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

July 15, 2016

10 CFR 50.73

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

Watts Bar Nuclear Plant, Units 1 and 2
Facility Operating License No. NPF-90 and NPF-96
NRC Docket No. 50-390 and 50-391

Subject: **Licensee Event Report 390/2016-008-00, Emergency Diesel Generator Manual Start Due to Loss of Voltage on the 6.9kV Shutdown Board 1B-B**

This submittal provides Licensee Event Report (LER) 390/2016-008-00. This LER provides details concerning an emergency diesel generator manual start due to loss of voltage on the 6.9kV Shutdown Board 1B-B during installation of the new open phase protective relays. This report is being submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A).

Please direct any questions concerning this matter to Gordon Arent, WBN Licensing Director, at (423) 365-2004.

Respectfully,

Paul Simmons
Site Vice President
Watts Bar Nuclear Plant

Enclosure
cc: See Page 2

cc (Enclosure):

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

NRC FORM 366 (11-2015) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2018

LICENSEE EVENT REPORT (LER)

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4. TITLE

Emergency Diesel Generator Manual Start Due to Loss of Voltage on the 6.9kV Shutdown Board 1B-B

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
									Watts Bar Nuclear Plant, Unit 2	05000391
05	17	2016	2016	- 008	00	07	15	2016	FACILITY NAME N/A	DOCKET NUMBER N/A

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
Unit 1 - Mode 1 Unit 2 - Mode 3	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
Unit 1 - 100% Unit 2 - 0%	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
Robert Clark, Licensing Engineer	423-365-1818

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO				

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

On May 17, 2016, at 1630 hours while restoring from a plant modification related to installation of new protective relays designed to detect open phase conditions on the 6.9kV shutdown boards, 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 1B-B. The 1B-B emergency diesel generator did not auto start during this event because it was out of service due to planned maintenance.

In response to the loss of power on the 6.9kV Shutdown Board 1B-B, the operators immediately entered Abnormal Operating Instruction, 0-AOI-43.02, Loss of Unit 1 Train B Shutdown Boards, and manually started emergency diesel generators 1A-A, 2A-A, and 2B-B. All equipment operated properly. The emergency diesel generators were not required to be paralleled to their respective boards because offsite power was available.

Offsite power was restored to the 6.9kV Shutdown Board 1B-B at 1802 hours on May 17, 2016. Event Notification 51940 was issued May 17, 2016. This event is being reported pursuant to 10 CFR 50.73(a)(2)(iv)(A).

NRC FORM 366A U.S. NUCLEAR REGULATORY COMMISSION
(11-2015)

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2018

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Watts Bar Nuclear Plant, Units 1 and 2	05000390	2016	- 008	- 00

NARRATIVE

I. PLANT OPERATING CONDITIONS BEFORE THE EVENT

Watts Bar Nuclear Plant (WBN) Unit 1 was in Mode 1 at 100 percent rated thermal power. Unit 2 was in Mode 3 at zero percent rated thermal power.

II. DESCRIPTION OF EVENT

A. Event

On May 17, 2016, a clearance was issued in preparation of installing new protective relays designed to detect open phase (OP) conditions on the 6.9 kV Shutdown Board 1B-B {EIIS:BU}, which is part of the on-site electrical distribution system [EIIS:EA}. The work scope required that the OP relays {EIIS:46} be tied in parallel with the existing loss of voltage (LOV), degraded voltage (DV), and overvoltage (OV) relays. The OP relays, including the LOV, DV, and the OV relays are electronic relays that sense the 3 phase 6.9kV bus voltage through a common step down potential transformer (PT). The electronic relays require dc power to operate. This power is provided by the vital dc control circuit which is the same power supply that is used to energize the protective relay trip logic circuit for the 6.9kV Shutdown Board 1B-B.

Upon completion of work, the 6.9kV Shutdown Board 1B-B clearance was approved for removal. During restoration of dc control power, it was noted that the B-phase relays for the LOV (phase B-C), DV (phase B-C) and OV (phase A-C), did not reset while the other relays did. After trouble shooting, the decision was made to pull PK Test Block 1-PK-211-B17/4 to isolate the ac sensing voltage from the newly installed OP relays and eliminate any associated wiring as a possible cause for inability to reset the above relays. The PK test block is an isolation device for disconnecting the new OP relays from the PT secondary circuit. Upon removal of the PK test block at 1630, the 6.9kV Shutdown Board 1B-B immediately de-energized.

