units 1 and 2 480 V Load Shed Logic, Division I was inoperable longer than the TS 3.8.1 LCO Condition C time of 7 days. Additionally, the Units 1 and 2 480 V Load Shed Logic, Division II was out of service twice during this time period to support testing on March 4, 2021, and May 19, 2021. With both divisions of 480 V Load Shed Logic out of service, Units 1 and 2 TS 3.8.1 LCO Condition J required immediate entry into LCO 3.0.3 which was not done since the inoperability of 0-RLY-231-00A7 was not known at the time.

The Tennessee Valley Authority (TVA) is submitting this report in accordance with Title 10 of the Code of Federal Regulations 50.73(a)(2)(i)(B), as any operation or condition which was prohibited by the plant's TS and 50.73(a)(2)(v), as any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to (A) shut down the reactor and maintain it in a safe shutdown condition; (B) remove residual heat, (C) control the release of radioactive material; and (D) mitigate the consequences of an accident.

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



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**NARRATIVE**

**C. Dates and approximate times of occurrences**

Dates and Approximate Times (CDT)	Occurrence
March 3, 2021	Last successful testing of relay 0-RLY-231-00A7 occurred
March 4, 2021, to March 6, 2021	480 V Load Shed Logic Division II taken out of service for testing
May 19, 2021, to May 20, 2021	480 V Load Shed Logic Division II taken out of service for testing
September 23, 2021, at 02:00	480 V Load Shed Logic Division I was declared inoperable during testing due to failure of 0-RLY-231-00A7
September 25, 2021, at 22:30	0-RLY-231-00A7 was replaced and 480 V Load Shed Logic, Division I was declared operable
October 28, 2021	Engineering evaluation of the relay failure was completed that determined 0-RLY-231-00A7 was likely inoperable since the last time it had been energized during testing on March 3, 2021

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

The failed component was a General Electric manufactured relay, model number 12HFA51A41H.

**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 failure of relay 0-RLY-231-00A7 was discovered during surveillance testing in accordance with procedure 0-SR-3.8.1.8(I).

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

Examination of the relay determined that the relay failed due to an internal failure of the coil with no external damage seen.



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**NARRATIVE**

**H. Operator actions**

No additional operator actions were identified.

**I. Automatically and manually initiated safety system responses**

No automatic or manual safety systems were initiated as a result of this event.

**III. Cause of the event**

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

Relay 0-RLY-231-00A7 failed due to an internal failure of the coil with no external damage seen.

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

This event did not involve a human performance related root cause.

**IV. Analysis of the event**

The Unit 1 and 2 Diesel Generators (EDG) are provided with a common 480 V load shed logic system with two redundant divisions. The 480 V AC Auxiliary Power System has the capability to load-shed to prevent overloading the Standby DGs. On loss of voltage for approximately 5 seconds, all 480V Shutdown Board electrically operated breakers, except those essential to safe shutdown are automatically tripped. The motor control center feeders serving 480V reactor motor operated valve (RMOV) boards are not disconnected due to loss of voltage. Undervoltage load shedding is performed by undervoltage relays to disconnect pre-selected loads from the 480V Shutdown Boards after these boards lose their normal supply. The loads which are required after undervoltage load shed are returned by manual operation. The load shed logic system disconnects pre-selected loads from the 480V Shutdown Boards and motor control centers in the event of an accident signal concurrent with diesel generator voltage available to the respective 4KV shutdown boards. Certain required plant loads are returned to service in a predetermined sequence in order to prevent overloading of the diesel generators in the process. Within 40 seconds after the initiating signal (EDG breaker closure with accident signal) is received, all automatic and permanently connected loads needed to recover the unit or maintain it in a safe condition are returned to service.

The failed relay was analyzed and it was determined that the relay coil had an open circuit internal to the coil. Engineering evaluation of this failure determined that an open circuit coil occurring while carrying current was the most credible scenario. Testing of the relay on September 23, 2021, did not involve the relay carrying current; therefore, it was determined that



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the relay had failed at a previous date. A review of the testing history of the relay determined that the last successful operation of the relay while carrying current was on March 3, 2021. Therefore, the relay was considered to be inoperable from that date.

TS LCO 3.8.1(b) requires Unit 1 and 2 DGs with two divisions of 480 V load shed logic and common accident signal logic to be Operable in Modes 1, 2, and 3. TS LCO 3.8.1 Condition C requires that, with one division of 480 V load shed logic inoperable, the required division of 480 V load shed logic must be restored with 7 days. TS LCO 8.3.1 Condition I requires that, if associated completion time of Condition C is not met, the unit must be in Mode 3 in 12 hours and Mode 4 in 36 hours. Additionally, TS LCO 3.8.1 Condition J requires that, with two divisions of 480 V load shed logic inoperable, LCO 3.0.3 must be entered immediately.

The engineering evaluation determined that Division I of the 480 V Load Shed logic was inoperable from March 3, 2021, to September 25, 2021. TS LCO 3.8.1 Condition C was not met during this time and the actions of TS LCO 3.8.1 Condition I were not complied with. Additionally, twice during this time period, both Divisions of the 480 V load shed logic were inoperable and the required actions of TS LCO 3.8.1 Condition J were not completed. Therefore, BFN was in violation of the TSs during these times.

**V. Assessment of Safety Consequences**

A Probabilistic Risk Analysis (PRA) Evaluation was performed to determine the safety significance of this event. The failure was modeled as a cumulative 78 hours of exposure during which time Emergency Core Cooling System (ECCS) response would have been challenged during conditions requiring use of onsite (DG) AC power. The BFN PRA model was quantified for Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) for Units 1, 2 and 3 assuming failure of the DGs and the dominant cutsets were evaluated to identify appropriateness of the above assumptions and to identify any early sequences involved.

CDE and LERF cutsets were generated and reviewed to determine the actual expected likelihood and consequences of a demand for onsite AC power in conjunction with an accident signal causing load shed impacts to the Units 1 and 2 DGs during a 78 hour interval (time that both relevant relays were unavailable). The review indicates that the core damage and large early release frequency risk increases were very small across all three units and both risk measures.

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

The Units 1 and 2 480 V Load Shed Logic, Division II was available to provide this function except for twice during this time period to support testing on March 4, 2021, and May 19, 2021 (approximately 78 hours).





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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**

The relay was inoperable from March 3, 2021, until it was replaced on September 25, 2021 (approximately 206 days).

**VI. Corrective Actions**

Corrective Actions for this event are being managed under Condition Report (CR) 1723229.

**A. Immediate Corrective Actions**

The failed relay was replaced and tested satisfactorily.

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

The relay will be sent to the manufacturer for additional review for potential reportability under 10 CFR 21.

**VII. Previous Similar Events at the Same Site**

There were no previous similar events occurring at BFN within the last three years.

**VIII. Additional Information**

There is no additional information.

**IX. Commitments**

There are no new commitments.