



Post Office Box 2000, Decatur, Alabama 35609-2000

July 11, 2022

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 3
Renewed Facility Operating License No. DPR-68
NRC Docket No. 50-296

Subject: **Licensee Event Report 50-296/2022-001-00 – Main Steam Relief Valves Lift Settings Outside of Technical Specifications Required Setpoints**

The enclosed Licensee Event Report provides details of the inoperability of Main Steam Relief Valves 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 50.73(a)(2)(i)(B), as any operation or condition which was prohibited by the plant's Technical Specifications.

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

Respectfully,

A handwritten signature in black ink, appearing to read "Matthew Rasmussen", is written over a horizontal line.

for Matthew Rasmussen
Site Vice President

Enclosure: Licensee Event Report 50-296/2022-001-00 – Main Steam Relief Valves Lift Settings Outside of Technical Specifications Required Setpoints

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cc (w/ Enclosure):

NRC Regional Administrator - Region II

NRC Senior Resident Inspector - Browns Ferry Nuclear Plant

NRC Project Manager - Browns Ferry Nuclear Plant

NRC FORM 366 (08-2020)		U.S. NUCLEAR REGULATORY COMMISSION		APPROVED BY OMB: NO. 3150-0104		EXPIRES: 08/31/2023	
 LICENSEE EVENT REPORT (LER)				<small>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, Library, and Information Collections Branch T-6 A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollections.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk ail: oira_submission@omb.eop.gov. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.</small>			
1. Facility Name Browns Ferry Nuclear Plant, Unit 3				2. Docket Number 05000296		3. Page 1 OF 7	
4. Title Main Steam Relief Valves Lift Settings Outside of Technical Specifications Required Setpoints							
5. Event Date			6. LER Number			7. Report Date	
Month	Day	Year	Year	Sequential Number	Revision No.	Month	Day
05	10	2022	2022	- 001 -	00	07	11
						8. Other Facilities Involved	
						Facility Name N/A	Docket Number 05000 N/A
						Facility Name N/A	Docket Number 05000 N/A
9. Operating Mode 1				10. Power Level 100			
11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: (Check all that apply)							
<input type="checkbox"/> 10 CFR Part 20		<input type="checkbox"/> 20.2203(a)(2)(vi)		<input type="checkbox"/> 50.36(c)(2)		<input type="checkbox"/> 50.73(a)(2)(iv)(A)	
<input type="checkbox"/> 20.2201(b)		<input type="checkbox"/> 20.2203(a)(3)(i)		<input type="checkbox"/> 50.46(a)(3)(ii)		<input type="checkbox"/> 50.73(a)(2)(v)(A)	
<input type="checkbox"/> 20.2201(d)		<input type="checkbox"/> 20.2203(a)(3)(ii)		<input type="checkbox"/> 50.69(g)		<input type="checkbox"/> 50.73(a)(2)(v)(B)	
<input type="checkbox"/> 20.2203(a)(1)		<input type="checkbox"/> 20.2203(a)(4)		<input type="checkbox"/> 50.73(a)(2)(i)(A)		<input type="checkbox"/> 50.73(a)(2)(v)(C)	
<input type="checkbox"/> 20.2203(a)(2)(i)		<input type="checkbox"/> 10 CFR Part 21		<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)		<input type="checkbox"/> 50.73(a)(2)(v)(D)	
<input type="checkbox"/> 20.2203(a)(2)(ii)		<input type="checkbox"/> 21.2(c)		<input type="checkbox"/> 50.73(a)(2)(i)(C)		<input type="checkbox"/> 50.73(a)(2)(vii)	
<input type="checkbox"/> 20.2203(a)(2)(iii)		<input type="checkbox"/> 10 CFR Part 50		<input type="checkbox"/> 50.73(a)(2)(ii)(A)		<input type="checkbox"/> 50.73(a)(2)(viii)(A)	
<input type="checkbox"/> 20.2203(a)(2)(iv)		<input type="checkbox"/> 50.36(c)(1)(i)(A)		<input type="checkbox"/> 50.73(a)(2)(ii)(B)		<input type="checkbox"/> 50.73(a)(2)(viii)(B)	
<input type="checkbox"/> 20.2203(a)(2)(v)		<input type="checkbox"/> 50.36(c)(1)(ii)(A)		<input type="checkbox"/> 50.73(a)(2)(iii)		<input type="checkbox"/> 50.73(a)(2)(ix)(A)	
<input type="checkbox"/> OTHER (Specify here, in abstract, or NRC 366A).							
12. Licensee Contact for this LER							
Licensee Contact Ryan Coons, Licensing Engineer						Phone Number (Include area code) 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
B	SB	RV	T020	N	N/A	N/A	N/A
14. Supplemental Report Expected)							
<input checked="" type="checkbox"/> No				<input type="checkbox"/> Yes (If yes, complete 15. Expected Submission Date			
				15. Expected Submission Date			
				Month Day Year N/A N/A N/A			
16. Abstract (Limit to 1560 spaces, i.e., approximately 15 single-spaced typewritten lines)							
<p>On May 10, 2022, the Tennessee Valley Authority was notified of As-Found testing results that four Main Steam Relief Valves (MSRVs) from Browns Ferry Nuclear Pant (BFN), Unit 3 were outside the +/- 3 percent set-point band required for operability.</p> <p>More than the one allowed MSRV was considered to be inoperable during the entire operating cycle and longer than permitted by Technical Specifications. During this time, BFN Unit 3 made entries into Modes of Operation that were not allowed under this condition. The affected valves remained capable of maintaining reactor pressure within the American Society of Mechanical Engineers code limits.</p> <p>It was determined that the MSRVs failed due to corrosion bonding to the valve seats and non-quantifiable leakage known as simmering. All thirteen of the MSRV pilot valves were replaced during the Unit 3 spring 2022 refueling outage. The Boiling Water Reactor Owners' Group is continuing to work toward a solution to improve the quality and adhesion of the platinum coating on the discs.</p>							

