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

June 26, 2018

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 390/2018-002-01, Shield Building Inoperability Due to Annulus Vacuum Transient**

This submittal provides Licensee Event Report (LER) 390/2018-002-01. This LER supplement provides details concerning a condition where spurious equipment operation resulted in the shield building pressure limits exceeding Technical Specification allowed values. This condition is being reported as an event that could have prevented fulfillment of a safety function in accordance with 10 CFR 50.73(a)(2)(v).

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

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 (02-2018) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 03/31/2020

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.

1. Facility Name	2. Docket Number	3. Page
Watts Bar Nuclear Plant, Unit 1	05000390	1 OF 6

4. Title

Shield Building Inoperability Due to Annulus Vacuum Transient

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
01	17	2018	2018	- 002	- 01	06	26	2018	N/A	05000
									Facility Name	Docket Number
										05000

9. Operating Mode	11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*			
1	☐ 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)
100	☐ 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)
Dean Baker, Licensing Engineer	423-452-4589

13. Complete One Line for each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable to ICES	Cause	System	Component	Manufacturer	Reportable to ICES
X	VC	RLY	BAILEY	Y	X	VC	PMC	BAILEY	Y

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 14 single-spaced typewritten lines)

At 2002 Eastern Standard Time (EST) on January 17, 2018, Watts Bar Nuclear Plant Unit 1 annulus differential pressure went outside its pressure limit. At that time, the Shield Building was declared inoperable requiring entry into Technical Specification 3.6.15 Limiting Condition for Operation (LCO), Conditions A and B. Action was taken by field operators to swap annulus vacuum control dampers due to slow system response to restore annulus differential pressure. At 2024 EST, annulus differential pressure was restored to required limits, the Shield Building was declared operable, and TS 3.6.15 LCO, Conditions A and B were exited. This is being reported as an event or condition that could have prevented fulfillment of a safety function.

Investigation revealed that an Emergency Gas Treatment System (EGTS) operational test on January 12, 2018, resulted in an abnormal damper configuration which contributed to this event. Following the event, tuning was performed on the actuator for control damper 1-PCO-65-49, however an equipment cause could not be confirmed. After a pressure transient on April 3, 2018 additional corrective actions were completed for 1-PCO-65-49 which included replacement of the actuator pneumatic relay and controller. The procedure for performance of the EGTS operational test will be revised to include restoration steps. Lessons learned from this event will be addressed in licensed operator training.

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.
Watts Bar Nuclear Plant, Unit 1	05000390	2018	- 002	- 01

NARRATIVE

I. PLANT OPERATING CONDITIONS BEFORE THE EVENT

Watts Bar Nuclear Plant (WBN) Unit 1 was at 100 percent rated thermal power (RTP) . WBN Unit 2 was also at 100 percent RTP and was unaffected by this event.

II. DESCRIPTION OF EVENT

A. Event Summary

At 2002 Eastern Standard Time (EST) on January 17, 2018, WBN Unit 1 annulus differential pressure went outside its pressure limit. At that time, the Shield Building {EIIS:NH} was declared inoperable requiring entry into Technical Specification (TS) 3.6.15, Limiting Condition for Operation (LCO) Conditions A and B. Action was taken by field operators to swap annulus vacuum control system {EIIS:VC} dampers {EIIS:CDMP} due to slow system response to restore annulus differential pressure. At 2024 EST, annulus differential pressure was restored to required limits, the Shield Building was declared operable, and TS LCO 3.6.15, Conditions A and B were exited.

This event is being reported to the Nuclear Regulatory Commission (NRC) 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 needed to control the release of radioactive material and mitigate the consequences of an accident.

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

Debris found in a subcomponent of the damper positioner likely contributed to this event.

C. Dates and Approximate Times of Occurrences

Date	Time (EST)	Event
1/12/18	1405	Commenced 0-SI-65-6-A, Emergency Gas Treatment System Train A Operational Test
1/12/18	1406	Received alarms for annulus differential pressure low (less than -5.5 inches (in.) water gauge (w.g.)). The pressure transient resulted in one of two differential pressure setpoints required to auto swap from the normal annulus control dampers to the backup. This resulted in both dampers 1-PCO-65-93 and 1-PCO-65-94 left in the open position and both control dampers in service (not a normal configuration)
1/12/18	1500	0-SI-65-6-A completed, Train A Emergency Gas Treatment System (EGTS) restored to operable status.
1/17/18	2002	TS LCO 3.6.15 entry due to Annulus Differential Pressure (DP) less than the TS required of -5.5 in. w.g.
1/17/18	2017	Operations placed backup annulus control damper in service (time is approximate)
1/17/18	2024	Exited TS LCO 3.6.15 Condition A and B due to Annulus DP being restored to greater than -5.5 in. w.g.

