



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

June 26, 2017

10 CFR 50.73

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 50-259/2017-003-00**

The enclosed Licensee Event Report (LER) provides details of an unanalyzed condition for tornado missiles striking the Emergency Diesel Generator Fuel Oil Vent Lines. The Tennessee Valley Authority (TVA) is submitting this report in accordance with Title 10 of the Code of Federal Regulations (CFR) 10 CFR 50.73(a)(2)(ii)(B), as any event or condition that resulted in the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety; and 10 CFR 50.73(a)(2)(v)(A)/(B)/(D), as any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to shut down the reactor and maintain it in a safe shutdown condition, remove residual heat, or mitigate the consequences of an accident.

Further evaluation is underway to determine if the Browns Ferry Nuclear Plant is susceptible to additional tornado missile effects. At this time, TVA anticipates the need to supplement this LER with the results of that evaluation.

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,

S. M. Bono  
Site Vice President

Enclosure: Licensee Event Report 50-259/2017-003-00 – Unanalyzed Condition for  
Tornado Missiles Striking the Emergency Diesel Generator Fuel Oil Vent Lines

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cc (w/ Enclosure):

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

**ENCLOSURE**

**Browns Ferry Nuclear Plant  
Unit 1, 2, and 3**

**Licensee Event Report 50-259/2017-003-00**

**Unanalyzed Condition for Tornado Missiles Striking the  
Emergency Diesel Generator Fuel Oil Vent Lines**

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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 Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by 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.

<b>1. FACILITY NAME</b> Browns Ferry Nuclear Plant, Unit 1	<b>2. DOCKET NUMBER</b> 05000259	<b>3. PAGE</b> 1 OF 5
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**4. TITLE**  
Unanalyzed Condition for Tornado Missiles Striking the Emergency Diesel Generator Fuel Oil Vent Lines

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
04	25	2017	2017	- 003	- 00	06	26	2017	Browns Ferry Nuclear, Unit 2	05000260
									FACILITY NAME	DOCKET NUMBER
									Browns Ferry Nuclear, Unit 3	05000296

<b>9. OPERATING MODE</b>  1	<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)</b>									
	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)						
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input checked="" type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)						
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)						
<b>10. POWER LEVEL</b>  100	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)						
	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)						
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)						
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> 73.77(a)(1)						
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> 73.77(a)(2)(i)						
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 73.77(a)(2)(ii)						
		<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> OTHER	Specify in Abstract below or in NRC Form 366A						

**12. LICENSEE CONTACT FOR THIS LER**

LICENSEE CONTACT Ryan Coons, Licensing Engineer	TELEPHONE NUMBER (Include Area Code) 256-729-2070
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**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

<b>14. SUPPLEMENTAL REPORT EXPECTED</b> <input checked="" type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input type="checkbox"/> NO	<b>15. EXPECTED SUBMISSION DATE</b>	MONTH	DAY	YEAR
		08	25	2017

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

In accordance with NRC Regulatory Issue Summary (RIS) 2015-06, Tornado Missile Protection, a design and licensing basis review was performed to evaluate the effects of exposing safety related features to tornado wind loads, depressurization loads, and strikes from tornado generated missiles.

On April 25, 2017, it was discovered that a tornado missile strike could potentially damage the exposed and unprotected portion of the D, 3A, 3B, 3C, and 3D Emergency Diesel Generator (EDG) fuel oil vent lines. This could potentially fully crimp the vent line, and disable the tank's vacuum prevention feature. Developing a vacuum in the fuel oil system would limit the fuel oil pump's ability to transfer fuel oil from the 7 day tank to the day tank, restricting or eliminating the fuel oil flow to the affected EDG, which would prevent the EDG from functioning. The development of a vacuum may also damage the 7 day tank.

This condition is an original plant design legacy issue. Due to the historical nature of this vulnerability, a specific cause was not identified.

The compensatory measures implemented provide alternate fuel tank venting as soon as a tornado warning has been declared. This is implemented by removing a sampling plug from each of 7 day fuel tank manhole covers inside the D, 3A, 3B, 3C, and 3D EDG rooms.



**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 Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by 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. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Browns Ferry Nuclear Plant, Unit 1	05000-259	2017	- 003	- 00

**NARRATIVE**

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

At the time of discovery, Browns Ferry Nuclear Plant (BFN), Units 1, 2, and 3, were in Mode 1 at 100 percent power.

**II. Description of Event**

**A. Event Summary**

In accordance with NRC Regulatory Issue Summary (RIS) 2015-06, Tornado Missile Protection (TMP), a design and licensing basis review was performed to evaluate the effects of exposing safety related features to tornado wind loads, depressurization loads, and strikes from tornado generated missiles.

On April 25, 2017, it was discovered during this evaluation that damage to the exposed and unprotected portion of the D, 3A, 3B, 3C, and 3D Emergency Diesel Generator (EDG) [DG] fuel oil vent lines [VLR] by a tornado missile strike has the potential to fully crimp the vent line, which would render the vacuum prevention feature ineffective. Developing a vacuum in the fuel oil system [DE] would limit the ability of the fuel oil pumps [P] to transfer fuel oil from the 7 day tank [TK] to the day tank. This would restrict or eliminate the flow of fuel oil to the affected EDG, which would prevent the EDG from functioning. A development of a vacuum may also damage the 7 day tank.

