TENNESSEE
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AUTHORITY

Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381

WBL-21-017

May 10, 2021

10 CFR 50.73

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

Watts Bar Nuclear Plant, Unit 2
Facility Operating License No. NPF-96
NRC Docket No. 50-391

Subject: **Licensee Event Report 391/2021-001-00, Automatic Reactor Trip on Main Turbine Trip caused by Main Feed Pump Trip due to Low Condenser Vacuum**

This submittal provides Licensee Event Report (LER) 391/2021-001-00. This LER provides details concerning a recent event where the operating main feedwater pumps tripped on low condenser vacuum, resulting in a turbine and subsequent reactor trip. This condition is being reported as a safety system actuation of the reactor protection system and the auxiliary feedwater system in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 50.73(a)(2)(iv)(A).

There are no new regulatory commitments contained in this letter. Please direct any questions concerning this matter to Tony Brown, WBN Licensing Manager, at (423) 365-7720.

Respectfully,

Anthony L. Williams IV
Site Vice President
Watts Bar Nuclear Plant

Enclosure: LER 391/2021-001-00, “Automatic Reactor Trip on Main Turbine Trip caused by Main Feed Pump Trip due to Low Condenser Vacuum”

cc (w/Enclosure):

NRC Regional Administrator – Region II
NRC Senior Resident Inspector – Watts Bar Nuclear Plant
NRC Project Manager – Region II

ENCLOSURE
Tennessee Valley Authority
Watts Bar Nuclear Plant
Unit 2

LER 391/2021-001-00, “Automatic Reactor Trip on Main Turbine Trip caused by Main Feed Pump Trip due to Low Condenser Vacuum”

NRC FORM 366 (08-2020) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 08/31/2023

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LICENSEE EVENT REPORT (LER)

(See Page 3 for required number of digits/characters for each block)

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

1. Facility Name	2. Docket Number	3. Page
Watts Bar Nuclear Plant, Unit 2	05000391	1 OF 5

4. Title

Automatic Reactor Trip on Main Turbine Trip caused by Main Feed Pump Trip due to Low Condenser Vacuum

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
									NA	05000
03	17	2021	2021	- 001 -	00	05	10	2021	Facility Name: NA	Docket Number: 05000

9. Operating Mode	10. Power Level
1	90

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)	☐ 50.36(c)(2)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(A)	**10 CFR Part 73**
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.69(g)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(4)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(i)	**10 CFR Part 21**	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(1)(i)
☐ 20.2203(a)(2)(ii)	☐ 21.2(c)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(i)
☐ 20.2203(a)(2)(iii)	**10 CFR Part 50**	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)	☐ 73.77(a)(2)(ii)
☐ 20.2203(a)(2)(iv)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)	
☐ 20.2203(a)(2)(v)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)	

☐ **Other** (Specify here, in Abstract, or in NRC 366A).

12. Licensee Contact for this LER

Licensee Contact	Phone Number (Include Area Code)
Daniel Fox, Licensing Engineer	(423) 368-0977

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
B	EA	52	GE	Y					

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 1560 spaces, i.e., approximately 15 single-spaced typewritten lines)

On March 17, 2021, at 1004 Eastern Daylight Time (EDT), the Watts Bar Nuclear Plant (WBN) Unit 2 experienced an automatic reactor trip on a main turbine trip due to a main feed pump trip on low condenser vacuum. Concurrent with the reactor trip, the Auxiliary Feedwater system actuated as designed. All control and shutdown rods inserted properly and all safety systems responded as designed.

The direct cause of the event was failure of a close latch to maintain an Alternate Supply Breaker open after installation in the Unit 2C Board. The Alternate Supply Breaker closed causing the Normal Supply Breaker to open, de-energizing the Unit 2C Board. The 2C Condenser Circulating Water (CCW) Pump lost power causing a reduction of CCW flow and subsequent main feed pump trip on low condenser vacuum. Corrective actions include incorporating vendor enhancements to the breaker maintenance procedures.

This condition is being reported as a safety system actuation in accordance with 10 CFR 50.73(a)(2)(iv)(A).

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Watts Bar Nuclear Plant, Unit 2	05000391	2021	- 001	- 00

NARRATIVE

I. Plant Operating Conditions Before the Event

Watts Bar Nuclear Plant (WBN) Unit 2 was at 90 percent Rated Thermal Power (RTP). Unit 1 was unaffected by this event.

II. Description of Event

A. Event Summary

On March 17, 2021, during the performance of a breaker swap Work Order, the Alternate Supply Breaker [EIIS:BKR] on the Unit 2C Board [EIIS:EA] inadvertently closed and tripped open upon installation. The Normal Supply Breaker opened as designed when the Alternate Supply Breaker closed. This caused a loss of power to the non-safety related Unit 2C Board and subsequent de-energization of the 2C Condenser Circulating Water (CCW) pump [EIIS:P] and reduction of CCW flow to the plant.

