March 18, 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) 50-260/2005-001-00

The enclosed report provides details of an unplanned inoperability condition of the Unit 2 high pressure coolant injection (HPCI) system which resulted from a loss of the system's discharge piping keep-fill. The keep-fill was lost during an unplanned suction source realignment of the system.

In accordance with 10 CFR 50.73(a)(2)(v)(B) and (D), TVA is reporting this event as a condition that could have prevented the fulfillment of the HPCI system safety functions of removing residual heat and mitigating the consequences of an accident.

There are no commitments contained in this letter.

Sincerely,

Original signed by:

M. D. Skaggs

cc: See page 2

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S:lic/submit/lers/U2 LER 2005-01.doc

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/2007

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.

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 2	05000260	1 OF 6

4. TITLE
Loss of High Pressure Coolant Injection (HPCI) Discharge Piping Keep-Fill

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
01	20	2005	2005	-001	-00	03	18	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)	X 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)	X 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	BJ	INS	Conax	Y						

14. SUPPLEMENTAL REPORT EXPECTED

☐ **YES** (*if yes, complete 15. EXPECTED SUBMISSION DATE*) ■ **NO**

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On January 20, 2005, at 2353 hours central standard time, alarms were received in the Unit 2 control room indicating that the normal high pressure coolant injection (HPCI) suction source had reached a low level. As a consequence of this indicated condition, the system's suction automatically transferred from the condensate storage tank (CST) to the Unit 2 suppression pool. At the time this suction transfer occurred, the normally closed HPCI inboard discharge isolation valve had been placed in the open position and its power removed in support of work being performed on 250 VDC Unit Battery 2. With the system discharge piping in this configuration, and given the relative elevation between the suppression pool water level and the discharge piping, the suction head pressure available from the suppression pool source was not sufficient to ensure the piping was kept full. The existence of voids in the upper elevations of the discharge piping was probable. With voiding present in the discharge piping, HPCI is vulnerable to waterhammer damage should the system initiate, therefore the capability to inject to the reactor vessel via HPCI was considered to be lost as a consequence of this event.

This event occurred because of a suction source transfer initiated by the spurious operation of a normal suction source level switch. The spurious operation occurred due to degraded wiring insulation in the vicinity of a CONAX seal. Corrective actions were to realign the system to the condensate storage tank (normal) suction and to replace the damaged wiring.

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

II. DESCRIPTION OF EVENT

A. Event:

On January 20, 2005, at 2353 hours central standard time, alarms were received in the Unit 2 control room indicating that the normal high pressure coolant injection (HPCI) [BJ] suction source had reached a low level. As a consequence of this indicated condition, the system's suction automatically transferred from the condensate storage tank (CST) [KA] to the Unit 2 suppression pool. At the time this suction transfer occurred, the normally closed HPCI inboard discharge isolation valve had been placed in the open position and its power removed in support of work being performed on 250 VDC Unit Battery 2 [EJ]. With the system discharge piping in this configuration, and given the relative elevation between the suppression pool water level and the discharge piping, the suction head pressure available from the suppression pool source was not sufficient to ensure the piping was kept full. The existence of voids in the upper elevations of the discharge piping was probable. With voiding present in the discharge piping, HPCI is vulnerable to waterhammer damage should the system initiate, therefore the capability to inject to the reactor vessel via HPCI was considered to be lost as a consequence of this event.

Because this event involved a condition that could have prevented the fulfillment of the HPCI system safety functions of removing residual heat and mitigating the consequences of an accident, it is reportable in accordance with 10 CFR 50.73 (a) (2) (v) (B) and (D).

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

None

C. Dates and Approximate Times of Major Occurrences:

January 18, 2005	2218 hours CST	HPCI inboard discharge isolation valve 2-FCV-073-44 (normally closed alignment) was opened and its motive power removed in support of maintenance activity on 250 VDC Unit Battery 2.
January 20, 2005	2353 hours CST	HPCI system suction swap occurred. Suction realigned to suppression pool. System piping configuration and valve alignment resulted in suspected partial voiding in discharge piping upper elevations. HPCI declared inoperable
January 21, 2005	0500 hours CST	HPCI normal suction alignment restored (aligned to CST)
	0719 hours CST	Required eight-hour report was made via telephone to the NRC Operations Center
	1650 hours CST	HPCI discharge piping keep-fill verified. Operations declared HPCI operable

D. Other Systems or Secondary Functions Affected

None

E. Method of Discovery

This event was immediately apparent to the operating crew through numerous indications and alarms in the Unit 2 control room.

F. Operator Actions

All operator actions taken in response to the loss of the HPCI system discharge piping keep-fill were appropriate. These actions included entering the appropriate Technical Specifications (TS) limiting conditions for operation and prioritizing the work necessary to restore the system to its normal suction alignment and verify piping keep-fill. No system or component operation was expected as a result of this event, and none occurred.

G. Safety System Responses

N/A No operational transient was induced by the HPCI system suction source swap, 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 unplanned HPCI suction source transfer from the CST to the Unit 2 suppression pool. The system normal alignment for stand-by readiness has the inboard discharge isolation valve (2-FCV-073-44) closed and the outboard isolation valve open; however, in this case, the inboard valve was also open in support of plant battery testing activities. Because of the relative elevation between the suppression pool water level and the system discharge piping, discharge piping keep-fill cannot be assured with suction aligned to the suppression pool if both of the system discharge isolation valves are open.

