

February 15, 2007

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop OWFN, P1-35
Washington, D. C. 20555-0001

10 CFR 50.73

Dear Sir:

**TENNESSEE VALLEY AUTHORITY - BROWNS FERRY NUCLEAR PLANT (BFN) -
UNIT 3 - DOCKET 50-296 - FACILITY OPERATING LICENSE DPR - 68 -
LICENSEE EVENT REPORT (LER) 50-296/2004-003-000**

The enclosed report provides details of failure to meet the requirements of the Technical Specifications (TS) Limiting Condition for Operation (LCO) 3.4.3 concerning main steam relief valve (MSRV) operability associated with the Unit 3 operating cycles 10 and 11.

Similar MSRV performance prior to calendar year 2001 was reported by TVA to NRC via LER. However, TVA did not report the failure to meet TS following the Unit 3 operating cycles 10 and 11 in 2002 and 2004. The failure to report the occurrences have been addressed by the TVA Corrective Action Program. LER 296/2006-01 was submitted for Unit 3 Cycle 12 operation. This LER, 296/2004-003-00, addresses the past conditions (i.e., 2002 and 2004) which had not been previously reported.

As such, in accordance with 10 CFR 50.73(a)(2)(i)(B), TVA is reporting this as any operation or condition prohibited by the unit's TS. There are no commitments contained in this letter.

Sincerely,

Original signed by:

Brian O'Grady

cc: See page 2

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Enclosure

cc (Enclosure):

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Enclosure

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NRC FORM 366 (6-2004)			U.S. NUCLEAR REGULATORY COMMISSION			APPROVED BY OMB NO. 3150-0104			EXPIRES 06/30/2007								
<h2 style="margin: 0;">LICENSEE EVENT REPORT (LER)</h2> <p style="margin: 5px 0 0 0;">(See reverse for required number of digits/characters for each block)</p>												Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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 Unit 3						2. DOCKET NUMBER 05000296			3. PAGE 1 OF 7								
4. TITLE Main Steam Relief Valve Inoperability LCO Exceeded During Operating Cycles 10 and 11 due to Setpoint Drift																	
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							
06	17	2004	2004-003-00			02	15	2007	none	N/A							
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)(i)(C)		50.73(a)(2)(vii)						
			20.2201(d)			20.2203(a)(3)(ii)			50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(A)						
			20.2203(a)(1)			20.2203(a)(4)			50.73(a)(2)(ii)(B)		50.73(a)(2)(viii)(B)						
			20.2203(a)(2)(i)			50.36(c)(1)(i)(A)			50.73(a)(2)(iii)		50.73(a)(2)(ix)(A)						
10. POWER LEVEL			20.2203(a)(2)(ii)			50.36(c)(1)(ii)(A)			50.73(a)(2)(iv)(A)		50.73(a)(2)(x)						
100			20.2203(a)(2)(iii)			50.36(c)(2)			50.73(a)(2)(v)(A)		73.71(a)(4)						
			20.2203(a)(2)(iv)			50.46(a)(3)(ii)			50.73(a)(2)(v)(B)		73.71(a)(5)						
			20.2203(a)(2)(v)			50.73(a)(2)(i)(A)			50.73(a)(2)(v)(C)		OTHER						
			20.2203(a)(2)(vi)			<input checked="" type="checkbox"/> X			50.73(a)(2)(v)(D)		specify in Abstract below or in NRC Form 366A						
12. LICENSEE CONTACT FOR THIS LER																	
NAME Steve Austin, Licensing Engineer						TELEPHONE NUMBER (Include Area Code) 256-729-2070											
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								
B	SB	RV	T020	Y													
14. SUPPLEMENTAL REPORT EXPECTED						15. EXPECTED SUBMISSION DATE			MONTH	DAY	YEAR						
<input type="checkbox"/> YES (if yes, complete 15. EXPECTED SUBMISSION DATE)						<input checked="" type="checkbox"/> NO			n/a	n/a	n/a						
<p style="font-size: small; margin: 0;">ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)</p> <p style="margin: 0;">Testing of main steam relief valves (MSRV) removed from Unit 3 following the operating cycles 10 and 11 respectively, revealed that in each set of valves tested, multiple valves mechanically actuated at pressures greater than 3% above their nominal setpoint. The Unit 3 Technical Specifications (TS) Limiting Condition for Operation (LCO) 3.4.3 requires that 12 MSRVs be operable in reactor Mode 1 (power operation), Mode 2 (startup), and Mode 3 (hot shutdown). If less than 12 MSRVs are operable, the unit is to be placed into Mode 3 within 12 hours and Mode 4 (cold shutdown) within 36 hours. Since each BFN unit has 13 installed MSRVs, any concurrent MSRV inoperability would require the above actions to be taken. While the setpoint-drift condition was not identified until after the valves' removal from the plant, MSRV pilot valve disc-seat corrosion bonding in boiling water reactor applications is a known phenomenon, and the condition is deemed to have developed and existed while the valves were in service during operation in cycles 10 and 11. Similar MSRV performance prior to calendar year 2001 was reported by TVA to NRC via LER. However, TVA did not report the failure to meet TS following the Unit 3 operating cycles 10 and 11 in 2002 and 2004. The failure to report the occurrences have been addressed by the TVA Corrective Action Program. LER 296/2006-01 was submitted for Unit 3 Cycle 12 operation. This LER, 296/2004-003-00, addresses the past conditions (i.e., 2002 and 2004) which had not been previously reported. The root cause of this condition was MSRV pilot valve disc-seat corrosion bonding which can develop during normal reactor operations. The affected valves were refurbished and their lift-setpoints re-established prior to their re-installation in the plant. There was no actual safety consequences associated with this condition.</p>																	

