



Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

March 21, 2016

10 CFR 50.73

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

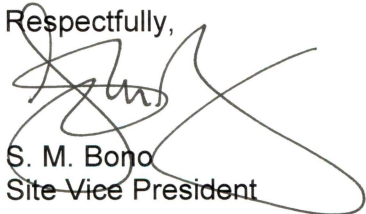
Browns Ferry Nuclear Plant, Unit 3
Renewed Facility Operating License No. DPR-68
NRC Docket No. 50-296

Subject: **Licensee Event Report 50-296/2016-001-00**

The enclosed Licensee Event Report provides details of the inoperability of the 3A Residual Heat Removal (RHR) Pump for longer than allowed by the Technical Specifications, and concurrent inoperability of 3B and 3D RHR Pumps. The Tennessee Valley Authority (TVA) is submitting this report in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 50.73(a)(2)(i)(B), as any operation or condition which was prohibited by the plant's Technical Specifications, and 10 CFR 50.73(a)(2)(v)(B) and (D), as an event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to remove residual heat and mitigate the consequences of an accident.

There are no new regulatory commitments contained in this letter. Should you have any questions concerning this submittal, please contact J. L. Paul, Nuclear Site Licensing Manager, at (256) 729-2636.

Respectfully,

A handwritten signature in black ink, appearing to be 'S. M. Bono', is written over the typed name and title.

S. M. Bono
Site Vice President

Enclosure: Licensee Event Report 50-296/2016-001-00 – Inoperable Residual Heat Removal Pump Results in Condition Prohibited by Technical Specifications and Safety System Functional Failure

cc (w/ Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant


ENCLOSURE

**Browns Ferry Nuclear Plant
Unit 3**

Licensee Event Report 50-296/2016-001-00

**Inoperable Residual Heat Removal Pump Results in Condition Prohibited by Technical Specifications
and Safety System Functional Failure**

See Enclosed

NRC FORM 366 (11-2015)		U.S. NUCLEAR REGULATORY COMMISSION			APPROVED BY OMB: NO. 3150-0104		EXPIRES: 10/31/2018					
 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 FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet 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 Browns Ferry Nuclear Plant, Unit 3					2. DOCKET NUMBER 05000296		3. PAGE 1 OF 7					
4. TITLE Inoperable Residual Heat Removal Pump Results in Condition Prohibited by Technical Specifications and Safety System Functional Failure												
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	19	2016	2016	- 001	- 00	03	21	2016	N/A	N/A		
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 type="checkbox"/> 50.73(a)(2)(iv)(A)		<input type="checkbox"/> 50.73(a)(2)(x)	
79			<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 checked="" 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 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 checked="" 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 Baruch Calkin, Licensing Engineer								TELEPHONE NUMBER (Include Area Code) (256) 614-7180				
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			
E	BO	43	G080	Y	N/A	N/A	N/A	N/A	N/A			
14. SUPPLEMENTAL REPORT EXPECTED <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO					15. EXPECTED SUBMISSION DATE							
					MONTH DAY YEAR N/A N/A N/A							
ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)												
<p>On January 19, 2016, at approximately 1100 Central Standard Time (CST), during troubleshooting of the Main Control Room (MCR) green light indication on the 3A Residual Heat Removal (RHR) Pump Motor Breaker Transfer Switch (MBTS), it was discovered that the 3A RHR Pump MBTS had malfunctioned, potentially preventing the pump from starting from the MCR. The 3A RHR Pump was declared inoperable. On January 20, 2016, at approximately 0030 CST, the 3A RHR Pump was declared operable following replacement of the 3A RHR Pump MBTS.</p> <p>A Past Operability Evaluation concluded that the 3A RHR Pump was inoperable from January 9 to January 20, 2016, exceeding the Technical Specification allowed outage time. During this time, the 3B and 3D RHR Pumps were also inoperable on January 14, 2016, from 0127 to 0215 CST, resulting in a Safety System Function Failure. A Probabilistic Risk Assessment determined there was a negligible increase in risk.</p> <p>The cause of this event was failure of the transfer switch to fully latch due to binding resulting from the MBTS being installed greater than its twenty-one year service life with no Preventative Maintenance (PM) performed. Corrective actions include verifying similar transfer switches are latched in the NORMAL position on BFN, Units 1, 2, and 3, and creating a PM activity with a replacement schedule for these switches.</p>												

