



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

October 16, 2017

10 CFR 50.73

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

Watts Bar Nuclear Plant, Unit 1
Facility Operating License No. NPF-90
NRC Docket No. 50-390

Subject: **Licensee Event Report 390/2017-010-00, Actuation of Turbine Driven
Auxiliary Feedwater Pump Due to Loss of 6.9kV Shutdown Board**

This submittal provides Licensee Event Report (LER) 390/2017-010-00. This LER provides details concerning a condition where the turbine driven Auxiliary Feedwater pump started when the 1B-B 6.9kV Shutdown Board lost power. This condition is being reported as a valid safety system actuation in accordance with 10 CFR 50.73(a)(2)(iv)(A) and as a loss of safety function in accordance with 10 CFR 50.73(a)(2)(v)(C) and 10 CFR 50.73(a)(2)(v)(D).

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

Respectfully,

A handwritten signature in blue ink, appearing to read "Paul Simmons", is written over a horizontal line.

Paul Simmons
Site Vice President
Watts Bar Nuclear Plant

Enclosure
cc: See Page 2

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cc (Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Watts Bar Nuclear Plant



LICENSEE EVENT REPORT (LER)

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1. FACILITY NAME

Watts Bar Nuclear Plant, Unit 1

2. DOCKET NUMBER

05000390

3. PAGE

1 OF 6

4. TITLE

Actuation of Turbine Driven Auxiliary Feedwater Pump Due to Loss of 6.9kV Shutdown Board

5. EVENT DATE

MONTH	DAY	YEAR
08	17	2017

6. LER NUMBER

YEAR	SEQUENTIAL NUMBER	REV NO.
2017	010	00

7. REPORT DATE

MONTH	DAY	YEAR
10	16	2017

8. OTHER FACILITIES INVOLVED

FACILITY NAME	DOCKET NUMBER
FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

1

<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 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)
<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)

10. POWER LEVEL

100

<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input 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 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 checked="" 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

Dean Baker, Licensing Engineer

TELEPHONE NUMBER (Include Area Code)

423-452-4589

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

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On August 17, 2017, at 1205 Eastern Daylight Time (EDT), the Watts Bar Nuclear Plant (WBN) lost power to the 1B-B 6.9kV Shutdown Board. The loss of power to this safety related bus resulted in an automatic start of the Unit 1 Turbine Driven Auxiliary Feedwater Pump (TDAFWP). Power to the 1B-B Shutdown Board (SDBD) was restored at 1505 EDT on August 17, 2017.

During the loss of power to the 1B-B SDBD, a reduction in containment and control rod drive mechanism cooling occurred. At 1233 EDT, lower containment average temperature exceeded Technical Specification (TS) limits, and TS 3.6.5 Condition A was entered for containment average air temperature not within limits. Lower containment average temperature was restored to within limits at 1525 EDT on August 17, 2017. This is reportable as a potential loss of safety function.

The cause of this event is mechanical vibration while closing a panel drawer resulting in actuation of protective relays that led to a loss of power. Clearances will require the relays involved in this event to be isolated during drawer movement to prevent a similar occurrence.

**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

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1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Watts Bar Nuclear Plant, Unit 1	05000390	2017	- 010	- 00

NARRATIVE**I. PLANT OPERATING CONDITIONS BEFORE THE EVENT**

Watts Bar Nuclear Plant (WBN) Unit 1 was at 100 percent rated thermal power (RTP) .

II. DESCRIPTION OF EVENT**A. Event Summary**

On August 17, 2017, at 1205 Eastern Daylight Time (EDT), the Watts Bar Nuclear Plant (WBN) lost power to the 1B-B 6.9kV Shutdown Board (SDBD){EIIS:SWGR}, which is part of the safety-related medium-voltage power system {EIIS:EB}. The loss of power to this safety related bus resulted in an automatic start of the Unit 1 Turbine Driven Auxiliary Feedwater Pump (TDAFWP){EIIS:P}. The motor driven AFW pumps (MDAFWPs) did not start and were not expected to start for this event. No other system actuations occurred as a result of loss of power to the 1B-B 6.9kV Shutdown Board. Power to the 1B-B SDBD was restored at 1505 EDT on August 17, 2017.

During the loss of power to the 1B-B SDBD, a reduction in containment and control rod drive mechanism cooling occurred. At 1233 EDT, lower containment average temperature exceeded Technical Specification (TS) limits, and TS 3.6.5 Condition A was entered for containment average air temperature not within limits. Lower containment average temperature was restored to within limits at 1525 EDT on August 17, 2017. This is reportable as a potential loss of safety function.

Other than several common Unit TSs having not been met, Unit 2 was not operationally impacted by the loss of power to the 1B-B Shutdown Board and remains in Mode 1 at 100% power.