The lower CCW flow caused condenser vacuum [EIIS:SH] to lower and resulted in a reactor trip on a main turbine trip due to Main Feed Pump (MFP) trip on low condenser vacuum. Concurrent with the reactor trip, all control and shutdown rods fully inserted, the Auxiliary Feedwater (AWF) System [EIIS:BA] actuated as designed, and all safety systems responded as designed. There were no complications associated with the reactor trip.

This event is being reported to the Nuclear Regulatory Commission (NRC) under 10 CFR 50.73(a)(2)(iv)(A) as a safety system actuation of the Reactor Protection System (RPS) and the AFW 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 safety related inoperable structures, components, or systems that contributed to this event.

C. Dates and approximate times (Eastern Daylight Time [EDT]) of occurrences

Date	Time (EDT)	Event
3/17/2021	0957	The 2C Board de-energized and 2C CCW pump lost power lowering CCW flow to the main condenser.
3/17/2021	0959	Operators started lowering reactor power in accordance with 2-AOI-39, “Rapid Load Reduction” in response to lowering vacuum in the main condenser.
3/17/2021	1002	Remaining condensate booster pumps tripped.
3/17/2021	1004	Automatic Main Turbine and Reactor trip occurred, Operators entered 2-E-0, “Reactor Trip or Safety Injection.”
3/17/2021	1048	Transitioned to 2-GO-5, Unit Shutdown from 30 percent Reactor Power to Hot Standby.

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

General Electric - AM 7.2-500-6HB, - 6.9KV - 2000 Amp Magne-Blast Circuit Breaker, Manufacture Date 5/27/1996.

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 component failure became evident when the Alternate Supply Breaker inadvertently closed after installation into the Unit 2C Board.

G. Failure mode, mechanism, and effect of each failed component

Upon racking in, the 2C Alternate Supply Breaker charging motor energizes to compress the breaker springs. The close latch maintains the springs in a charged state with the breaker open. In this case, the close latch did not properly engage with the charging spring cam roller to maintain the springs charged. When the engagement of the closed latch was not obtained, the springs discharged, resulting in a mechanical closure of the breaker (no electrical signal).

H. Operator actions

Operators reduced reactor power in response to lowering vacuum in the main condenser.

I. Automatically and manually initiated safety system responses

The Main Feed Pumps tripped on low condenser vacuum, which resulted in an automatic Turbine and Reactor trip, and subsequent actuation of the AFW system.

III. Cause of the Event

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

The most probable cause of the unintentional closure of the Unit 2C Board Alternate Supply Breaker was the inconsistent return of the close latch to the reset position as confirmed by the closing latch adjusting screw not in contact with the frame when the closing latch rotated to reset position (observation of breaker in shop during post event inspection). This was most likely caused by internal friction on the close latch shaft and bearings and could be further compounded by degraded spring tension on the latch.

This failure had no effect on any safety systems or functions.

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

No human performance root causes were identified for this event.

IV. Analysis of the Event

At the time of the event, the Unit 2 CCW system was operating at reduced margin with the 2D CCW pump out of service for repairs. The loss of the additional CCW pump caused a pressure transient in the plant condenser systems. Operators in the control room responded to the event and began lowering reactor power to stabilize the plant. The MFP condenser vacuum lowered resulting in a MFP trip which led to an automatic Turbine and Reactor trip from approximately 90 percent RTP.

V. Assessment of Safety Consequences

This event closely matches and is bounded by the Loss of Normal Feedwater event described in the Updated Final Safety Analysis Report (UFSAR). A probablistic risk review of this event shows the risk from this trip is very small.

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

Not applicable.

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

Not applicable.

C. For failure that rendered a train of a safety system inoperable, an estimate of the elapsed time from the discovery of the failure until the train was returned to service

Not applicable.

VI. Corrective Actions

This event was entered into the Tennessee Valley Authority's (TVA) Corrective Action Program and is being tracked under Condition Report 1679456.

A. Immediate Corrective Actions

The faulty breaker was removed from the Unit 2C Board and quarantined. As an intermediate compensatory measure, breaker swaps on Normal and Alternate Supply Breakers were put on hold pending an online risk evaluation.

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

The overhaul procedure will be enhanced to include replacing specific internal components based on internal vendor operating experience. In addition, a step will be added to the Close Latch Reset check which will simulate breaker installation to verify proper close latch alignment.

VII. Previous Similar Events at the Same Site

LER 391/2016-005-00 describes a Unit 2 reactor trip that occurred on June 20, 2016, as a result of a MFP trip on low condenser vacuum. This specific event was caused by a human performance error.

LER 391/2020-005-00 describes an event where a normal feeder breaker failed to close during a Shutdown Board transfer. This failure was due to a faulty switch contact internal to the breaker.

No similar inadvertent breaker closure events are known.

VIII. Additional Information

There is no additional information.

IX. Commitments

There are no new commitments.