The loss of power was caused by the LOV relays that initiate the trip sequence to separate offsite power from the 6.9kV Shutdown Board. The 1B-B emergency diesel generator (EDG) did not auto start during this event because it was out of service due to planned maintenance.

In response to the loss of power on the 6.9kV Shutdown Board 1B-B, the operators immediately entered Technical Specifications (TS) Limiting Condition of Operation (LCO) 3.8.9, Distribution System - Operating, Action Condition A. The operators also entered Abnormal Operating Instruction, 0-AOI 43.02, Loss of Unit 1 Train B Shutdown Boards, and manually started EDGs 1A-A, 2A-A, and 2B-B. All equipment operated properly. The EDGs were not required to be paralleled to the boards because offsite power was available.

Offsite power was restored to the 6.9kV Shutdown Board 1B-B at 1802 hours on May 17, 2016.

This event is being reported pursuant to 10 CFR 50.73(a)(2)(iv)(A),for any event or condition that resulted in manual or automatic actuation of the emergency ac electrical power system as listed in 10 CFR 50.73(a)(2)(iv)(B), paragraph (8).

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

There were no additional structures, components or systems that contributed to this event.

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C. Dates and Approximate Times of Occurrences

Date	Time (EDT)	Event
05/17/16	1428	Clearance lifted to allow restoring protective relays to service.
05/17/16	1630	Loss of 6.9kV Shutdown Bd. 1B-B.
05/17/16	1630	Entered TS LCO 3.8.9, Action Condition A, One or more AC electrical power distribution subsystems inoperable.
05/17/16	1630	Entered 0-AOI-43.02, Loss of Unit 1 train B Shutdown Boards.
05/17/16	1630	Manually started EDGs 1A-A, 2A-A and 2B-B.
05/17/16	1630	Entered TS LCO 3.8.4, Action Condition A, One vital DC electrical subsystem inoperable.
05/17/16	1630	Entered TS LCO 3.7.11, Action Condition A, One CREATCS train inoperable.
05/17/16	1632	Entered TS LCO 3.7.8, Action Condition A, One ERCW train inoperable.
05/17/16	1802	Offsite power restored to 6.9kV Shutdown Bd. 1B-B.

D. Manufacturer and Model Number of Components that Failed

There were no component failures.

E. Other Systems or Secondary Functions Affected

No other systems or functions were affected.

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

The event was self-evident at the time the 6.9kV Shutdown Board 1B-B lost power.

G. Failure Mode and Effect of Each Failed Component

During restoration of dc control power, it was noted that the B-phase relays for the LOV (phase B-C), DV (phase B-C) and OV (phase A-C), did not reset while the other relays did. After trouble shooting, the decision was made to pull PK Test Block 1-PK-211-B17/4 to isolate the ac sensing voltage from the newly installed OP relays and eliminate any associated wiring as a possible cause for inability to reset the above relays. This action created a voltage transient on the PT secondary that caused the remaining LOV relays to trip. Once the protective relay trip logic for the LOV relays was satisfied the 6.9kV Shutdown Board 1B-B tripped isolating the bus from offsite power. This event was attributed to vulnerabilities in board restoration procedures due to reliance on the same dc control power fuses to isolate control power to both the sensing relays and the protective relay trip logic circuit.

H. Operator Actions

1. Operators entered TS LCO 3.8.9, Distribution System, Condition A, One or more AC electrical power distribution subsystems inoperable, for Units 1 and 2 with a Completion Time of 8 hours.

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2. Operators entered Abnormal Operating Instruction, 0-AOI-43.02, Loss of Unit 1 Train B Shutdown Boards, and manually started EDGs 1A-A, 2A-A, and 2B-B. All equipment operated properly. The EDGs were not required to be paralleled to the boards because offsite power was available.

3. Operators entered TS 3.8.4, Condition A, One vital DC electrical subsystem inoperable, for Units 1 and 2 due to Battery Board II voltage below 128VDC following loss of power. Operators transferred Battery Charger II normal power supply to the alternate supply within the required 2 hour Completion Time.

4. Operators entered TS 3.7.11, Condition A, One CREATCS train inoperable for Units 1 and 2. Entry was due to high oil temperature alarm on the B-train Main Control Room (MCR) Chiller following loss of power. Operators transferred control room cooling functions to the A-train MCR Chiller.