This event is being reported to the Nuclear Regulatory Commission (NRC) under 10 CFR 50.73(a)(2)(iv)(A) as a valid safety system actuation and under 10 CFR 50.73(a)(2)(v)(C) and (D) as an event or condition that could have prevented fulfillment of a safety function.

B. Inoperable Structures, Components, or Systems that Contributed to the Event

No inoperable equipment contributed to this event.

C. Dates and Approximate Times of Occurrences

Events described below occurred on August 17, 2017.

Time	Event
1205	Power lost to 1B-B 6.9kV Shutdown Board. Entered multiple TS including 3.3.5 Loss of power to Diesel Generator (DG) start instrumentation, 3.3.6 Containment ventilation isolation instrumentation, 3.5.2 Emergency Core Cooling system (ECCS) Operating for one train inoperable, 3.8.4 DC Sources Operating for one vital DC electrical power subsystem inoperable, 3.8.7 Inverters Operating for one inverter channel inoperable, and 3.8.9 for Distribution Systems Operating for one or more AC electrical power distribution subsystems inoperable. The Unit 1 TDAFWP automatically starts on loss of power to the 1B-B Shutdown Board.
1206	Entered 0-AOI-43.02, Loss of U1 Train B Shutdown Boards.

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Watts Bar Nuclear Plant, Unit 1	05000390	2017	- 010	- 00

NARRATIVE

Time	Event
1233	Entered TS 3.6.5 Containment Air Temperature is not met.
1258	Entered TS 3.1.8, Rod Position Indication not met due to more than one Analog Rod Position Indication (ARPI) outside of +/-12 steps from group demand position due to increased containment temperatures. Entered LCO 3.0.3 due to no condition existing for more than one ARPI outside of limits.
1320	Authorized Work Order (WO) 118948922 to Troubleshoot 1B DG Potential Transformer (PT) and Degraded Voltage PT Drawers and Fuses.
1331	Crew briefed for 1-AOI-39, Rapid Load Reduction
1405	Entered TS 3.8.4 DC Sources Operating, Condition B due to expiration of TS 3.8.4 Condition A.
1432	Entered TS 3.7.5 AFW System is not met for Unit 1, one train AFW not operable due to taking the 1B-B MDAFWP to pull-to-lock (PTL) during 1B-B Shutdown board restoration.
1433	Entered TS 3.7.8, Essential Raw Cooling Water (ERCW) Systems is not met. One ERCW train inoperable due to taking E-B and G-B ERCW to PTL for 1B-B Shutdown board restoration.
1505	Re-energized the 1B-B Shutdown Board from offsite power in accordance with 0-AOI-43.02 and 0-SOI-211.02. TS 3.3.5, TS 3.3.6, TS 3.8.7, and TS 3.8.9 now met.
1525	TS 3.6.5 Containment Air Temperature is now met.
1542	TS 3.1.8, Rod Position Indication is now met. Exited TS Limiting Condition for Operation (LCO) 3.0.3 due to restoring ARPI to within limits.
1556	Exited TS 3.7.5, AFW system due to restoring 1B-B MDAFWP to operable.
1557	TS 3.5.2, ECCS Operating is now met due to restoring power to B train ECCS components.
1559	TS 3.7.8 ERCW Systems is now met due to restoring E-B and G-B ERCW pumps to Operable status.
1601	Exited 1-AOI-39
1758	Exited 1-AOI-43.02 after completion

D. Manufacturer and Model Number of Components that Failed During the Event

There were no failed components that contributed to this event.

E. Other Systems or Secondary Functions Affected

The loss of the 1B-B Shutdown board resulted in a reduction in containment cooling capability, which led to lower containment average temperature exceeding TS limits.

F. Method of discovery of each Component or System Failure or Procedural Error

The control room received multiple alarms due to the loss of the 1B-B 6.9kV SDBD.

G. Failure Mode and Effect of Each Failed Component

No actual equipment failures occurred during this event.

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NARRATIVE**H. Operator Actions**

Operator actions to recover from the loss of power to the 1B-B SDBD are described in Section II.C of this report.

I. Automatically and Manually Initiated Safety System Responses

The loss of power to the 1B-B SDBD led to the start of the TDAFWP.

III. CAUSE OF THE EVENT**A. The cause of each component or system failure or personnel error, if known.**

Due to an alignment condition of the EDG 1B PT drawer, an inordinate amount of force was required to be used during drawer closure. This action impacted connections in the protective relay PT drawer immediately above and adjacent to the EDG PT drawer such that it caused the protective relays to sense and respond to the loss of voltage to the 6.9kV SDBD 1B. Since the EDG 1B was out of service due to a component outage, the EDG 1B was not able to start and maintain voltage on the 6.9kV SDBD.

