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

June 13, 2016

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 391/2016-001-00, Loss of Automatic Containment Isolation for the Steam Generator Blowdown Sampling Lines**

This submittal provides Licensee Event Report (LER) 391/2016-001-00. This LER provides details concerning improper use of electrical jumpers that led to a loss of automatic containment isolation for the Steam Generator Blowdown Sampling Lines. This report is being submitted in accordance with 10 CFR 50.73(a)(2)(i)(B) and 10 CFR 50.73(a)(2)(vii).

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

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4. TITLE

Loss of Automatic Containment Isolation for the Steam Generator Blowdown Sampling 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	14	2016	2016	- 001	00	06	13	2016	N/A	N/A
									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)*			
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)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
0	☐ 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)*

From March 18, 2016, when Watts Bar Nuclear Plant Unit 2 first entered Mode 4 to April 14, 2016 with the plant in Mode 3, it was determined that a condition prohibited by Technical Specifications (TS) existed. During this time both automatic and manual closure of the containment isolation valves and the sample isolation valves for the Steam Generator Blowdown (SGBD) sampling lines were disabled due to improperly installed electrical jumpers in the valve control circuits. The misplaced jumpers bypassed the Phase A containment isolation signals, the auto/manual start signals for the Auxiliary Feedwater (AFW) pumps, and the control valve seal-in circuits. Containment isolation on a Phase A signal is used to control potential release of radioactive material to the environ in the event of a Design Bases Accident. The AFW pump auto/manual start signals are used to isolate the SGBD sampling lines to preserve steam generator inventory. The seal-in circuits are used to allow the operator to manually position the valves in either the open or closed position from the main control room. This event occurred prior to initial reactor criticality. There was no loss of safety function.

The isolation valves for the SGBD sample lines were returned to service on April 14, 2016. This event is being reported pursuant to 10 CFR 50.73(a)(2)(i)(B) and 10 CFR 50.73(a)(2)(vii)(B) and (C).

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LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

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NARRATIVE

I. PLANT OPERATING CONDITIONS BEFORE THE EVENT

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

II. DESCRIPTION OF EVENT

A. Event

On April 14, 2016, while maintenance was attempting to restore Unit 2 Steam Generator Blowdown (SGBD) {EIIS:KN} sampling lines to normal alignment, it was discovered that when the hand switches for the SGBD Sample Isolation Valves (SIVs) and the Containment Isolation Valves (CIVs) {EIIS:ISV} were taken to the close position, the valves momentarily indicated closed (green) and then immediately returned to the open position (red) when released. All affected valves had electrical jumpers incorrectly installed that bypassed the Phase A containment isolation signals, the auxiliary feedwater (AFW) system {EIIS:BA} pump auto/manual start signals and the control valve seal-in circuits. The jumpers were installed prior to entering Mode 4 in accordance with Chemistry procedure 2-CM-6.60, Steam Generator Sampling in Hot Sample Room (Modes 2-6), Rev 5. The affected valves are listed below:

Train-A Inboard SGBD SIVs	Train-B Outboard CIVs
2-FCV-43-54D	2-FCV-43-55
2-FCV-43-56D	2-FCV-43-58
2-FCV-43-59D	2-FCV-43-61
2-FCV-43-63D	2-FCV-43-64

Inboard containment isolation provisions for the SGBD Sampling System are provided by Train-A SIVs located in the closed system inside containment while outboard containment isolation is provided by the Train-B CIVs (listed above). The SIVs located inside containment are not CIVs. They are normally closed and only opened to obtain chemistry samples when required. However, to conserve SG level and to meet the single failure criteria the SIVs are designed to automatically close along with the outboard CIVs when the AFW pumps are running. The SIVs will also close on a Phase A containment Isolation Signal but this is a secondary function. Due to the misplaced jumpers, the inoperable outboard CIVs were in violation of Technical Specification (TS) 3.6.3. "Containment Isolation Valves," that require the CIVs to be Operable in Modes 1, 2, 3, and 4. The duration of inoperability was from March 18, 2016 (1832 EDT), when WBN Unit 2 first entered Mode 4, to April 14, 2016 (2234 EDT) when the isolation valves were returned to service. This event is being reported pursuant to 10 CFR 50.73(a)(2)(i)(B), "Any operation or condition which was prohibited by the plant's Technical Specifications,' and 10 CFR 50.73(a)(2)(vii)(B) and (C), "Common Cause Inoperability of Independent Trains or Channels."