LICENSEE EVENT REPORT (LER)

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Browns Ferry Nuclear Plant Unit 3	05000296	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	3 OF 7
		2004	--003	-- 00	

NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)

May 2002	The relevant MSR/V setpoint determination surveillance procedure for the removed pilot cartridges was completed, documenting that 7 as-found lift setpoints exceeded the allowable TS value during Cycle 10 operation.
February 2004	Unit 3 was shutdown for the Cycle 11 refueling outage. During the outage, refurbished MSR/V pilot cartridges with properly adjusted setpoints were installed.
March 2004	Unit 3 Cycle 12 operation commenced.
May 2004	The relevant MSR/V setpoint determination surveillance procedure for the removed pilot cartridges was completed, documenting that 6 as-found lift setpoints exceeded the allowable TS value during Unit 3 Cycle 11 operation.

D. Other Systems or Secondary Functions Affected

None.

E. Method of Discovery

The out-of-tolerance lift setpoints were discovered during bench testing at the Wyle Laboratories Huntsville, Alabama facility following the Unit 3 Cycle 10 and Unit 3 Cycle 11 refueling outages.

F. Operator Actions

None.

G. Safety System Responses

None.

III. CAUSE OF THE EVENT

A. Immediate Cause

The immediate cause of this reportable condition was an undetectable out-of-tolerance-high lift setpoint condition on required MSR/Vs which most likely existed for longer time than allowed by the unit's TS during Unit 3 Cycle 10 and Unit 3 Cycle 11 operations.

B. Root Cause

The root cause of this condition is a long-identified issue of MSR/V pilot valve disc-seat corrosion bonding. The corrosion bond is a metal oxide film that develops during normal reactor operations. Corrosion occurs because the MSR/V pilot valve is located at a stagnant (non-flowing) high point in the main steam piping. The stagnant conditions allow steam to condense in the vicinity of the pilot valve, resulting in an environment consisting of moisture and non-condensable gases. The principal non-condensable gases present are oxygen and hydrogen. The oxygen combines with the exposed internal metal surfaces to form corrosion products.

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C. Contributing Factors

None.

IV. ANALYSIS OF THE EVENT

The condition being reported is operation of Unit 3 in a condition prohibited by the TS. The TS require the MSR/V mechanical actuation as-found setpoint to be within 3% of the nominal actuation value. The as-found valve lift setpoints following the Cycle 10 and Cycle 11 operating cycles are summarized in the tables below. The shaded table values indicate test results outside the 3% tolerance.