NRC FORM 366A
(11-2015)

U.S. NUCLEAR REGULATORY COMMISSION

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LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

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1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
Browns Ferry Nuclear Plant, Unit 3	05000296	YEAR	SEQUENTIAL NUMBER	REV NO.
		2016	- 001	- 00

NARRATIVE

I. Plant Operating Conditions Before the Event

At the time of discovery, Browns Ferry Nuclear Plant (BFN), Unit 3, was operating in Mode 1 at approximately 79 percent rated thermal power. BFN, Units 1 and 2, were unaffected by this event.

II. Description of Events

A. Event:

On January 13, 2016, Operations personnel identified the MCR green light indication located above the 3A Residual Heat Removal (RHR)[BO] Pump handswitch was not illuminated. The light bulb was replaced but the light remained extinguished. A work order was initiated. Operations verified correct light indications locally at the breaker.

On January 19, 2016, at approximately 1100 Central Standard Time (CST), during troubleshooting of the Main Control Room (MCR) green light indication on the 3A RHR Pump Motor Breaker [BKR] Transfer Switch (MBTS)[43], it was discovered that the 3A RHR Pump MBTS, 3-43-074-0005, had malfunctioned potentially preventing the pump from starting from the MCR. Contacts [CNTR] 4-4C in the MBTS were found to be open, creating an open circuit. Operations personnel declared 3A RHR Pump inoperable.

On January 20, 2016, at approximately 0030 CST, Operations personnel declared 3A RHR Pump operable following replacement of 3A RHR Pump MBTS.

A Past Operability Evaluation (POE) was performed for the 3A RHR Pump. The POE concluded that the 3A RHR Pump was inoperable from January 9, 2016, to January 20, 2016, exceeding the Technical Specification allowed outage time. During this time, 3B and 3D RHR Pumps were inoperable on January 14, 2016, from 0127 to 0215 CST, resulting in a Safety System Functional Failure.

B. Status of structures, components, or systems that were inoperable at the start of the event and that contributed to the event:

No inoperable systems, structures, or components contributed to this event.

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NARRATIVE**C. Dates and approximate times of occurrences:**

January 9, 2016, at 1500 CST	Operations personnel completed RHR System piping flushes. This was the last time the 3A RHR Pump MBTS was known to have been in the correct position.
January 14, 2016, at 0127 CST	Operations personnel declared 3B and 3D RHR Pumps inoperable for planned system flush.
January 14, 2016, at 0215 CST	Operations personnel declared 3B and 3D RHR Pumps operable.
January 19, 2016, at 1100 CST	During troubleshooting of MCR green light indication, the 3EA 4kV Shutdown Board was inspected. It was identified that contacts 4-4C were not making good contact, creating an open circuit. Operations personnel declared 3A RHR Pump inoperable.
January 20, 2016, at 0030 CST	Operations personnel declared 3A RHR Pump operable following replacement of 3A RHR Pump MBTS.

D. Manufacturer and model number (or other identification) of each component that failed during the event:

The failed component during this event was a General Electric (GE) SB-1 switch. The part number is 16SB1RB2A11LSM2V.

E. Other systems or secondary functions affected:

There were no other systems or secondary systems affected.

F. Method of discovery of each component or system failure or procedural error:

On January 13, 2016, Operations personnel identified the MCR green light indication located above the 3A RHR pump handswitch was not illuminated. The light bulb was replaced but the light remained extinguished. A work order was initiated. Operations verified correct light indications locally at the breaker.

