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

August 31, 2020

10 CFR 50.73
10 CFR 50.4(a)

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

Browns Ferry Nuclear Plant, Unit 2
Renewed Facility Operating License No. DPR-52
NRC Docket No. 50-260

Subject: **Licensee Event Report 50-260/2020-001-00 – Core Spray System Inoperable for Longer than Permitted by Technical Specifications**

The enclosed Licensee Event Report provides details of the inoperability of the Core Spray system for longer than allowed by plant Technical Specifications. The Tennessee Valley Authority 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. The TVA is also submitting this report in accordance with 10 CFR 50.73(a)(2)(v)(D), as an event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to 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, Site Licensing Manager, at (256) 729-2636.

Respectfully,

S. M. Bono
Site Vice President

Enclosure: Licensee Event Report 50-260/2020-001-00 – Core Spray System Inoperable for Longer than Permitted by Technical Specifications

NRC FORM 366 (08-2020) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 08/31/2023

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LICENSEE EVENT REPORT (LER)

1. Facility Name	2. Docket Number	3. Page
Browns Ferry Nuclear Plant, Unit 2	05000260	1 OF 8

4. Title

Core Spray System Inoperable for Longer than Permitted by Technical Specifications

5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved	
Month	Day	Year	Year	Sequential Number	Revision No.	Month	Day	Year	Facility Name	Docket Number
07	01	2020	2020	- 001 -	00	08	31	2020	N/A	05000260
									Facility Name	Docket Number
									N/A	05000 N/A

9. Operating Mode	10. Power Level
1	100

11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*

10 CFR Part 20	☐ 20.2203(a)(2)(vi)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(A)	**10 CFR Part 73**
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.69(g)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(4)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(i)	**10 CFR Part 21**	☒ 50.73(a)(2)(i)(B)	☒ 50.73(a)(2)(v)(D)	☐ 73.77(a)(1)
☐ 20.2203(a)(2)(ii)	☐ 21.2(c)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(i)
☐ 20.2203(a)(2)(iii)	**10 CFR Part 50**	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)	☐ 73.77(a)(2)(ii)
☐ 20.2203(a)(2)(iv)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)	
☐ 20.2203(a)(2)(v)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)	

☐ **OTHER** (Specify here, in abstract, or NRC 366A).

12. Licensee Contact for this LER

Licensee Contact	Phone Number (Include area code)
Ryan Coons, Licensing Engineer	256-729-2070

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

Cause	System	Component	Manufacturer	Reportable to IRIS	Cause	System	Component	Manufacturer	Reportable to IRIS
X	BM	FAN	B343	Y	N/A	N/A	N/A	N/A	N/A

14. Supplemental Report Expected)		15. Expected Submission Date	Month	Day	Year
☒ No	☐ Yes (If yes, complete 15. Expected Submission Date		N/A	N/A	N/A

16. Abstract (Limit to 1560 spaces, i.e., approximately 15 single-spaced typewritten lines)

On July 1, 2020, the motor thermal overloads associated with the 2A Core Spray Room Cooler Fan were found tripped during a surveillance test. The breaker was not tripped, and was found still in the "on" position. Operators reset the thermal overloads, which restarted the room cooler fans without resetting the breaker. The thermal overloads were replaced on July 2, 2020.

After a recurrent trip on July 6, 2020, troubleshooting determined that mechanical binding within the motor sporadically increased the running current, which tripped the thermal overloads. An engineering evaluation later determined that the non-functional Core Spray Room Cooler Fan rendered the Loop I Core Spray subsystem inoperable from May 29, 2020 until July 12, 2020, which is longer than allowed by Technical Specification (TS) 3.5.1, “Emergency Core Cooling Systems (ECCS) -- Operating”. On June 13, 2020 a planned surveillance rendered the Loop II Core Spray System inoperable. This resulted in a period of time with both Loops I and II of the Core Spray System concurrently inoperable resulting in a Safety System Functional Failure (SSFF) of systems that are needed to mitigate the consequences of an accident.

