June 23, 2006

U.S. Nuclear Regulatory Commission 10 CFR 50.73
ATTN: Document Control Desk
Mail Stop OWFN, P1-35
Washington, D. C. 20555-0001

Dear Sir:

TENNESSEE VALLEY AUTHORITY - BROWNS FERRY NUCLEAR PLANT (BFN) - UNIT 3 - DOCKET 50-296 - FACILITY OPERATING LICENSE DPR - 68 - LICENSEE EVENT REPORT (LER) 50-296/2006-001-00

The enclosed report provides details of a failure to meet the requirements of a Technical Specifications (TS) Limiting Condition for Operation (LCO) because two main steam relief valves (MSRV) had become inoperable as a result of setpoint drift. The setpoint drift was discovered during bench testing at an off-site facility subsequent to the MSRV pilot cartridges' removal from BFN Unit 3. The Unit 3 MSRV's likely operated with these as-found setpoints outside the allowable TS values for longer than the allowable LCO time.

As such, in accordance with 10 CFR 50.73(a)(2)(i)(B), TVA is reporting this event 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

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

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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	2. DOCKET NUMBER	3. PAGE
Browns Ferry Unit 3	05000296	1 OF 6

4. TITLE
Main Steam Relief Valve Inoperability LCO Exceeded as a Result of Lift 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
									none	N/A
05	03	2006	2006-001-00			06	23	2006	FACILITY NAME none	DOCKET NUMBER 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)*

	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)
	20.2203(a)(2)(ii)		50.36(c)(1)(ii)(A)		50.73(a)(2)(iv)(A)		50.73(a)(2)(x)
	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)	X	50.73(a)(2)(i)(B)		50.73(a)(2)(v)(D)		specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER *(Include Area Code)*
Paul S. Heck, Nuclear Engineer, Licensing and Industry Affairs	256-729-3624

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
[ ] **YES** (*if yes, complete 15. EXPECTED SUBMISSION DATE*) [X] **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*)

Following testing of main steam relief valves (MSRV) removed from Unit 3, it was discovered that 2 of the 13 tested valves mechanically actuated at pressures greater than 3% above their nominal setpoint. The Unit 3 Technical Specifications Limiting Condition for Operation (LCO) 3.4.3 requires that 12 MSRVs be operable in reactor modes 1, 2, and 3. If less than 12 MSRVs are operable, then the unit is to be placed into Mode 3 within 12 hours and Mode 4 within 36 hours. Since each BFN unit has 13 installed MSRVs, the inoperability of more than 1 MSRV would require the above actions to occur. 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 while the valves were in service during Unit 3 Cycle 12 operation.

The root cause of this condition was MSRV pilot valve disc-seat corrosion bonding which can develop during normal reactor operations. The affected valves will be refurbished and their lift-setpoints re-established prior to reinstallation in the plant. There were no actual safety consequences associated with this event.

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

I. PLANT CONDITION(S)

At the time the subject past inoperability condition was identified, Unit 3 was operating at 100% steady state power (approximately 3458 megawatts thermal). Unit 1 was shutdown and defueled and was not directly affected by the identified condition. Unit 2 was operating at 100% steady state power (approximately 3458 megawatts thermal) and was also not directly affected by this condition.

II. DESCRIPTION OF EVENT

A. Event:

Following testing of main steam relief valves (MSRV) [SB] removed from Unit 3, it was discovered that 2 of the 13 tested 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 modes 1, 2, and 3. If less than 12 MSRVs are operable, the unit is to be placed into Mode 3 within 12 hours and Mode 4 within 36 hours. Since each BFN unit has 13 installed MSRVs, the inoperability of more than 1 MSRV would require the above actions to occur. 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 while the valves were in service during Unit 3 Cycle 12 operation.

The period during which these 2 MSRV's operated with lift setpoints beyond the TS allowable values is unknown, but as the TS required action completion time is only 12 hours, it is probable that the allowed time frame was exceeded. Therefore, in accordance with 10 CFR 50.73(a)(2)(i)(B), TVA is reporting this event as any operation or condition prohibited by the plant's Technical Specifications

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

None

C. Dates and Approximate Times of Major Occurrences:

March 2004		MSRV pilot cartridges with properly adjusted setpoints installed on Unit 3 during its Cycle 11 refueling outage.
March 30, 2004	1026 hours CST	Unit 3 reactor declared critical and power ascension commenced for Cycle 12 operation
October 2005		Five MSRV pilot cartridges replaced during Unit 3 mid-cycle maintenance outage due to excessive pilot valve leakage
February 28, 2006	0900 hours CST	Unit 3 manually scrammed to commence the Cycle 12 refueling outage
March 2006		The 8 MSRV pilot cartridges which were not replaced in the October 2005 maintenance outage were removed from Unit 3 and prepared for shipment to Wyle Laboratories along with the 5 previously removed for as-found lift setpoint determination. Eight replacement MSRV pilot cartridges with properly adjusted setpoints were installed on Unit 3.