On April 3, 2018, annulus vacuum was found lowering, and operations personnel transferred vacuum control to the backup control damper. Subsequent troubleshooting of 1-PCO-65-49 required the replacement of the positioner pneumatic-relay and the actuator controller.

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

No equipment failures were found following the January 17, 2018 event. Following a pressure transient on April 3, 2018, two components were replaced. The pneumatic relay {EIIS:RLY} within the positioner was found to contain foreign material. The pneumatic relay is manufactured by Bailey, Part number AP21100. The Bailey actuator controller {EIIS:PMC} was also replaced, part number 549215JAKL1PAF.

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

Plant alarms indicated that shield building vacuum was less than required.

G. Failure Mode and Effect of Each Failed Component

No equipment failure was found following the January 17, 2018 event.

H. Operator Actions

Upon receipt of the alarms, operations personnel responded in accordance with operating procedures.

I. Automatically and Manually Initiated Safety System Responses

Not applicable. While operators swapped the annulus vacuum control dampers, this is not a safety related system.

III. CAUSE OF THE EVENT

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

No equipment failures were found following the January 17, 2018 event, so an equipment cause cannot be confirmed. Following an annulus vacuum transient on April 3, 2018, the actuator positioner pneumatic relay and the actuator controller were found failed.

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

No human performance root causes are attributable to this event.

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Watts Bar Nuclear Plant, Unit 1	05000390	2018	- 002	- 01

NARRATIVE

IV. ANALYSIS OF THE EVENT

The WBN containment design includes a free standing steel pressure vessel surrounded by a reinforced concrete shield building. The shield building is maintained at a negative pressure of greater than -5 inches w.g. as required by TS during normal operation by the annulus vacuum control system, which is not safety-related. To address instrument uncertainty, the operations alarm for the shield building is set at -5.5 in. w.g. The annulus vacuum control system consists, in part of redundant paths for pressure control, each of which include an isolation damper (1-PCO-65-93 and 1-PCO-65-94) and a control damper (1-PCO-65-48 and 1-PCO-65-49) to maintain the shield building vacuum at a setpoint of -6.2 in. w.g. (see simplified sketch). In the event of an accident, the safety-related Emergency Gas Treatment System (EGTS) {EIIS:BH} would filter the exhaust from the shield building, reducing the offsite dose to members of the public and to control room operators from postulated leakage of the containment pressure vessel.

The design of the EGTS is that it is capable of achieving an acceptable negative pressure in the shield building annulus assuming the annulus is not at a negative pressure. While the annulus is normally expected to be at a negative pressure relative to atmospheric, the dose analysis conservatively assumes the annulus is at atmospheric pressure at event initiation. After blowdown, the annulus pressure will increase rapidly due to expansion of the containment vessel as a result of primary containment atmosphere temperature and pressure increases. The annulus pressure will continue to rise due to heating of the annulus atmosphere by conduction through the containment vessel. After a delay, the EGTS operates to maintain the annulus pressure below atmospheric pressure. Review of data traces for this event indicate that the annulus pressure went as low as approximately -4.6 inches w.g which bounds the analysis limit of atmospheric pressure.

Accordingly, while the shield building was outside its normal pressure limits, the safety function of the shield building to limit dose to the public and to control room operations personnel was not lost.

On January 12, 2018, a surveillance test was performed on Train A EGTS. During this test, a pressure transient occurred that was allowed by the test which resulted in opening the isolation dampers of both annulus vacuum control paths, which is an abnormal configuration. This also resulted in both associated modulating dampers controlling annulus vacuum in a near fully closed position. An alarm was received during the pressure transient, but was not treated as valid by the operating staff and the related alarm response procedure was not entered.

On January 17, 2018, a plant assistant unit operator recognized that both annulus vacuum control dampers were in service and closed isolation damper 1-PCO-65-94 to restore the annulus vacuum system to the normal operating alignment. The control room was not notified of this configuration change. Because both trains of modulating dampers were fully closed at this time to maintain setpoint (-6.2 in. w.g.), annulus pressure initially went more negative than normal and the modulating damper 1-PCO-65-49 overcorrected, resulting in a reduction in annulus vacuum below that required by TS 3.6.15. When the assistant operator isolated the backup control damper, the plant response was not as expected, and the unit supervisor directed swapping to the backup control dampers to restore pressure. The slow response of damper 1-PCO-65-49 contributed to this event.

On April 3, 2018, annulus vacuum was found lowering, and operations personnel transferred vacuum control to the backup control damper. Subsequent troubleshooting of 1-PCO-65-49 required the replacement of the positioner pneumatic-relay and the actuator controller.