As a corrective action, the motor, thermal overloads, temperature switch, and starter coil were replaced. As a corrective action to prevent recurrence, BFN is creating a new Preventative Maintenance (PM) to measure the motor current readings to the thermal overloads every two years, during the summer months when the fan is in high use. This will detect possible changes in continuous running current prior to overcurrent trips or motor damage.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Browns Ferry Nuclear Plant, Unit 2	05000260	2020	- 001	- 00

NARRATIVE

I. Plant Operating Conditions Before the Event

At the time of discovery, Browns Ferry Nuclear Plant (BFN) Unit 2 was in Mode 1 at approximately 100 percent power.

II. Description of Event

A. Event Summary

On July 1, 2020, at 2240 Central Daylight Time (CDT), the motor thermal overloads [TS] associated with the 2A Core Spray Room Cooler Fan (BFN-2-FAN-064-0072) [FAN] were found tripped during the performance of a surveillance test. This trip prevented the fan from starting. The breaker [BKR] was not tripped, and was found still in the "on" position. This resulted in the inoperability of the 2A and 2C Core Spray pumps [P], which the fan supported, and rendered the Loop I Core Spray system inoperable. Operators were dispatched to reset the thermal overloads, and the room cooler fans started without resetting the breaker. The thermal overloads were replaced on July 2, 2020 at 2010 CDT. An engineering evaluation determined that the thermal overload replacement provided a reasonable assurance of restoring and maintaining operability in the absence of contrary information.

After a recurrent trip on July 6, 2020, the breaker was reset and instrumentation was installed to determine the cause of the trip. This additional troubleshooting determined that mechanical binding within the motor [MO] was sporadically increasing the running current, and tripping the thermal overloads. This challenged the previous assumption of operability. An engineering evaluation later determined that the 2A Core Spray Room Cooler Fan had been inoperable since May 29, 2020.

Operators declared the 2A Core Spray Room Cooler functional, and the 2A and 2C Core Spray pumps and Loop I Core Spray system operable on July 12, 2020, after replacing the motor, thermal overloads, temperature switch, and starter coil.

Technical Requirement Manual (TRM) 3.3.3.2, Low Pressure ECCS Area Cooler Instrumentation, states that the non-functionality of the Core Spray Area Cooler Fan Thermostat Instrument Channel is a requirement for Core Spray system [BM] operability. Additionally, Technical Specification (TS) 3.5.1, ECCS – Operating, requires that each Emergency Core Cooling System (ECCS) injection/spray subsystem shall be operable when BFN, Unit 2 is in Modes 1, 2 and 3.

An engineering evaluation determined that the Low Pressure ECCS Area Cooler Instrumentation was non-functional between May 29, 2020 and July 12, 2020, and incapable of performing its required safety function. This resulted in the inoperability of the 2A and 2C Core Spray pumps, which rendered the BFN, Unit 2 Loop I Core Spray system inoperable for longer than permitted by TS 3.5.1.

NARRATIVE

On June 6, 2020, Unit 2 entered Mode 4 to begin Unit 2 Forced Outage 7 (F207), to address unrelated challenges involving high temperatures in the Low Pressure Turbine Hood. On June 7, 2020, the Unit 2 Loop II Core Spray system was declared inoperable from 1240 CDT to 1255 CDT for routine surveillance testing. Both Core Spray subsystems were inoperable during this time, and could not have performed their required safety function. By entering Mode 2, BFN, Unit 2 entered a TS 3.5.1 Applicable Mode when LCO TS 3.5.1 Required Actions were not met, which is contrary to the requirements of TS LCO 3.0.4. During the June 11, 2020 surveillance, two or more low pressure ECCS spray subsystems were inoperable while in Mode 1. TS LCO 3.5.1, Condition H required an immediate entry into TS LCO 3.0.3. This Required Action was unmet.

On June, 13, 2020, the Unit 2 Loop II Core Spray system was declared inoperable from 0257 CDT to 0315 CDT for routine surveillance testing. Both Core Spray subsystems were inoperable during this time, and could not have performed their required safety function.