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

No human performance causes are attributed to this event.

IV. ANALYSIS OF THE EVENT

On August 17, 2017 at 1205 EDT, Unit 1 received multiple alarms due to the loss of the 6.9kV SDBD 1B. The EDG 1B did not re-energize the 6.9kV SDBD 1B due to being tagged out for maintenance. Restoration from the EDG 1B component outage was underway and the clearance involving the EDG 1B PT fuses was being worked.

After the Operators reinstalled the 1-FU-211-B7 fuses in panel 7 of 6.9kV SDBD 1B, an inordinate amount of force was required to close the EDG PT drawer. Panel 7 also contains a PT drawer directly above the EDG 1B PT drawer which is associated with the degraded and loss of voltage relays. The PT drawers contain fuses and stabbed electrical connectors such that proper seating of the drawer is required to complete the electrical circuit. When this extra force was applied to the EDG 1B PT drawer, the protective relay PT drawer directly above received enough vibration to sense an undervoltage/loss of voltage condition. The loss of voltage relays were found tripped and required resetting prior to restoration of the 6.9kV SDBD 1B. The type of jarring force applied to the EDG 1B PT draw was of a different frequency band than that associated with normal seismic events. Normal seismic events consist of a higher more rhythmic frequency which the Shutdown Boards are designed to withstand.

Upon the event of an undervoltage condition, the 6.9kV SDBDs are designed to trip all the board feeder breakers, start the EDG and then tie the board on to the EDG. Each 6.9kV SDBD is supplied by a physically and electrically separate EDG. During this event, the EDG 1B was under a component outage. The EDG 1B was unable to start due to a clearance in place, and the actuation of the loss of voltage protective relays prevented a transfer to the alternate feeder breaker for the 6.9kV SDBD 1B. The 6.9kV

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Watts Bar Nuclear Plant, Unit 1	05000390	2017	- 010	- 00

NARRATIVE

SDBD 1B normal feeder breaker, alternate feeder breaker, and associated protective relay scheme functioned as designed.

V. ASSESSMENT OF SAFETY CONSEQUENCES

From an accident standpoint, the most significant item was the increase in lower containment average temperature above the accident analysis assumptions (peak average indicated value of 121.3 degrees Fahrenheit). A review of the containment analysis indicates, for the normal 120 degree limit in lower containment, that the limiting pressure for a large break loss of coolant accident (LOCA) is 9.36 psig and limiting temperature is 235 degrees Fahrenheit. The small temperature increase above the lower containment temperature limit is expected to have a small impact that is within design limits. If the conclusion of the final evaluation is different, a supplement to this LER will be submitted.

During the event, TS 3.0.3 was entered for multiple ARPI being outside limits, which is a condition not addressed by TS 3.1.8. TS 3.0.3 was exited in less than three hours, which is well within the limit of seven hours before Mode 3 must be entered. All ARPI were restored to within limits, and no rod movement occurred during this event.

A risk review performed for this event indicated that the increase in core damage probability was less than 1E-6.

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

The 1A-A Shutdown board remained operable during this event.

- 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

The 1B-B Shutdown board, and associated components, were without power for about 3 hours.

VI. CORRECTIVE ACTIONS

This event was entered into the Tennessee Valley Authority (TVA) Corrective Action Program and is being tracked under Condition Report (CR) 1329397.

- A. Immediate Corrective Actions

Upon receiving alarms for a loss of shutdown board 1B-B, efforts commenced to manage the event and restore power to the 1B-B shutdown board. Power was restored approximately 3 hours after it was lost.

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NARRATIVE**B. Corrective Actions to Prevent Recurrence or to Reduce Probability of Similar Events Occurring in the Future**

During SDBD maintenance, the loss of voltage relays will be isolated as part of the clearance process to prevent a similar occurrence. Plant procedures associated with maintenance of the PT drawers will be revised to verify smooth opening and closing operation of the drawers.

VII. PREVIOUS SIMILAR EVENTS AT THE SAME SITE

On July 15, 2016, WBN Unit 1 reported a loss of voltage to the 1B-B 6.9kV Shutdown board in LER 390/2016-008. On May 17, 2016 while restoring from a plant modification, the feeder breakers for the 6.9kV Shutdown Board 1B-B tripped resulting in a loss of bus voltage. The feeder breakers tripped due to actuation of the loss of voltage relays in the shutdown board protective relay trip logic circuit resulting in separation of offsite power from the 6.9kV Shutdown Board 1 B-B. The cause was attributed to an inadequate process due to the order of AC and DC fuse restoration. While similar, the 2016 event was process related, and the 2017 event is attributed to mechanical vibration causing relay actuation.

VIII. ADDITIONAL INFORMATION

None.

IX. COMMITMENTS

None.