April 12, 2005

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 2 - DOCKET 50-260 - FACILITY OPERATING LICENSE DPR - 52 - LICENSEE EVENT REPORT (LER) 50-260/2005-002-00

The enclosed report provides details of a failure to meet the requirements of a Technical Specifications Limiting Condition for Operation regarding the inoperability of a primary containment isolation valve.

In accordance with 10 CFR 50.73(a)(2)(i)(B), TVA is reporting this event as an operation or condition prohibited by the plant's Technical Specifications. There are no commitments contained in this letter.

Sincerely,

Original signed by:

Mike D. Skaggs

cc: See page 2

Enclosure
cc (Enclosure):

Ms. Eva Brown, Project Manager
U.S. Nuclear Regulatory Commission
(MS 08G9)
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852-2739

Mr. Stephen J. Cahill, Branch Chief
U.S. Nuclear Regulatory Commission
Region II
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW, Suite 23T85
Atlanta, Georgia 30303-8931

NRC Resident Inspector
Browns Ferry Nuclear Plant
10833 Shaw Road
Athens, Alabama 35611-6970

TEA:DTL:PSH:BAB
Enclosure
cc (Enclosure):
A. S. Bhatnagar, LP 6A-C
J. C. Fornicola, LP 6A-C
R. G. Jones, NAB 1A-BFN
K. L. Krueger, POB 2C-BFN
R. F. Marks, PAB 1C-BFN
F. C. Mashburn, BR 4X-C
N. M. Moon, LP 6A-C
J. R. Rupert, NAB 1A-BFN
K. W. Singer, LP 6A-C
E. J. Vigluicci, ET 11A-K
NSRB Support, LP 5M-C
EDMS WT CA - K
LEREvents@inpo.org

S:lic/submit/lers/LER 2005-02 U2.doc

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 2	05000260	1 OF 6

4. TITLE
Primary Containment Isolation Valve Inoperable in Excess of Technical Specifications Allowable Outage Time

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 none	DOCKET NUMBER N/A
02	03	2005	2005-002-00			04	12	2005	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
X	CE	VLV	BW/IP	Y						

14. SUPPLEMENTAL REPORT EXPECTED		15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ **YES** (*if yes, complete 15. EXPECTED SUBMISSION DATE*)	■ **NO**				

ABSTRACT (*Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines*)

On 2/10/05, engineering personnel performed a local inspection of the reactor water clean-up system's outboard suction isolation valve This valve serves as a primary containment isolation valve (PCIV). The inspection revealed that the valve's packing gland retainer was broken, the gland follower was no longer properly positioned on the valve body, and the valve stem exhibited galling. Following an evaluation by site engineering, the valve was declared inoperable. The inboard suction valve was closed at 1859 hours, and power was removed from its motor operator. This was done in accordance with Technical Specifications (TS) Limiting Condition for Operation 3.6.1.3 Action A.1 to isolate the affected flow path by at least one closed and deactivated valve when a PCIV is inoperable. Post-event review determined the valve had last been positioned to its as-found (open) condition at approximately 2121 hours CST on 2/2/05. The damage to the valve is thought to have occurred then. The valve would not have responded to a close command while in that condition and was therefore inoperable beginning at that time. The allowable TS action completion time of 4-hours expired at approximately 0121 hours on 2/3/05, and the continued operation of the system using this flow path between then and 1859 hours on 2/10/05 was in violation of the Unit 2 TS.

The valve damage is thought to have occurred after the valve packing gland follower bolts loosened and allowed the follower to cock on the valve stem. The valve was repaired and tested, bolt torquing on similar valves will be verified, and preventive maintenance procedures on such bolt torquing will be evaluated.

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

I. PLANT CONDITION(S)

During this event Unit 2 was in Mode 1, operating at approximately 3458 megawatts thermal (100 percent power). Unit 1 was shutdown and defueled and was unaffected by the event. Unit 3 was in Mode 1 at approximately 3458 megawatts thermal (100 percent power) and was also unaffected by this event.