Unit 3 Cycle 10 As-Found Lift Setpoints								
		Service Dates						
Valve Position	Nominal Setpoint	Serial #	From	To	1st test/ dev.	2nd test/ dev.	3rd test/ dev.	4th test/ dev.
3-PCV-01-004	1155	1085	5/3/2000	3/26/2002	1178/ 2.0%	1178/ 2.0%	1168/ 1.1%	n/a
3-PCV-01-005	1145	1028	5/3/2000	3/26/2002	1169/ 2.1%	1159/ 1.2%	1153/ .7%	1156/ 1.0%
3-PCV-01-018	1145	1018	5/3/2000	3/26/2002	1177/ 2.8%	1158/ 1.1%	1157/ 1.0%	1152/ 0.6%
3-PCV-01-019	1135	1023	5/3/2000	3/26/2002	1264/ 11.4%	1151/ 1.4%	1152/ 1.5%	1133/ -0.2%
3-PCV-01-022	1145	1065	5/3/2000	3/26/2002	1184/ 3.4%	1154/ 0.8%	1145/ 0.0%	1151/ 0.5%
3-PCV-01-023	1135	1063	5/3/2000	3/26/2002	1183/ 4.2%	1171/ 3.2%	1135/ 0.0%	1125/ -0.9%
3-PCV-01-030	1145	1075	5/3/2000	3/26/2002	1232/ 7.6%	1158/ 1.1%	1144/ -0.1%	1140/ -0.4%
3-PCV-01-031	1135	1059	5/3/2000	3/26/2002	1149/ 1.2%	1141/ 0.5%	1139/ 0.4%	1139/ 0.4%
3-PCV-01-034	1135	1034	5/3/2000	3/26/2002	1226/ 8.0%	1140/ 0.4%	1148/ 1.1%	n/a
3-PCV-01-041	1155	1024	5/3/2000	3/26/2002	1280/ 10.8%	1178/ 2.0%	1176/ 1.8%	n/a
3-PCV-01-042	1155	1068	5/3/2000	3/26/2002	1170/ 1.3%	1171/ 1.4%	1154/ -0.1%	1150/ -0.4%
3-PCV-01-179	1155	1027	5/3/2000	3/26/2002	1176/ 1.8%	1168/ 1.1%	1155/ 0.0%	1155/ 0.0%
3-PCV-01-180	1155	1073	5/3/2000	3/26/2002	1221/ 5.7%	1183/ 2.4%	1201/ 4.0%	1204/ 4.2%

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NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)

Unit 3 Cycle 11 As-Found Lift Setpoints								
			Service Dates					
Valve Position	Nominal Setpoint	Serial #	From	To	1st test/ dev.	2nd test/ dev.	3rd test/ dev.	4th test/ dev.
3-PCV-01-004	1155	1014	4/10/2002	3/01/2004	1223/ 5.9%	1148/ -0.6%	1146/ -0.8%	n/a
3-PCV-01-005	1145	1021	7/02/2003	3/01/2004	1164/ 1.7%	1130/ -1.3%	1135/ -0.9%	n/a
3-PCV-01-018	1145	1079	4/10/2002	3/01/2004	1160/ 1.3%	1136/ -0.8%	1126/ -1.7%	n/a
3-PCV-01-019	1135	1022	4/10/2002	3/01/2004	1131/ -0.4%	1113/ -1.9%	1122/ -1.1%	n/a
3-PCV-01-022	1145	1017	4/10/2002	3/01/2004	1140/ -0.4%	1137/ -0.7%	1137/ -0.7%	n/a
3-PCV-01-023	1135	1084	4/10/2002	3/01/2004	1185/ 4.4%	1152/ 1.5%	1145/ 0.9%	n/a
3-PCV-01-030	1145	1232	4/10/2002	3/01/2004	1212/ 5.9%	1122/ -2.0%	1123/ -1.9%	n/a
3-PCV-01-031	1135	1072	4/10/2002	3/01/2004	1198/ 5.6%	1133/ -0.2%	1128/ -0.6%	n/a
3-PCV-01-034	1135	1031	4/10/2002	3/01/2004	1175/ 3.5%	1145/ 0.9%	1150/ 1.3%	n/a
3-PCV-01-041	1155	1016	4/10/2002	3/01/2004	1237/ 7.1%	1139/ -1.4%	1133/ -1.9%	n/a
3-PCV-01-042	1155	1015	4/10/2002	3/01/2004	1190/ 3.0%	1164/ 0.8%	1152/ -0.3%	n/a
3-PCV-01-179	1155	1032	4/10/2002	3/01/2004	1161/ 0.5%	1149/ -0.5%	1150/ -0.4%	n/a
3-PCV-01-180	1155	1026	4/10/2002	3/01/2004	1168/ 1.1%	1147/ -0.7%	1144/ 1.0%	n/a