On January 19, 2016, Maintenance personnel discovered that Contacts 4-4C were open while troubleshooting MCR green light indication on the 3A RHR Pump MBTS.

G. The failure mode, mechanism, and effect of each failed component, if known:

This event was the result of age-related degradation of the MBTS, which rendered the switch unable to fully latch in the correct position.

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H. Operator actions:

In response to indication that the 3A RHR Pump was not functional, Operations personnel took the following actions:

- Declared 3A RHR Pump inoperable
- Declared 3A RHR Pump operable following troubleshooting and replacement of switch by Electrical Maintenance Personnel, and exited TS LCOs

I. Automatically and manually initiated safety system responses:

No safety system responses resulted from this event.

III. Cause of the event

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

The direct cause of this event was the opening of Contacts 4-4C in the 3A RHR Pump Motor Breaker MBTS. With the MBTS in the NORMAL position, Contacts 4-4C should be closed. Contacts 4-4C opened unexpectedly due to the MBTS not being placed in the fully latched condition when in the NORMAL position.

The apparent cause of this event was binding resulting from the MBTS being installed greater than its twenty-one year service life with no Preventative Maintenance (PM) performed.

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

At the time of the event, no PM tasks existed to periodically replace GE SB-1 switches that are classified as Critical/Non-Critical Components and are "maintained" type switches (i.e., not spring return type switches). Additionally, no PM was performed on the MBTS because vendor manual guidance cautions against the use of any lubricants and/or cleaning agents in any form (including aerosol sprays commonly available) for GE transfer switches.

IV. Analysis of the event:

The Tennessee Valley Authority (TVA) is submitting this report in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 50.73(a)(2)(i)(B), as any event or condition which was prohibited by the plant's TS, and 10 CFR 50.73(a)(2)(v)(B) and (D), as an event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to remove residual heat and mitigate the consequences of an accident.

This event was the result of 3A RHR Pump Motor Breaker MBTS failing to latch in the NORMAL position due to binding in the ball detent and position sprocket mechanism. This binding resulted from the MBTS being installed greater than its twenty-one year service life with no preventive maintenance performed on the switch. This led to a situation where 3A RHR Pump was potentially

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NARRATIVE

unable to automatically start, or manually start from the Control Room.

A POE determined that 3A RHR Pump was inoperable from January 9, 2016 at 1335 CST until January 20, 2016 at 0030 CST. TS LCO 3.5.1 requires that, in Modes 1, 2, and 3, each Emergency Core Cooling System (ECCS) injection/spray subsystem and the Automatic Depressurization System (ADS) function of six safety/relief valves shall be operable. High Pressure Coolant Injection (HPCI)[BJ] and ADS valves are not required to be operable with reactor steam dome pressure less than or equal to 150 pounds per square inch gauge (psig). Required Action A.1 requires, with one required ECCS injection/spray subsystem inoperable, that the required ECCS injection/spray subsystem be restored to operable status within seven days. Required Action B requires Unit 3 to be in Mode 3 within twelve hours and Mode 4 within thirty-six hours if the Required Actions and associated Completion Times of Condition A are not met. 3A RHR Pump, credited as a required low pressure ECCS injection/spray subsystem, was inoperable for approximately eleven days. Therefore, BFN, Unit 3, was in violation of Required Actions A.1 and B.

The Low Pressure Coolant Injection (LPCI) function of RHR requires two operable pumps in order to fill the Reactor Vessel to at least two-thirds of its height during an accident. 3B and 3D RHR Pumps were inoperable on January 14, 2016, from 0127 to 0215 CST. During the time when 3B and 3D RHR pumps were inoperable concurrently with 3A, the BFN, Unit 3, Residual Heat Removal System (RHRS) would have been incapable of performing this safety function.

V. Assessment of Safety Consequences

This event resulted in BFN, Unit 3, 3A RHR Pump being inoperable for longer than allowed by the TS. The ability of the system to automatically start or manually start from the MCR was affected. At no time was the system known to have lost the capability to respond to a local manual start signal.