**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

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1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Browns Ferry Nuclear Plant, Unit 3	05000-296	2022	- 001	- 00

NARRATIVE**I. Plant Operating Conditions before the Event**

At the time of discovery, Browns Ferry Nuclear Plant (BFN) Unit 3 was in Mode 1 at approximately 100 percent power.

II. Description of Event**A. Event Summary**

On May 10, 2022, NWS Technologies notified the Tennessee Valley Authority (TVA) with the as found testing results of the thirteen Main Steam Relief Valves (MSRVs) [RV], which were removed during the spring 2022 Unit 3 Refueling Outage 20 (U3R20). Four MSRVs (BFN-3-PCV-001-0004, BFN-3-PCV-001-0022, BFN-3-PCV-001-0034, and BFN-3-PCV-001-0041) had as found lift settings which were outside of the +/- 3 percent band of their setpoints required for operability.

Technical Specification (TS) 3.4.3, Safety/Relief Valves (S/RVs), requires twelve of the thirteen S/RVs to be operable for S/RV system [SB] operability. The four MSRVs were found to have been inoperable for an indeterminate period of time during the entire operating cycle between March 25, 2020, and February 26, 2022, and longer than permitted by TS 3.4.3.

Throughout this event, the two stage MSRV pilot valves remained capable of maintaining the reactor pressure below 1375 pounds per square inch gauge (psig), which is the American Society of Mechanical Engineers (ASME) code limit of 110 percent of the vessel design pressure. The valves remained capable of performing 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.

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

There were no structures, systems, or components (SSCs) whose inoperability contributed to this event.

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

Dates and Approximate Times	Occurrence
March 25, 2020	Unit 3 entered Mode 2, beginning Fuel Cycle 20 (U3C20).
April 2, 2020	Unit 3 entered Mode 4 following a manual scram to address excessive drywell leakage.
April 3, 2020	Unit 3 entered Mode 2 and commenced startup.
April 4, 2020	Unit 3 entered Mode 4 following a manual scram to allow corrective maintenance on the 3A Recirc Pump.
April 5, 2020	Unit 3 entered Mode 2 and commenced startup.
February 26, 2022	Unit 3 entered Mode 4 for U3R20.
May 10, 2022	NWS Technologies notified the TVA with as-found testing results of the thirteen Unit 3 MSRV pilot valves removed during U3R20.

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

The failed components were all Target Rock Corporation two stage pressure control valves, model number 7567F.

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 MSRV failures were discovered at NWS Technologies during their as found testing of the thirteen MSRV two stage pilot valves which were removed during U3R20.

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

MSRVs BFN-3-PCV-001-0004, BFN-3-PCV-001-0022, BFN-3-PCV-001-0034, and BFN-3-PCV-001-0041 failed due to corrosion bonding to the valve seats and non-quantifiable leakage known as simmering.

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NARRATIVE**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**

MSRVs BFN-3-PCV-001-0004, BFN-3-PCV-001-0022, BFN-3-PCV-001-0034, and BFN-3-PCV-001-0041 failed due to corrosion bonding to the valve seats and non-quantifiable leakage known as simmering. As a result of corrosion bonding, the force required to break the crystal structure of the corrosion bond alters the mechanical setpoint of the pilot valve. This issue is commonly known to the industry as set point drift. Simmering valves results in mechanical setpoint drift and is generally the result of low stellite in the seat.

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 3 TS Limiting Condition for Operation (LCO) 3.4.3 requires twelve Operable S/RVs during Modes 1, 2, and 3. If one or more required S/RVs become inoperable, Required Action A.1 requires entering Mode 3 within 12 hours and Required Action A.2 requires entering Mode 4 within 36 hours. S/RV Operability requires that S/RVs be within a +/- 3 percent band of their setpoint values in accordance with Surveillance Requirement (SR) 3.4.3.1. BFN Unit 3 has thirteen MSRVs to satisfy this requirement with margin.