March 22, 2006	0703 hours CST	Unit 3 reactor declared critical and power ascension commenced for Cycle 13 operation
May 3, 2006		The relevant MSRV setpoint determination surveillance procedure for the 13 total removed pilot cartridges was formally completed, documenting that two as-found lift setpoints exceeded the allowable TS value.

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 facility.

F. Operator Actions

N/A. The condition being reported was undetectable by the plant staff, and no operator response actions were required.

G. Safety System Responses

N/A. The condition being reported did not contribute to any actual plant event, and no safety system responses of any kind were required.

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 2 required MSRV's which most likely existed for longer than allowed by the unit's TS.

B. Root Cause

The root cause of this condition was the long-identified issue of MSRV pilot valve disc-seat corrosion bonding. The corrosion bond is a metal oxide film that develops during normal reactor operations. Corrosion occurs because the MSRV 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.

C. Contributing Factors

None

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

IV. ANALYSIS OF THE EVENT

The condition being reported is operation of Unit 3 in a manner prohibited by the TS. The TS require the MSRV mechanical actuation as-found setpoint to be within 3% of the nominal actuation value. In spring 2006, 13 pilot cartridges from Unit 3 were tested for as-found lift setpoint determination. The 13 valves consisted of 5 valves removed in an October 2005 maintenance outage and 8 valves removed during the March 2006 refueling outage. The requisite post-service testing found that 2 of 13 valves did not meet the 3% criterion. While the specific valves under test were not in service at the time of the discovery, having been replaced during outage activities, it is probable that the setpoint drift condition had been in existence while the valves were in service on Unit 3, hence the past operability impact.

In addition to the 2 valves which exhibited a setpoint drift in the high direction, the as-found mechanical lift setpoint of the 5 valves removed in October 2005 could not be determined due to inability of the test facility's steam production capability to overcome the pilot valves' leakage rates. These 5 valves had been removed from Unit 3 during a mid-cycle maintenance outage because of this pilot valve leakage issue. The safety consequences of this condition are discussed in Paragraph V. below.

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.

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.

Based on the test data, it is likely that during Unit 3 Cycle 12 operation, 2 MSRV's would have opened via the mechanical actuation of the pilot valves at pressures higher than 1194 psig. Six MSRVs were found to actuate at pressures of 1094, 1134, 1144, 1161, 1178, and 1186 psig, respectively. To specifically meet the success criteria of GE-NEB13-01866-05, 1 of the 5 valves removed in October 2005 would have had to have actuated at or before 1184 psig. However, of these 5 valves, each of which was removed due to steam leakage, none could be successfully tested due to limitations of the test facility's steam production capability to overcome the leakage. Therefore their as-found lift setpoints are not known. It is noted that 5 of the 8 tested valves mechanically actuated at a pressure less than 1184, and a sixth valve actuated only 2 psig above that point. Since the existence of pilot valve leakage has not historically correlated with elevated actuation pressures, it is considered very unlikely that all of the five untestable valves would have as-found setpoints above 1184 psig. However, to further characterize the safety significance of this condition, TVA obtained an analysis from Areva NP which utilized the as-found lift setpoint values on the 8 testable MSRV's and which assumed the remaining 5 non-testable MSRV's would not open at all. This analysis determined that the pressure

relief safety objective would have been satisfied, with no part of the Unit 3 pressure boundary exceeding relevant pressure limits.

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 handswitches 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, and a design to accomplish this function will be installed on BFN Unit 1 before it returns to power operation. Since this automatic opening circuitry has been in place at BFN, there have 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 MSRV's as described above, and the recent test data could only demonstrate that 6 would have done so via mechanical actuation. However, the special analysis performed by Areva NP demonstrated that the as-found lift setpoints, taking no credit at all for the 5 non-testable valves, were sufficient to protect the pressure boundary. The automatic opening circuitry provides additional defense-in-depth to assure the pressure relief function. This condition did not have any significant impact on the health and safety of the public.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

Five MSRV pilot valve cartridges were replaced during the Unit 3 October 2005 mid-cycle maintenance outage, and eight MSRV pilot valve cartridges were replaced during the Unit 3 Cycle 12 refueling outage. Each of the replacement cartridges demonstrated a properly adjusted lift setpoint during bench-testing prior to installation.

B. Corrective Actions to Prevent Recurrence(1)

Work orders will track 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

(1) TVA does not consider these corrective actions regulatory commitments. The completion of these actions will be tracked in TVA's Corrective Action Program.

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. Though this phenomenon has only a relatively small impact on the MSRV function and because of the compensatory hardware mitigation which has been installed at BFN, BFN is continuing to work with other industry stakeholders toward the total elimination of this issue.

C. Additional Information

Browns Ferry corrective action document PER 102298

D. Safety System Functional Failure Consideration:

The condition being reported involves only setpoint drift of 2 of 13 MSRV's. The safety/relief function of this set of valves was not compromised. A safety system functional failure did not result from this condition.

E. Loss of Normal Heat Removal Consideration:

N/A. This condition being reported did not involve a reactor scram.

VIII. COMMITMENTS

None