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
03/18/16	1832	Entered Mode 4 with inoperable CIVs
03/30/16	1639	Entered Mode 3 with inoperable CIVs
04/02/16	0453	Re-entered Mode 4 with inoperable CIVs
04/08/16	0527	Re-entered Mode 3 with inoperable CIVs
04/14/16	1700	Maintenance discovered CIVs for the SGBD sampling lines inoperable with plant in Mode 3. Entered LCO 3.6.3, Condition C.
04/14/16	2234	Exited TS LCO 3.6.3, Condition C.

D. Manufacturer and Model Number of Components that Failed

There were no component failures. The inoperable CIVs were due to human error.

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 failure of the CIVs to close was discovered during attempts by maintenance to restore SGBD sample lineup.

G. Failure Mode and Effect of Each Failed Component

The inability to close the CIVs for the SGBD sampling lines was due to improper installation of the electrical jumpers used in the valve control circuits. The misplaced jumpers not only bypassed the AFW pump auto/manual start signal but also the Containment Phase A Isolation signal and the control valve seal-in circuit. Bypassing the control valve seal-in circuits caused the valves to immediately return to the open position when the hand switches were released from the closed position. Bypassing the seal-in circuits defeated the ability to manually close the CIVs from the main control room.

H. Operator Actions

Upon identifying the failure to close the CIVs for the SGBD sampling lines, (TS) Limiting Condition for Operation (LCO) 3.6.3, Condition C, "One or more penetration flow paths with one containment isolation valve inoperable," was entered.

I. Automatically and Manually Initiated Safety System Responses

The condition described in this report did not result in any automatic or manual safety systems activation.

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III. CAUSE OF THE EVENT

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

The inability to automatically or manually close the SIVs and the CIVs for the SGBD sampling lines was due to improper installation of the jumpers used in the valve control circuits. The misplaced jumpers not only bypassed the AFW pump running contacts but also the Containment Phase A Isolation signals and the control valve seal-in circuits. Bypassing the control valve seal-in circuits is the reason why the valves immediately returned to the open position when the hand switches were released from the closed position.

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

Chemistry procedure 2-CM-6.60, Revision 5, specified the wrong terminal points for bypassing the AFW pump auto/start signals. This event was attributed to a lack of procedural compliance for safety related systems, along with a lack of peer checking, during the procedure revision process. In particular, Revision 5 was not coordinated with the Electrical Engineering Group prior to implementation. Lack of formal procedure preparer training and inadequate system knowledge contribute to procedure noncompliance.

IV. ANALYSIS OF THE EVENT

During plant operation, SG samples for each steam generator are taken every 72 hours to verify primary to secondary leakage is within limits. When the AFW System is in service, flow paths that could result in a loss of SG inventory are isolated, including SG blowdown and SG sampling. To obtain a representative sample, 11 liters of sample must be purged through the sample line. The sample flowrate for each SG is approximately 8 gallons per hour (gph). In Mode 1, with AFW secured, a SG sample can be taken without the use of jumpers. To allow a SG sample to be taken in Modes 2-4 when the AFW is in service, jumpers are installed around the open contacts for the AFW pumps using chemistry procedure 2-CM-6.60. These jumpers allow the SIVs and the CIVs for the SGBD sampling lines to remain open with the AFW pumps running, but will not prevent the isolation of the sample flow path from a Phase A containment isolation signal. On March 14, 2016, when attempting to restore the Unit 2 SGBD sampling lines to normal alignment, the hand switches for the SIVs and CIVs were placed in the closed position, the valves momentarily indicated closed (green) and then immediately returned to the open position (red) when released. At that time it was determined that the jumpers were not properly installed.

The CIVs for the SGBD sampling lines are required to be Operable per TS in Modes 1-4. With the jumpers improperly installed, the CIVs were disabled. The SGBD Sampling System for Unit 2 credits a closed system inside containment as the first containment boundary with automatic isolation valves located outside containment as the second containment boundary. While the CIVs in question were prevented from automatic closure, the closed system inside containment remained operable and manual flow control valves located downstream of the defeated outboard CIVs were available to provide redundant isolation if necessary. Accordingly, the containment isolation safety function was not lost. However, defeating the automatic and manual closure of the outboard CIVs represents a condition prohibited by TS.