**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 whose inoperability contributed to this condition.

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

Dates & Approximate Times

April 25, 2017,  
at 1630 CDT

Occurrence

The D, 3A, 3B, 3C, and 3D EDGs were declared inoperable following an engineering evaluation of TMP, which found that the EDG 7 day tank vent piping is subject to potential damage.

April 25, 2017,  
at 1631 CDT

In accordance with NRC Enforcement Guide Memorandum (EGM) 15-002, Revision 1, Enforcement Discretion for Tornado-Generated Missile Protection Non-Compliance, initial compensatory measures were implemented which provide additional protection and lessen tornado missile effects.



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Browns Ferry Nuclear Plant, Unit 1	05000-259	2017	- 003	- 00

Dates & Approximate Times

April 25, 2017,  
at 1647 CDT

April 25, 2017,  
at 1653 CDT

Occurrence

The D, 3A, 3B, 3C, and 3D EDGs were declared Operable at this time.

The NRC was notified of the unanalyzed condition that significantly degraded plant safety.

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

This condition did not involve any equipment failure.

**E. Other systems or secondary functions affected**

No other systems or secondary functions were affected by this condition.

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

This event did not involve the actual failure of plant equipment. However, an unanticipated potential for failure was discovered on April 25, 2017, as part of a design and licensing basis review to evaluate the effects of tornados and tornado missiles on safety related features, in accordance with RIS 2015-06.

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

This condition did not involve the actual failure of plant equipment.

**H. Operator actions**

There were no operator actions associated with this condition.

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

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

**III. Cause of the event**

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

This condition is an original plant design legacy issue. Due to the historical nature of this vulnerability, a specific cause was not identified.

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

There were no human performance related root causes for this condition.



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Browns Ferry Nuclear Plant, Unit 1	05000-259	2017	- 003	- 00

**IV. Analysis of the event**

The Tennessee Valley Authority (TVA) is submitting this report in accordance with Title 10 of the Code of Federal Regulations (CFR) 50.73(a)(2)(ii)(B), as any event or condition that resulted in the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety; and 10 CFR 50.73(a)(2)(v)(A)/(B)/(D), as any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to shut down the reactor and maintain it in a safe shutdown condition, remove residual heat, or mitigate the consequences of an accident.

The condition was discovered on April 25, 2017, at 1630 CDT, when an engineering evaluation of TMP determined that the 7 day tank vent piping is subject to potential damage for the D, 3A, 3B, 3C, and 3D EDGs rendering the EDGs inoperable for potential tornado missile protection. An actual tornado missile event could have caused a safety system functional failure due to the inoperability of multiple EDGs. However, compensatory measures were established to provide additional protection for alleviating tornado missile effects, in accordance with EGM 15-002, Revision 1. These initial compensatory measures allowed the affected EDGs to be considered Operable but nonconforming.

Further evaluation is underway to determine if BFN is susceptible to additional tornado missile effects. At this time, TVA anticipates the need to supplement this LER with the results of that evaluation.

**V. Assessment of Safety Consequences**

The exposed portion of the fuel oil vent lines for the D, 3A, 3B, 3C and 3D EDGs are not protected from a tornado generated missile strike. An exposed portion of a fuel oil vent line could experience crimping damage such that it cannot perform its function to prevent the development of a vacuum in the fuel oil system. The development of a vacuum in the fuel oil system would render the fuel oil transfer system from the 7 day tank to the day tank ineffective. The affected EDG(s) would be unable to function due to lack of fuel oil.

To prevent tornado missile induced EDG inoperability, BFN Operations personnel are now procedurally required to open an alternate ventilation path on the EDG 7 day fuel tanks following the declaration of a tornado warning. This condition had no actual safety consequences impacting plant or public safety because BFN did not experience an actual tornado missile event; however, the compensatory actions that have been implemented in the Severe Weather procedure will manage this condition's risk to 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**

This condition did not result in any actual system or component failures.



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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 condition did not occur during a shutdown.

**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**

This condition is an original plant design legacy issue. Due to the historical nature of this vulnerability, a specific cause was not identified. Initial compensatory measures to restore operability were implemented within 17 minutes of discovering the condition.

**VI. Corrective Actions**

Corrective Actions are being managed by TVA's corrective action program under Condition Report (CR) 1288222.

**A. Immediate Corrective Actions**

An operator workaround was implemented to provide an alternate fuel tank venting as soon as possible following a tornado event.

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

The comprehensive compensatory measures included revising the Severe Weather procedure to include removing a sampling plug on each of the EDG 7 day fuel oil tanks to provide an alternate ventilation path when a tornado warning has been declared. These comprehensive compensatory measures will remain in place until the vulnerability is permanently resolved.

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

A search of the BFN Corrective Action Program identified no similar conditions that have occurred at BFN.

**VIII. Additional Information**

There is no additional information.

**IX. Commitments**

There are no new commitments.