October 16, 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) 50-296/2006-003-00

The enclosed report provides details of a manual reactor scram which occurred on Unit 3. The scram was initiated in response to a fluid leak in the main turbine electro-hydraulic control (EHC) system. All plant systems responded in accordance with the plant design.

In accordance with 10 CFR 50.73(a)(2)(iv)(A), TVA is reporting this event as a manual actuation of the reactor protection system and of containment isolation valves in more than one system. There are no commitments contained in this letter.

Sincerely,

Original signed by:

Brian O'Grady

cc: See page 2

Enclosure
cc (Enclosure):

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

Mr. Malcolm T. Widmann, 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

WDC:DTL:PSH:BAB
Enclosure
cc (Enclosure):
B. M. Aukland, POB 2C-BFN
M. Bajestani, NAB 1A-BFN
A. S. Bhatnagar, LP 6A-C
R. H. Bryan, BR 4X-C
R. G. Jones, POB 2C-BFN
G. V. Little, NAB 1D-BFN
R. A. DeLong, SAB 1E-BFN
K. W. Singer, LP 6A-C
P. D. Swafford, LP 6A-C
E. J. Vigluicci, WT 6A-K
NSRB Support, LP 5M-C
INPO:LEREvents@inpo.org
EDMS WT CA - K

s:lic/submit/subs/u3 ler 296/2006-03.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)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Browns Ferry Unit 3	05000296	1 OF 5

4. TITLE
Manual Scram in Response to Main Turbine Electro-Hydraulic Control (EHC) System Fluid Leak

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
08	29	2006	2006-003-00			10	16	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)	X	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)		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	TG	SEAL	GE	Y					

14. SUPPLEMENTAL REPORT EXPECTED		15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
YES (*if yes, complete 15. EXPECTED SUBMISSION DATE*)	X NO		n/a	n/a	n/a

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

On August 29, 2006, while in steady state operation at 100% power, control room annunciation was received at 2210 hours CDT of a low level in the main turbine electro-hydraulic control (EHC) fluid reservoir. Local inspection of the tank confirmed an actual low level and also that the tank level was continuing to drop. At 2223 hours, reactor power was reduced to approximately 78% via reactor recirculation pump speed reduction, and, at 2225 hours, a manual scram was initiated in accordance with plant procedures. All control rods fully inserted and expected system responses were received. Actuation of primary containment isolation system groups 2, 3, 6, and 8 occurred due to the expected temporary lowering of reactor water level below the actuation setpoint. Valve realignment as part of the main turbine trip which followed the scram isolated the location of the EHC fluid leak from the rest of the system. The normal heat rejection path (from the reactor to the main condenser via the main steam lines with reactor water make-up provided by the condensate/feedwater systems) remained in service. Reactor water level was recovered to the normal operating range by the normal reactor water level control system. Neither the high pressure coolant injection nor reactor core isolation cooling systems were used during this event.

The root cause of the EHC fluid leak was determined to be inadequate O-ring compression on a solenoid valve mounting due to the use of device mounting bolts which were too long. The bolts and the valve were supplied as a kit by the vendor. Plant procedures will be revised to verify bolt length and mounting hole depth in future activities involving EHC components.

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

I. PLANT CONDITION(S)

Prior to the subject scram event, Unit 3 was operating at 100% steady state power (approximately 3458 megawatts thermal). Unit 1 was shutdown and defueled and was not affected by the event. Unit 2 was operating at 100% steady state power (approximately 3458 megawatts thermal) and also was not affected by the event.

II. DESCRIPTION OF EVENT

A. Event:

On Tuesday, August 29, 2006, while in steady state operation at 100% power, control room annunciation was received at 2210 hours CDT of a low level in the main turbine electro-hydraulic control (EHC) [TG] fluid reservoir. Local inspection of the tank confirmed an actual low level and also that the tank level was continuing to drop. At 2223 hours, reactor power was reduced to approximately 78% via reactor recirculation pump speed reduction, and, at 2225 hours, a manual scram was initiated in accordance with plant procedures. All control rods fully inserted and expected system responses were received. Actuation of primary containment isolation system (PCIS) [JM] groups 2, 3, 6, and 8 occurred due to the expected temporary lowering of reactor water level below the actuation setpoint. This logic isolates shutdown cooling [BO] (if in service), isolates the reactor water cleanup (RWCU) [CE] system, isolates the normal reactor building ventilation [VA], initiates the standby gas treatment (SGT) [BH] system, initiates the control room emergency ventilation (CREV) [VI] system, and retracts Traversing Incore Probes [IG] (if inserted). Valve realignment as part of the main turbine trip which followed the scram isolated the location of the EHC fluid leak from the rest of the system. The normal heat rejection path (from the reactor to the main condenser via the main steam lines with reactor water make-up provided by the condensate/feedwater systems [SD/SJ]) remained in service. Reactor water level was recovered to the normal operating range by the normal reactor water level control system. Neither the high pressure coolant injection (HPCI) [BJ] nor reactor core isolation cooling (RCIC) [BN] systems were used during this event. Reactor water level did not drop to the auto-initiation point for these systems, and they were not manually placed in service by the control room staff.

Because this event involved a manual actuation of the reactor protection system and the operation of containment isolation valves in more than one system, and because the scram was not part of a pre-planned sequence, this event is reportable in accordance with 10 CFR 50.73 (a) (2) (iv) (A).