The SIVs and the CIVs in the SGBD sampling lines also serve as redundant isolation valves to prevent potential loss of SG inventory that could impact the AFW function following an accident or plant

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transient. As discussed above manual flow control valves located downstream of the defeated outboard CIVs were available to isolate the SGBD sampling lines if required. In addition, SG inventory loss due to sampling, when in use, is small (8 gph). With the AFW in service and no decay heat on Unit 2, the ability to shut down the reactor and maintain a safe shutdown condition was not impacted. With no core decay heat, removal of residual heat is not an issue. With no irradiated fuel in the Unit 2 core, an uncontrolled release of radioactive material is not credible. The small loss of SG inventory would not have adversely impacted the ability to mitigate the consequences of an accident. However, the loss of both trained isolation valves represent a common cause inoperabilty of independent trains.

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 WBN Unit 2 design credits a closed system inside containment as the first containment boundary with automatic isolation valves located outside containment as the second containment boundary. While the disabled CIVs prevented automatic and manual isolation of the SGBD sampling lines, a containment isolation boundary for the closed system inside containment remained operable for mitigating Design Bases Accidents. In addition, flow control valves (FSV-43-60A, B, C, and D) downstream of the CIVs were available to manually isolate the SGBD sampling lines to maintain containment integrity and preserve SG inventory if necessary.

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

SG inventory loss due to sampling, when in use, is small (8 gph). With AFW in service and no decay heat on Unit 2, the ability to shut down the reactor and maintain a safe shutdown condition was not impacted. With no core decay heat, removal of residual heat is not an issue. With no irradiated fuel in the Unit 2 core, an uncontrolled release of radioactive material is not credible, The small loss of SG inventory would not have adversely impacted the ability to mitigate the consequences of an accident.

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 containment isolation valves for the SGBD sampling lines were discovered to be inoperable on April 14, 2016 at approximately 1700 EDT and were returned to service on April 14, 2016 at 2234 EDT, which was approximately 5 hours and 34 minutes.

VI. CORRECTIVE ACTIONS

This event was entered into the Tennessee Valley Authority Corrective Action Program and is being tracked under condition report (CR) 1160910.

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A. Immediate Corrective Actions

The electrical jumpers were removed and the SIVs and the CIVs were returned to service.

B. Corrective Actions to Prevent Recurrence

Revised Procedure 2-CM-6.60, "Steam Generator Sampling in Hot Sample Room (Modes 2-6)," to incorporate revised jumper control and appropriate departmental procedure reviews. The effectiveness of this corrective action will be assessed at the conclusion of the Unit 2 Power Ascension Testing. This assessment will determined whether the procedure revisions correctly performed the intent of 2-CM-6.60.

VII. ADDITIONAL INFORMATION

A. Previous similar events at the same plant

On March 21, 2008, with Watts Bar Unit 1 in Mode 3 it was discovered that jumpers installed to block the Safety Injection (SI) automatic actuation logic in the Sold State Protection System had not been removed. The jumpers were installed during Cycle 8 Refueling Outage in accordance with Instrument Maintenance Instruction ((IMI) 99.040. The SI automatic actuation function is required in Modes 1, 2, 3, and 4 per TS 3.3.2, Table 3.3.2-1, Function 1.b. Upon discovery the plant entered TS LCO 3.0.3.

With the plant in Modes 3 and 4, both trains of the SI automatic actuation logic were rendered inoperable for approximately 33 hours and 38 minutes. The event was reported under NRC Event Notification Number 44085. The event was attributed to a combination of both procedural inadequacy (i.e., the step removing the jumper did not required verification) and personnel error.

B. Additional Information

None.

C. Safety System Functional Failure Consideration

This condition did not result in a safety system functional failure because a containment isolation boundary for the closed system inside containment remained operable and was capable of mitigating a Design Bases Accident. Additional flow control valves located downstream of the defeated CIVs were available to isolate the SGBD sampling lines to maintain containment integrity and to preserve SG inventory if the AFW pumps were required to mitigate a design bases event.

D. Scrams with Complications Consideration

There was no scram associated with this event.

VIII. COMMITMENTS

None.