II. DESCRIPTION OF EVENT

A. Event:

On the afternoon of February 10, 2005, in conjunction with a planned maintenance outage on the reactor water clean-up system (RWCU) [CE] system, site engineering personnel [utility – non-licensed] performed a local inspection of the system's outboard suction isolation valve, 2-FCV-069-0002. The inspection was performed in support of a separate troubleshooting effort involving an electrical ground traced to circuits involving the valve's position limit switches. This valve serves as a primary containment isolation valve (PCIV). The inspection revealed that the valve's packing gland retainer was broken, the gland follower was no longer properly positioned on the valve body, and the valve stem exhibited galling. Following an evaluation of the valve's capability to perform its containment isolation function by site engineering personnel, performed immediately after completion of the inspection, the valve was declared inoperable at 1836 hours. The inboard suction valve, 2-FCV-069-0001, was closed at 1859 hours, and power was removed from its motor operator. This was done in accordance with Technical Specifications (TS) Limiting Condition for Operation (LCO) 3.6.1.3 Action A.1 to isolate the affected flow path by at least one closed and deactivated valve when a PCIV is inoperable. Subsequent electrical troubleshooting on 2-FCV-069-0002 found the valve motor's thermal overloads were tripped, and the valve motor marginally failed an insulation integrity (megger) test. The valve had last been positioned to its as-found (open) condition at approximately 2121 hours CST on February 2, 2005, and that is when the damage to the packing gland retainer, displacement of the gland follower, and operation of the motor's thermal overload protection is thought to have occurred. The valve would not have responded to a close command while in that condition and was therefore inoperable beginning at that time. The allowable TS action completion time of 4-hours therefore expired at approximately 0121 hours on February 3, 2005, and the continued operation of the system using this flow path between then and 1859 hours on February 10, 2005, was in violation of the Unit 2 TS.

In summary, a violation of the TS requirements commenced at approximately 0121 hours CST on February 3, 2005 when the allowable 4-hour interval elapsed. TS compliance was restored at 1859 hours on February 10, 2005.

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 TS.

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

None

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Browns Ferry Nuclear Plant Unit 2	05000260	2005	-- 002	-- 00	3 OF 6

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

C. Dates and Approximate Times of Major Occurrences:

February 2, 2005	2121 hours CST	RWCU isolation valve 2-FCV-069-0002 was stroked open. Post-event review determined that this valve operation had most likely caused the observed mechanical damage and motor thermal overload operation. In this condition, the valve was incapable of performing its design isolation function.
February 7, 2005	2303 hours CST	Troubleshooting of an electrical ground in the RWCU pump trip circuitry progressed far enough to associate the problem with 2-FCV-069-0002 position limit switches.
February 10, 2005	0533 hours CST	The RWCU system was removed from service for heat exchanger leak repair, and physical inspection of the valve was undertaken in conjunction with the system outage in support of the electrical troubleshooting effort.
February 10, 2005	1836 hours CST	Valve 2-FCV-069-0002 was declared inoperable following evaluation of its as-found condition.
February 10, 2005	1859 hours CST	TS LCO 3.6.1.3 Action A.1 was completed to close and remove power from the inboard PCIV 2-FCV-069-0001
February 15, 2005	2135 hours CST	Maintenance and testing was completed on 2-FCV-069-0002 to replace the motor on the valve operator and to verify the valve operated properly. The valve was declared operable for PCIV purposes.

D. Other Systems or Secondary Functions Affected

None

E. Method of Discovery

Physical inspection of the valve performed in conjunction with a planned RWCU system maintenance outage found the valve's packing gland retainer broken, the gland follower no longer properly positioned on the valve, and galling of the valve stem. Engineering evaluation determined the valve was unable to perform its design isolation function. Upon notification of this condition, Operations declared the valve inoperable for PCIV purposes and closed the inboard isolation valve in accordance with TS LCO 3.6.1.3 Action A.1.

F. Operator Actions

The operator actions taken in response to the identification of the failed state of 2-FCV-069-0002 were appropriate. These actions included declaring the valve inoperable, entering the appropriate TS limiting conditions for operation, and isolating the affected flowpath.

G. Safety System Responses

N/A No operational transient was induced by the RWCU isolation valve inoperability, and the unit remained in steady state power operation.

III. CAUSE OF THE EVENT

A. Immediate Cause

The immediate cause of this event was the latent failure of 2-FCV-069-0002 such that its PCIV function could not be fulfilled.

B. Root Cause

The root cause of this event most probably was the relaxation of the torque on the bolts holding the packing gland follower in place. Relaxation of the torque allowed the gland follower to cock on the valve stem, and the resulting stresses imposed during valve stroke eventually caused these bolts and the gland retainer ring to break.