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

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

On June 7, 2020, and again on June 13, 2020, Operators declared the Unit 2 Loop II Core Spray system inoperable for routine surveillance testing. This rendered both Core Spray subsystems inoperable, unable to perform their required safety function.

NARRATIVE

C. Dates and approximate times of occurrences

Dates	Occurrence
May 29, 2020	Operators performing a routine surveillance test found that the 2A Core Spray Room Cooler Fan thermal overloads had tripped. The Operators reset the thermal overloads. The Loop I Core Spray subsystem was determined to be operable, based on the evidence which was available at the time.
June 6, 2020	Unit 2 entered Mode 4 to begin F207.
June 10, 2020	Unit 2 entered Mode 2 after completing F207.
June 13, 2020	The Loop II Core Spray system was inoperable from 0257 CDT to 0315 CDT for routine surveillance testing.
July 1, 2020	During a surveillance test, Operators found that the 2A Core Spray Room Cooler Fan thermal overloads had tripped. The Operators reset the thermal overloads.
July 2, 2020	2A Core Spray Room Cooler Fan thermal overloads were replaced.
July 6, 2020	Operators declared the 2A Core Spray Room Cooler non-functional after failing to autostart in response to elevated room temperatures. Manual start attempts also failed, rendering the Loop I Core Spray system inoperable. The thermal overloads had tripped again. Troubleshooting revealed motor binding caused abnormally high starting current.
July 12, 2020	The 2A Core Spray Room Cooler was declared functional after the completion of repair work and their associated post-maintenance tests.
July 17, 2020	An engineering evaluation determined that the non-functional 2A Core Spray Room Cooler caused the inoperability of the Loop I Core Spray system from May 29, 2020 until July 12, 2020.

D. Manufacturer and model number of each component that failed during the event

The failed component was a fan manufactured by the Bohn Aluminum and Brass Corporation, model number HCS-221LF.

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

The 2A Core Spray Room Cooler Fan motor failure was discovered while troubleshooting the thermal overloads, which were found tripped after failing to respond to automatic and manual start signals, despite previous resets and replacements.

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

Troubleshooting determined that the 2A Core Spray Room Cooler Fan failed due to mechanical binding within its motor. This binding was sporadically increasing the running current, and tripping the thermal overloads. A motor bearing inner race looseness issue caused the bearing to spin on motor shaft after motor began producing heat, and the resulting increase in motor current caused overcurrent trips on the motors thermal overloads. This motor bearing issue persisted because it was not detectable from monitoring vibration data.

H. Operator actions

There were no operator actions associated with this event.

I. Automatically and manually initiated safety system responses

There were no automatic or manual safety system responses associated with this event.

III. Cause of the event

A. Cause of each component or system failure or personnel error

Troubleshooting determined that the 2A Core Spray Room Cooler Fan failed due to mechanical binding within its motor. This binding sporadically increased its running current, which tripped the thermal overloads.

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

No human performance related root causes were identified.

IV. Analysis of the event

BFN, Unit 2 TS LCO 3.5.1 requires that each ECCS injection/spray subsystem and the six Automatic Depressurization System (ADS) safety/relief valves shall be operable during Mode 1; and in Modes 2 and 3, excluding the high pressure coolant injection (HPCI) system and the ADS valves, which are not required when the reactor steam dome pressure is less than or equal to 150 psig. If one low pressure ECCS injection/spray subsystem becomes inoperable, or one low

pressure coolant injection (LPCI) pump in both LPCI subsystems becomes inoperable, Required Action A.1 requires restoring the affected low pressure ECCS injection/spray subsystem(s) to operable status within 7 days.

The recurrent thermal overload failures invalidated the previous presumptions of operability, and the Unit 2 Loop I Core Spray system was later determined to have been inoperable from May 29, 2020 to July 12, 2020, which is longer than permitted by TR 3.3.3.2 and TS 3.5.1.

Unit 2 Loop II Core spray system was removed from service on June 7, 2020, and again on June 13, 2020, to perform surveillance testing. Each test lasted approximately 15 minutes. During these tests, neither Core Spray system was available to perform their required safety function to mitigate the consequences of an accident.