5. Operators entered TS 3.7.8, Condition A, One ERCW train inoperable for Units 1 and 2. Operators place B-train ERCW pumps E-B and G-B in the Stop Pull to Lock Position following loss of power to the 6.9kV Shutdown Bd. 1B-B. However, B-train ERCW pumps F-B and H-B were available because these pumps are powered by the 6.9kV Shutdown Bd. 2B-B which did not lose offsite power and the EDG 2B-B was operable.

III. CAUSE OF THE EVENT

A. The cause of each component or system failure or personnel error, if known.

There was no component or system failure or personnel error.

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

The cause was attributed to inadequate restoration procedures due to reliance on the same dc control power fuses to isolate control power to both the sensing relays and the protective relay trip logic circuit.

IV. ANALYSIS OF THE EVENT

As described in Section II.G, the LOV relays initiated the trip sequence to separate the offsite power circuits from the 6.9kV Shutdown Board 1B-B due to cycling dc and ac sensing voltage to the protective relays. When dc control power was restored, the B-phase LOV, DV, and OV relays were in the tripped state with the protective relay trip logic circuit enabled. When the PK test block was pulled during trouble shooting to remove the ac sensing voltage to the OP relays it created a voltage transient on the PT secondary circuit which caused the remaining LOV relays to trip. Once the 2 out of 3 trip logic for the LOV relays was satisfied the feeder breakers to the 6.9kV Shutdown Board 1B-B tripped isolating the bus from offsite power.

Based on discussion with the relay vendor the preferred sequence for restoring dc control power for the protective relays is to remove PK Test Block 1-PK-211-B7/7 from the protective relay trip logic circuit, restore dc control power (i.e., install dc control fuses), and then a final step to restore ac sensing voltage (i.e., install PT primary fuses). The above PK test block should not be reinstalled until all protective relays are verified reset (i.e., not tripped).

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V. ASSESSMENT OF SAFETY CONSEQUENCES

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

The design bases for the 6.9kV shutdown boards are that two shutdown boards within the same load group must be available to mitigate an accident on one unit and maintain the other non-accident unit in hot standby (Mode 3). There are two load groups A and B. Load group A is supported by 6.9kV Shutdown Boards 1A-A and 2A-A. Load group B is supported by 6.9kV Shutdown Boards 1B-B and 2B-B. Since a minimum of one load group (i.e., Shutdown Board 1A-A and 2A-A) was Operable, the design bases as defined in Chapters 8 and 15 of the Updated Final Safety Analysis Report (UFSAR) for the 6.9kV Shutdown Boards were met.

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. At the time of event WBN Unit 1 was in Mode 1 at 100 percent rated thermal power. WBN Unit 2 was in Mode 3.

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 6.9kV Shutdown Board 1B-B was inoperable for 1 hour and 32 minutes before offsite power was restored.

VI. CORRECTIVE ACTIONS

This event was entered into the Tennessee Valley Authority Corrective Action Program and is being tracked under Condition Report (CR) 1172243.

A. Immediate Corrective Actions

Operators entered Abnormal Operating Instruction, 0-AOI-43.02, Loss of Unit 1 Train B Shutdown Boards, and manually started EDGs 1A-A, 2A-A, and 2B-B. All equipment operated properly. The EDGs were not required to be paralleled to their respective shutdown boards because offsite power was available.

B. Corrective Actions to Prevent Recurrence

WBN will revise General Operating Instruction 0-GOI-7, Generic Equipment Operating Guidelines, to include general guidance for disabling and restoring the 6.9kV protective relay trip logic circuits.

VII. ADDITIONAL INFORMATION

A. Previous similar events at the same plant

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No previous similar events have occurred because the protective relays are not normally de-energized for any preventative maintenance. The configuration of de-energizing the relays was a requirement for installing the new open phase relays.

B. Additional Information

None.

C. Safety System Functional Failure Consideration

This event did not result in a safety system functional failure because as a minimum load group A (i.e., Shutdown Board 1A-A and 2A-A) were available to mitigate the design bases events described in the UFSAR for either Unit 1 or 2.

D. Scrams with Complications Consideration

There was no scram associated with this event.

VIII. COMMITMENTS

None.