C. Contributing Factors

None

IV. ANALYSIS OF THE EVENT

As previously stated, the valve's failure was revealed by a physical inspection performed in conjunction with a planned system maintenance outage. Subsequent investigation determined that both the valve and its associated motor operator had suffered damage. Post-event review of the physical evidence determined that the following sequence of events was the most probable:

1. Over time, torque relaxation occurred on the bolts holding the gland follower to the packing gland retainer ring.
2. The torque relaxation led to the packing gland follower becoming cocked on the valve stem rather than being oriented concentric with it.
3. Subsequent stem travel during routine valve operation caused stem galling due to contact with sharp interior edges of the gland follower. Metal shaved from the stem built up under the follower. This build-up increased the force required by the valve motor to move the stem and also increased the load on the bolts holding the follower in place.
4. The stem-to-gland follower friction increased until the point that the gland retainer ring deformed and one of the follower hold-down bolts broke, thus freeing the gland follower to move with the valve stem. This event is thought to have occurred during the valve opening stroke on February 2, 2005.
5. Displacement of the gland follower resulted in loss of the valve stem packing. During the valve opening, the valve reached its backseat and sustained leakage along the stem did not occur. The purpose of the planned RWCU system maintenance had been to repair a minor heat exchanger leak, and this leak had created an environment more humid than normal in the vicinity of valve 2-FCV-069-0002. Moisture in the motor operator from these high humidity conditions is suspected to be a reason for the marginal failure of the valve motor's insulation test subsequently performed on February 11, 2005. It is also possible that the short-term system leakage directly along the valve stem following packing loss, but before the valve reached its backseat, could have contributed to the moisture in the motor. Moisture in the valve's limit switch compartment is a likely contributor to the electrical ground problem which provoked the inspection.
6. The valve's failed state was revealed during the physical inspection performed on the afternoon of February 10, 2005.

The capability of the galled stem to carry design loading requirements was evaluated, and it was determined that the relatively small amounts of galling which had occurred had little impact on the stem's mechanical integrity. The motor on the valve operator was replaced, the valve was repacked, the packing gland was repaired, and the valve was mechanically and electrically tested and demonstrated operable. The system was then returned to service on February 15, 2005.

V. ASSESSMENT OF SAFETY CONSEQUENCES

By convention, pipe breaks involving systems carrying primary coolant outside primary containment are classified as high energy line breaks (HELB), whereas such breaks inside primary containment are classified as loss-of-coolant-accidents (LOCA). Because a RWCU HELB is a plausible event, and also because isolation of the system has no serious short-term impact on normal plant operations, the system is designed to automatically isolate when any plant conditions which might indicate a HELB are identified. However, for any plant transient or accident scenario other than a RWCU HELB, isolation of the RWCU system does not significantly contribute to the event's mitigation. It can be seen, therefore, that the PCIV function for the RWCU system isolation valves is only important for a very narrow set of plant events. The inboard suction isolation valve 2-FCV-069-0001 is located inside the primary containment, while 2-FCV-069-0002 is located in the reactor building. These two valves are physically separated by the drywell wall, they use separate power supplies, and they are not subject to common mode failures. The capability to isolate the system was never lost because the series (inboard) valve 2-FCV-069-0001 remained operable. This isolation capability was explicitly demonstrated when the inboard valve properly operated to isolate the system during completion of TS LCO 3.6.1.3 Action A.1 on February 10, 2005. Additionally, if a RWCU HELB and a coincident failure of both valves are assumed, the major impact occurs to secondary containment rather than the reactor itself. Emergency operating instructions address symptomatically how to mitigate such an unisolable leak, and broad plant capability would remain for core and containment cooling even should such an event be hypothesized.

Given the narrow set of plant events requiring RWCU isolation, the low likelihood of such an event's occurrence (especially within the limited time frame involved), the availability of the redundant isolation valve, and the fact that even in the event of a HELB and a failure to isolate the break the plant retains broad capability for core and containment cooling, the health and safety of the public was not significantly affected by the subject event.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

The motor on the valve operator was replaced and the valve external component parts replaced as necessary.

B. Corrective Actions to Prevent Recurrence[1]

- The gland follower bolt torquing will be verified on valves with similar configuration
- Preventive maintenance activities to establish proper bolt torquing will be evaluated
- Application of live-load packing on the identified set of valves will be considered

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

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Browns Ferry Nuclear Plant Unit 2	05000260	2005	-- 002	-- 00	6 OF 6

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

VII. ADDITIONAL INFORMATION

A. Failed Components

Isolation Valve (BW/IP International – Model W9825079, with Limitorque SMB-1 motor operator)

B. Previous LERs on Similar Events

None

C. Additional Information

Browns Ferry corrective action document PER 76546

D. Safety System Functional Failure Consideration:

This event does not involve a safety system functional failure which would be reported in accordance with NEI 99-02. During the period that 2-FCV-0069-0002 was judged incapable of automatically closing to isolate primary containment, the redundant isolation valve remained operable and capable of isolating the RWCU system in the event of a system break outside the drywell.

E. Loss of Normal Heat Removal Consideration:

N/A This event did not involve a reactor scram.

VIII. COMMITMENTS

None