TS LCO 3.0.4 states that when an LCO is not met, entry into a Mode or other specified condition in the Applicability shall only be made when the associated actions to be entered permit continued operation in the Mode or other specified condition in the Applicability for an unlimited period of time. On June 10, 2020, following the completion of a forced outage to address unrelated challenges involving high temperatures in the Low Pressure Turbine Hood, BFN, Unit 2 entered a TS 3.5.1 Applicable Mode when LCO TS 3.5.1 Required Actions were not met. Therefore, Unit 2 was in violation of TS 3.0.4 when Mode 2 was entered on June 10, 2020.

During the June 13, 2020 surveillance, two or more low pressure ECCS spray subsystems were inoperable while in Mode 1. TS LCO 3.5.1, Condition H required an immediate entry into TS LCO 3.0.3. This Required Action was unmet.

V. Assessment of Safety Consequences

The 2A Core Spray Room Cooler Fan would not have performed its specified safety function to maintain the ambient air temperature in the area of the ECCS motors below 148 degrees F in an accident condition. Both automatic start functions to respond to pump starts and high room temperatures were affected. The 2A Core Spray Room Cooler Fan would not have met its mission time of 30 days. Therefore, the Core Spray 2A and 2C pump motors could not perform their specified safety functions while the room cooler was unavailable in an accident condition, and were declared inoperable.

A Probabilistic Risk Assessment (PRA) evaluation has determined that having the air cooling unit subsystem affected by this event (2-ACU-064-0072) unavailable for 44 days results in an Incremental Conditional Core Damage Probability (ICCDP) of 4.08-07, and a Total Incremental Conditional Large Early Release Probability (ICLERP) of 6.71E-10. These risk estimates indicate a Green significance. Based on the above, the TVA has concluded that the increase in risk was small, and posed no threat to the protection of the health and safety of the public.

NARRATIVE

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

Each BFN Unit contains two independent Core Spray subsystems, and the Unit 2 Loop II Core Spray system was unaffected by this event.

However, on June 7, 2020, and again on June 13, 2020, the Unit 2 Loop II Core spray system was removed from service to perform surveillance testing. Each test lasted approximately 15 minutes. During these tests, neither Core Spray system was available to perform their required safety function in response to an accident.

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

On June, 7, 2020, during F207, the Unit 2 Loop II Core Spray system was declared inoperable from 1240 CDT to 1255 CDT for routine surveillance testing. Both Core Spray subsystems were inoperable during this time, and could not have performed their required safety function.

When two or more low pressure ECCS spray subsystems are inoperable while in Mode 4, TS LCO 3.5.2, Condition C requires immediately suspending any Operations with the Potential to Drain the Reactor Vessel, and to restore one ECCS spray subsystem to operable status within 4 hours. This Required Action was met.

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

The Unit 2 Loop I Core Spray system was inoperable for approximately 44 days from the time of inoperability, and 12 days from the time of discovery.

VI. Corrective Actions

The Corrective Actions for this event were entered into the TVA's corrective action program under Condition Reports (CRs) 1612226, 1620331, 1620905, 1621239.

A. Immediate Corrective Actions

The motor, thermal overloads, temperature switch, and starter coil were replaced.

B. Corrective Actions to Prevent Recurrence or to reduce the probability of similar events occurring in the future

BFN is creating a new Preventative Maintenance to measure the motor current readings to the thermal overloads every two years, during the summer months when the fan is in high use. This will prevent reoccurrence for motor and thermal overload trips by detecting possible changes in continuous running current prior to overcurrent trips or motor damage.

VII. Previous Similar Events at the Same Site

A search of BFN Units 1, 2, and 3 LERs for the last five years identified no LERs associated with Core Spray Room Cooler Fan failures. A review of CRs and WOs did not identify any issues with operability in the past 3 years. All previous predictive maintenance monitoring over the last 3 years indicated that the motor's performance was satisfactory.

VIII. Additional Information

There is no additional information.

IX. Commitments

There is no additional information.