The setpoint drift is the result of corrosion at the pilot valve disc-seat interface. The material of construction for the pilot valve seat and disc is Stellite 6B. This material has exceptional hardness and erosion characteristics. However, when placed into an operating environment typical of a boiling water reactor, the steam exposed surface areas can oxidize and form a surface corrosion film. The surface corrosion film has a crystalline structure. At the point of contact between the pilot valve seat and disc, the crystalline matrix on the two surfaces can merge and form what is referred to as a corrosion bond between the disc and seat. This bond adds to the resistance of the setpoint adjustment spring which system pressure must overcome to mechanically actuate the pilot valve; therefore, the system pressure necessary to open the valve increases above the as-left setpoint in some proportion to the magnitude of the corrosion present. Generally, once this bond has been broken by opening the pilot valve, the lift setpoints observed on subsequent lifts are within the nominal 3% tolerance.

V. ASSESSMENT OF SAFETY CONSEQUENCES

As stated in the BFN Updated Final Safety Analysis Report (UFSAR) paragraph 4.4.1, the safety objective of the Nuclear System Pressure Relief System is to prevent overpressurization of the nuclear system; this protects the nuclear system process barrier from failure which could result in the uncontrolled release of fission products. The Power Uprate Transient Analysis Task Report, GE-NEB13-01866-05, for BFN determined that the reactor vessel overpressure protection function of the MSRVs is provided if 2 MSRVs open at or before 1184 psig and with an additional 5 (for a total of 7) opening at or before 1194 psig.

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NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)

Considering the as-found test data for Unit 3 Cycle 10 cited above, it can be seen that 8 valves opened at or below pressures of 1184 psig. Likewise, considering the as-found test data for Unit 3 Cycle 11 cited above, it can be seen that 7 valves opened at pressures at or below 1184 psig, with 2 additional valves opening between 1184 and 1194 psig. For both operating cycles the as-found performance of the MSRVs is within the relevant analysis.

In addition to the mechanical actuation of the pilot valves via increasing process steam pressure, each MSRV pilot valve can also be actuated by control air pressure via a solenoid valve. The solenoid valve can be energized either manually via control panel hand-switches or by automatic circuitry driven by pressure-sensing logic. The automatic actuation method utilizes high-quality instrumentation, and the circuits have demonstrated high reliability in service. This circuitry was installed on BFN Units 2 and 3 as part of the site response to the pilot valve disc-seat bonding phenomenon. Since this automatic opening circuitry has been in place at BFN, there has been no observed pressurization transient events (e.g., turbine trip events) in which an MSRV has failed to open when demanded.

The formal BFN design analysis requires the opening of 7 MSRVs as described above, and the as-found test data shows that this analysis was met. The automatic opening circuitry provides additional defense-in-depth to assure the pressure relief function. The subject past-inoperability condition did not have any significant impact on the health and safety of the public.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

All MSRV pilot valve cartridges were replaced during the associated refueling outages.

B. Corrective Actions to Prevent Recurrence⁽¹⁾

Work orders tracked refurbishment of the pilot valves having excessive leakage and/or lift setpoint out of tolerance.

VII. ADDITIONAL INFORMATION

A. Failed or Degraded Components

Target Rock MSRV model No. 7567F

B. Previous LERs on Similar Events

Numerous previous reports on similar events have been made from BFN and other nuclear plants. The physical phenomenon affecting MSRV lift setpoints which results in this reportable condition is well-understood, and it has been the subject of much industry study. Different mitigative approaches have been tested, but none have successfully eliminated the issue. The installation of the instrumentation logic/circuitry which will automatically open the MSRVs as appropriate during pressurization transients largely negates the condition's safety impact.

(1) TVA does not consider this corrective action a regulatory commitment. The completion of this action will be tracked in TVA's Corrective Action Program.

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This phenomenon has only a relatively small impact on the MSR/V function. BFN has installed compensatory mitigation hardware. BFN is continuing to work with other industry stakeholders toward the total elimination of this issue.

C. Additional Information

Browns Ferry corrective actions for rework of the valves in Unit 3 Cycles 10 and 11 are documented in BFPER 961764 and PER 61823. The failure to report the MSR/V setpoint drift is documented in PER 112190.

D. Safety System Functional Failure Consideration:

The condition being reported involves only setpoint drift of varying numbers of MSR/V's on Unit 3. The safety/relief function provided by these valves was not compromised at any time. As such, a safety system functional failure did not result from this condition.

E. Loss of Normal Heat Removal Consideration:

The condition being reported did not involve a reactor scram.

VIII. COMMITMENTS

None.