The safety objectives of the RHRS are as follows:

- To restore and maintain the coolant inventory in the reactor vessel so that the core is adequately cooled after a loss-of-coolant accident. The RHRS also ensures cooling for the pressure suppression pool for condensation of steam resulting from the blowdown due to a design basis loss-of-coolant accident.
- To further extend the redundancy of the Core Standby Cooling Systems by providing for containment cooling.

The Low Pressure Coolant Injection function of the RHRS is designed to reflood the reactor vessel to at least two-thirds core height and to maintain this level. During the period where 3A, 3B, and 3D RHR Pumps were inoperable, this function was not available.

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A Probabilistic Risk Assessment was performed during the period of 3A RHR inoperability, and found that the change in Incremental Core Damage Probability and the change in Incremental Large Early Release Probability for the time period that the system was inoperable correspond to a negligible increase in risk (2.69E-08 and 2.45E-09, respectively). Based on the above, TVA has concluded that, during the time period that 3A RHR Pump was inoperable, there was no significant risk to the health and safety of the public or plant personnel for this event.

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

During this event, 3A RHR Pump retained the ability to manually start from pump motor breaker 3-BKR-74-5, on 3EA 4KV Shutdown Board. Additionally, all required ADS valves and at least one Core Spray (CS)[BG] Loop remained operable at all times.

B. For events that occurred when the reactor was shut down, availability of systems or components needed to shut down the reactor and maintain safe shutdown conditions, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident:

This event did not occur when the reactor was shut down.

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

This event resulted in inoperability of the RHR Pump for approximately eleven days, from the last time the MBTS was known to have been in the correct position on January 9, 2016, until the time the pump was returned to service on January 20, 2016.

VI. Corrective Actions:

Corrective Actions (CA) are being managed by TVA's Corrective Action Program (CAP) under Condition Report (CR) 1126697. The CAs addressing this condition are described below:

1. Verify similar SB-1 transfer switches are latched in the NORMAL position on BFN, Units 1, 2, and 3.
2. Create a PM activity to periodically replace GE SB-1 transfer switches similar to the 3A RHR Pump MBTS on a 20 year frequency.

VII. Additional Information:

A. Previous Similar Events:

A review of the BFN CAP and Licensee Event Reports (LERs) for Units 1, 2, and 3 revealed two similar events over the last three years:

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LER 50-296/2014-003-00 describes a RHR SDC Inboard Suction Valve Isolation Relay [RLY] which was rendered inoperable for longer than allowed by TS due to improper landing of leads during PM. The event is similar because an improperly connected wire resulted in a long period of inoperability for a safety system. CAs were to develop and deliver a case study to the Maintenance, Modifications, and Operations departments based on the details of this event, and to inspect HFA relay terminations.

LER 50-260/2015-001-00 describes a failure of the 2A RHR Pump to manually start from the control room due to a loose terminal wire. The event is similar because an improperly latched hand switch resulted in a long period of inoperability for a safety system. Corrective Actions for this event were to discipline the individuals responsible, to tighten the loose fastener, and to revise maintenance instructions to reduce the probability of recurrence.

CAs from these LERs would not have prevented this event.

B. Additional Information:

There is no additional information.

C. Safety System Functional Failure Consideration:

The safety function of RHRS is to restore and maintain the coolant inventory in the reactor vessel so that the core is adequately cooled after a loss-of-coolant accident. During the concurrent inoperability of 3A, 3B, and 3D RHR Pumps, the BFN, Unit 3, RHRS was unable to perform its safety function to remove residual heat and mitigate the consequences of an accident. Therefore, in accordance with guidance in NUREG-1022, this event is considered a safety system functional failure.

D. Scram with Complications Consideration:

This event did not result in a reactor scram.

VIII. COMMITMENTS

There are no new commitments.