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NARRATIVE

V. ASSESSMENT OF SAFETY CONSEQUENCES

As described in the previous section, the safety function of the shield building to mitigate a design basis accident was not lost. Therefore the consequences of this event are low.

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

Both trains of EGTS 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 shield building was outside of its normal allowed negative pressure for approximately 22 minutes, however the shield building could still perform its safety function.

VI. CORRECTIVE ACTIONS

This event was entered into the Tennessee Valley Authority (TVA) Corrective Action Program and is being tracked under Condition Reports (CRs) 1378357, 1387151, 1395914, 1397625, and 1414833.

A. Immediate Corrective Actions

Operations personnel took prompt action to restore shield building vacuum to greater than 5 inches w.g. by swapping to the backup control damper. The dampers associated with the Unit 1 annulus vacuum control system were tuned to provide better response during a system transient.

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

The positioner pneumatic relay and the controller associated with damper 1-PCO-65-49 were replaced. Operations personnel involved in this event were coached on the need to follow alarm response procedures and to communicate with control room staff when damper configuration changes are performed. The EGTS Operational test procedures will be revised to include steps to restore proper damper configuration for annulus vacuum control at the completion of testing. Lessons learned from this event will be addressed in licensed operator training.

VII. PREVIOUS SIMILAR EVENTS AT THE SAME SITE

LER 390/2017-008 reported an event where shield building vacuum was less than -5 inches w.g. due to spurious equipment operation. As described above, no actual loss of safety function capability occurred

because the safety function of the EGTS to reduce radiological dose is performed even if the shield building is not at a vacuum.

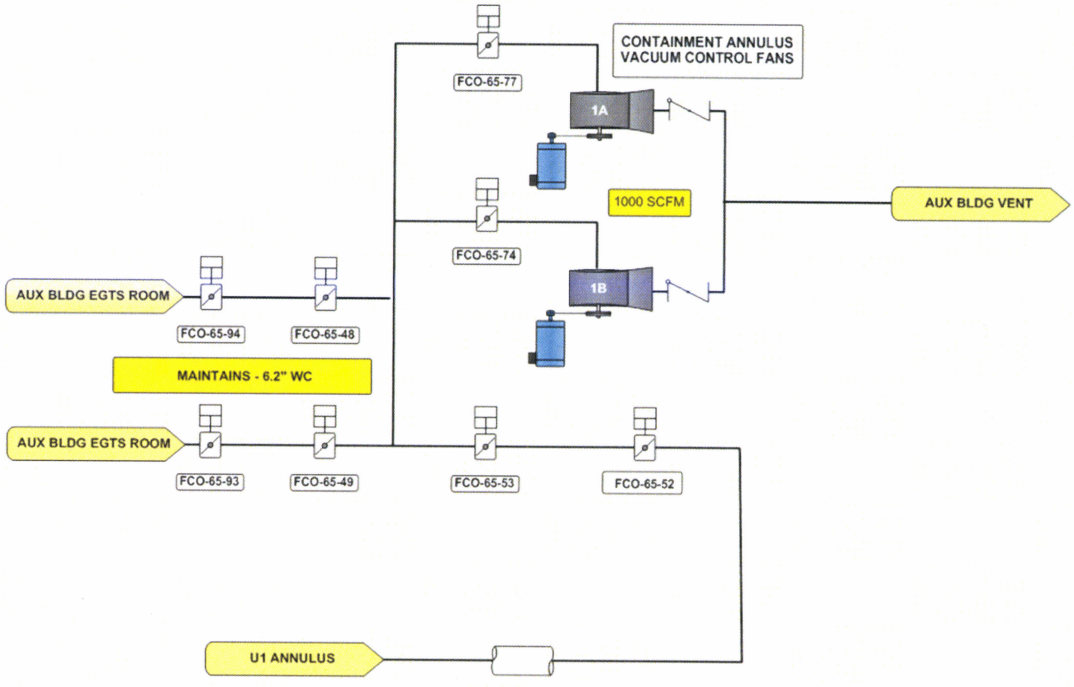
LER 390/2017-007 reported a number of events in the past three years where shield building vacuum was less than -5 inches w.g. These events were the result of either unexpected plant response during Unit 2 power ascension testing or were the result of equipment failures. As described above, no actual loss of safety function capability occurred because the safety function of the EGTS to reduce radiological dose is performed even if the shield building is not at a vacuum.

VIII. ADDITIONAL INFORMATION

None.

IX. COMMITMENTS

None.



Annulus Vacuum Control Simplified Sketch