When tested, the following four S/RVs were outside the allowable +/- 3 percent band.

<u>S/RV ID Number</u>	<u>Setpoint (psig)</u>	<u>Test Result (psig)</u>	<u>Difference (Percent)</u>
BFN-3-PCV-001-0004	1155	1200	+ 3.9
BFN-3-PCV-001-0022	1145	1259	+10.0
BFN-3-PCV-001-0034	1135	1180	+ 4.0
BFN-3-PCV-001-0041	1155	1202	+ 4.1

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Prior to startup from U3R20, all thirteen MSRV pilot valves were replaced with refurbished valves which were certified to lift within +/- 1 percent of their setpoint. Operating Experience has shown that Target Rock two stage MSRV setpoint drift is not a uniform, linear process. The corrosion bonding increases at a random rate. Without an accurate and reliable model for predicting or estimating the setpoint drift development, the point in time where the setpoint exceeded the +/- 3 percent limit cannot be reliably determined. Since this drift occurred during the operating cycle when the MSRVs were installed, MSRVs BFN-3-PCV-001-0004, BFN-3-PCV-001-0022, BFN-3-PCV-001-0034, and BFN-3-PCV-001-0041 are conservatively considered to be inoperable for an indeterminate period of time between March 25, 2020, and February 26, 2022. More than one MSRV was considered to be inoperable during the entire operating cycle and longer than permitted by TS 3.4.3.

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 two separate occasions (April 3, 2020 and April 5, 2020) BFN, Unit 3 entered a TS 3.4.3 Applicable Mode when LCO TS 3.4.3 Required Actions were not met. Therefore, BFN, Unit 3 was in violation of TS 3.0.4.

V. Assessment of Safety Consequences

System availability was not impacted by this event. The failure of the MSRV pilot valves to meet their TS 3.4.3 specified mechanical setpoints did not impact their remote manual operation or activation through the MSRV Automatic Actuation Logic, since these operating modes and functions rely upon electrically signaled control air solenoids to open the MSRV pilot valves.

TS Bases 3.4.3 states that the overpressure protection system must accommodate the most severe pressurization transient. The MSRVs remained capable of maintaining the reactor pressure below 1375 psig, which is the ASME code limit (110 percent of the vessel design pressure). The valves remained capable of performing their required safety function.

Based on the above, the TVA has concluded that sufficient systems were available to provide the required safety functions needed to protect the health and safety of the public.

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 operating unit has a non-safety related, electrical logic system (MSRV Actuation Logic) installed, which provides defense in depth against MSRV setpoint drift by electrically opening MSRV groups based upon setpoints at 1135 psig, 1145 psig, and 1155 psig. Therefore, during a reactor pressure transient event, the four 1135 psig group MSRVs, followed by the four 1145 psig group MSRVs, and finally the five 1155 psig group MSRVs

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NARRATIVE

would receive an electrical open signal, providing a defense in depth function to allow the valves to perform their safety function.

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

This event did not occur when the reactor was shutdown.

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

TS 3.4.3 requires twelve of the thirteen S/RVs to be operable for S/RV system operability. It is conservatively assumed that less than twelve S/RVs were operable for the duration of the fuel cycle, from March 25, 2020, and February 26, 2022.

VI. Corrective Actions

Corrective Actions are being managed by the TVA's corrective action program under Condition Reports (CRs), 962223, 1286467, 1410577, 1521190, 1658693, 1699286, and 1775232.

A. Immediate Corrective Actions

All thirteen of the BFN, Unit 3 MSRV pilot valves were replaced with refurbished valves during U3R20. As left testing verified that these refurbished pilot valves were within +/- 1 percent of their setpoints.

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

As most recently discussed in LER 50-260/2021-002-00, a flaking issue has been noted with the platinum coated pilot discs. The Boiling Water Reactor Owners' Group (BWROG) is continuing to work toward a solution to improve the quality and adhesion of the platinum coating on the discs. The corrective actions suggested by the BWROG will be incorporated to correct setpoint drift. To reduce the probability of seat leakage occurring in the future, pilot seat rebuilds will be performed in valves that have low stellite in the seat.

VII. Previous Similar Events at the Same Site

A search of LERs from BFN, Units 1, 2, and 3 over the last five years identified seven LERs associated with MSRV lift settings outside of TS required setpoints:

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- LER 50-260/2021-002-00, for Unit 2 Cycle 21
- LER 50-259/2020-003-01, for Unit 1 Cycle 13
- LER 50-296/2020-002-00, for Unit 3 Cycle 19
- LER 50-260/2019 002 00, for Unit 2 Cycle 20
- LER 50-259/2018 007 00, for Unit 1 Cycle 12
- LER 50-296/2018 004 00, for Unit 3 Cycle 18
- LER 50-260/2017 004 00, for Unit 2 Cycle 19

VIII. Additional Information

There is no additional information.

IX. Commitments

There are no new commitments.