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

None

C. Dates and Approximate Times of Major Occurrences:

August 29, 2006	2210 hours CDT	Control room annunciation received that the EHC fluid reservoir level was low. Local observation verified the low level condition and that level was continuing to drop.
August 29, 2006	2223 hours CDT	Unit 3 reactor power lowered to approximately 78% via recirculation pump speed runback in anticipation of the manual scram

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

August 29, 2006	2225 hours CDT	The reactor was manually scrammed and the main turbine tripped
August 30, 2006	2101 hours CDT	Reactor mode switch was placed in start-up
August 31, 2006	0417 hours CDT	Unit 3 reactor was declared critical and power ascension commenced to continue Cycle 13 operation

D. <u>Other Systems or Secondary Functions Affected</u>

None

E. <u>Method of Discovery</u>

The event being reported is a manual scram directly initiated by the operating crew. The condition requiring the scram (EHC fluid leak) was first noted via main control room alarms, and the leak was subsequently verified by local inspection by the operating crew.

F. <u>Operator Actions</u>

The operating crew responded properly, in accordance with their training and plant procedures, to assess the EHC leak significance, to scram the reactor and place it in a stable condition, and to mitigate the leak itself.

G. <u>Safety System Responses</u>

All equipment operated in accordance with the plant design during this event.

The RPS logic responded to the manual scram switch operation to initiate the reactor scram. All control rods fully inserted into the core.

The PCIS logic responded per design to the expected lowered reactor water level by actuating the following isolation groups:

- Group 2 - Residual Heat Removal shutdown cooling function isolation (not in service at the time of the event)
- Group 3 - RWCU system isolation
- Group 6 - primary and secondary containment isolation, including the isolation of the normal reactor building ventilation and the initiation of the SGT and CREV systems
- Group 8 - withdrawal and isolation of the Traversing Incore Probes (the probes were not inserted at the time of this event)

Reactor water level was maintained by the condensate/feedwater systems and the normal water level control systems such that no automatic or manual operation of the HPCI or RCIC systems occurred during this event.

A manual scram event does not result in a primary system pressurization transient. No main steam relief valve operation was expected and none occurred.

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

III. CAUSE OF THE EVENT

A. Immediate Cause

The immediate cause of this event was the initiation of an unplanned manual scram as a result of a hydraulic fluid leak in the EHC system.

B. Root Cause

The root cause of this condition was the mounting bolts, supplied with the valve from the vendor, were too long to allow proper compression of the associated fitting O-ring.

C. Contributing Factors

None

IV. ANALYSIS OF THE EVENT

This event was an uncomplicated plant scram. The temporarily lowered reactor water level is an expected plant response to a scram during power operation. All plant systems responded in accordance with the plant design.

The EHC system controls both main turbine speed and load and reactor pressure via the positioning of turbine control and stop valves and turbine bypass valves. The valve positioning is accomplished by high pressure hydraulic fluid which is precisely controlled and directed by various solenoid and servo valves. In the subject event, a leak of this high pressure hydraulic fluid developed, and the reactor was manually scrammed as a precaution against the possible loss of the EHC system function.

The leak was found to have developed on main turbine control valve #2 at the interface between the associated fast acting solenoid valve (FASV) and its mounting surface. An O-ring was found to have failed. Failure of the O-ring was induced because it had been inadequately compressed by the mounting bolt torque. This valve had been replaced during the Unit 3 spring 2006 refueling outage. Post-event evaluation revealed that the installed mounting bolts were too long for the bolt holes provided, such that the bolts bottomed out in these holes before adequate compression of the O-ring was achieved. The small length differential between the installed bolts and those of correct length was not discernible to the naked eye. The bolts and the valve were supplied as a kit by the vendor. Checking of other EHC valve installations on Unit 3 did not identify any similar bolt length/hole depth mismatches. Plant procedures are being revised to specify and to verify the correct bolt lengths and mounting hole depths in future maintenance activities involving EHC components.

V. ASSESSMENT OF SAFETY CONSEQUENCES

BFN Updated Final Safety Analysis Report Chapter 14 discusses the plant accidents and transients that have been analyzed in association with BFN operation. The subject event, a manual reactor scram initiated from substantially less than full power, is a much less challenging event than those analyzed. All plant equipment operated properly in response to the scram. There were no safety consequences of this event, and the health and safety of the public were not adversely affected.

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
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Browns Ferry Nuclear Plant Unit 3	05000296	2006	-- 003	-- 00	5 OF 5

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

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

- The reactor was manually scrammed and the main turbine tripped. Valve realignment associated with the turbine trip isolated the leak location from the rest of the EHC system.
- EHC system fluid inventory was restored.

B. Corrective Actions to Prevent Recurrence[1]

- Relative bolt length/hole depths were checked on other similar Unit 3 locations
- Create/revise maintenance procedure(s) to address verification of clearance between bolt length and hole depth to ensure adequate O-ring compression when a valve is replaced.

VII. ADDITIONAL INFORMATION

A. Failed or Degraded Components

mounting bolt supplied by General Electric

B. Previous LERs on Similar Events

260/1999-09 - Manual Reactor Scram due to an EHC leak

The 1999 event on Unit 2 was caused by the failure of a stainless steel tubing welded connection, and the corrective actions associated with this event are not relevant to the mounting bolt length issue of the August 29, 2006 event being reported here.

C. Additional Information

Browns Ferry corrective action document PER 109756

D. Safety System Functional Failure (SSFF) Consideration:

This event does not involve a safety system functional failure which would be reported in accordance with NEI 99-02. The manual scram was initiated in response to a malfunction of non-safety related equipment. All safety-related equipment performed in accordance with plant design in response to the event.

E. Loss of Normal Heat Removal Consideration:

Reactor make-up was continued by the condensate and feed water systems, and decay heat was removed via steaming to the main condenser. There was no loss of normal heat removal condition associated with this scram event.

VIII. COMMITMENTS

None

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