B. Root Cause

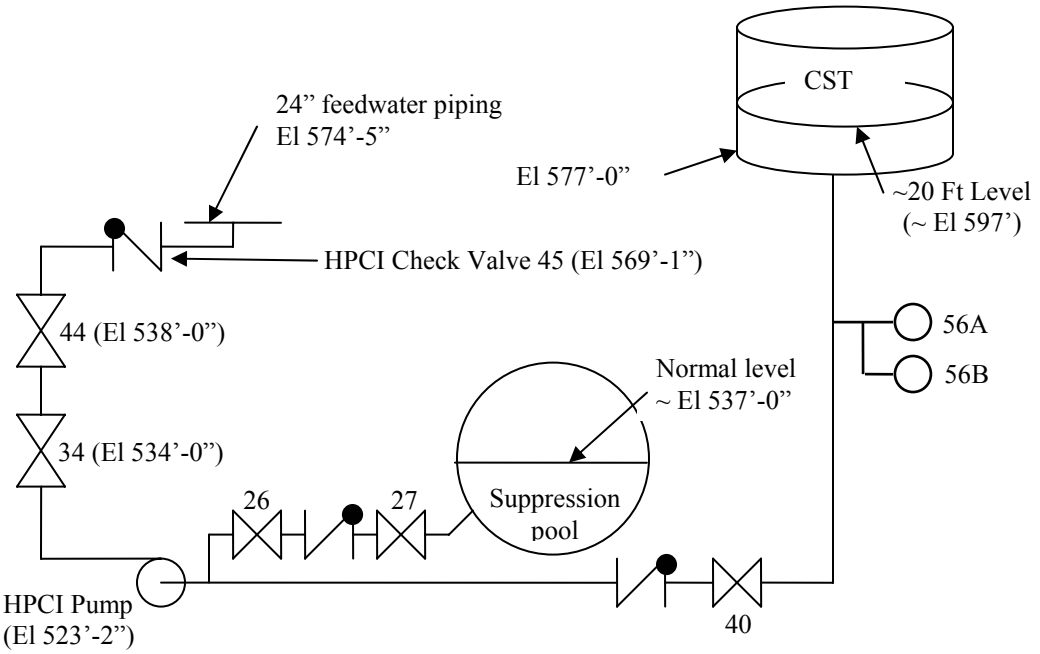
The root cause of this event was the existence of damaged insulation on wiring to a level switch (2-LS-073-56A) which monitored the availability of the normal suction source from the CST. This insulation damage caused intermittent, spurious logic actuation which resulted in the suction source transfer.

C. Contributing Factors

As is further described in Section IV below, this event would not have occurred if the HPCI system discharge valves had not both been open. If either valve had been closed, the elevation of the suppression pool water relative to the elevation of the discharge piping at the location of the isolation valves is such that keep-fill would have remained assured. While the suction source transfer would have occurred at any time the level switch logic actuated, the loss of keep-fill is only expected to occur if this abnormal (maintenance) alignment is in place.

IV. ANALYSIS OF THE EVENT

See the simplified sketch of the HPCI system below. To make the sketch and the following discussion more readable, the device function abbreviations and the unit/system code have been omitted.



The system alignment for stand-by readiness has the pump suction aligned to the CST via normally open valve 40. Series suppression pool suction isolation valves 26 and 27 are normally closed. Inboard discharge isolation valve 44 is normally closed, while the outboard discharge isolation valve 34 is normally open. The discharge piping elevation at the point of connection with the feedwater system piping is approximately 574 feet (above sea level), while the normal water level in the CST is at an approximate elevation of 597 feet. This net elevation difference, along with the atmospheric pressure above the CST tank water inventory, is adequate to keep the HPCI discharge piping full during stand-by conditions. Level switches 56A and 56B monitor the suction piping water inventory, and the switches operate in a one-out-of-two logic to initiate suction source transfer if low water level is sensed. When this logic actuates, suppression pool valves 26 and 27 will automatically open. Valve 40 will automatically close when both 26 and 27 are fully open.

In the subject event, the inboard isolation valve 44 had been placed in the open position with its power removed in support of maintenance activities which affected the power source. With both the 34 and 44 valves open, the discharge piping up to elevation 569 was in direct communication with the rest of the system. While the system was so aligned, level switch 56A spuriously operated due to degraded insulation on the wiring connections to the switch. The associated system logic initiated a HPCI suction transfer from the CST to the suppression pool. All valves operated per the plant design during this transfer. Given the elevation difference between the upper portions of the HPCI system discharge piping and the suppression pool water level, and the warmer temperature of the water in the HPCI piping physically near the operating main feedwater line, some voiding likely occurred in the upper elevations of the HPCI discharge piping.

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

The maintenance alignment in existence at the time of this event was key. If the HPCI inboard discharge valve had been closed in the normal stand-by readiness alignment, the water column on the discharge side of the pump which would have required supporting by the suppression pool level and its overpressure would have been approximately 30 feet shorter. No system voiding will occur if a suction transfer takes place with HPCI in the normal stand-by alignment.

HPCI was immediately declared inoperable when the suction transfer occurred. Any voiding which occurred would have been due to the creation of a low pressure steam bubble in the partial vacuum environment at the highest elevations of the discharge piping. No path existed for non-condensables to be introduced into the piping during the event; therefore, none could have been trapped in the system piping as a result of this event, so the system function was effectively restored when the system was realigned to the CST approximately 5 hours after the event. System operability was formally declared after the piping keep-fill was verified approximately 17 hours after the event. All operator actions in response to the loss of the discharge piping keep-fill were appropriate.

V. ASSESSMENT OF SAFETY CONSEQUENCES

While the loss of HPCI function being reported existed for approximately 5 hours, the Browns Ferry Unit 2 TS allow for reactor power operation for up to 14 days with an inoperable HPCI system. This allowed outage time reflects the fact that events requiring HPCI operation are of low probability. In this event HPCI was inoperable for only a small fraction of the time allowed under the TS. Additionally, all other ECCS equipment remained fully functional and available for service. Accidents and transients occurring in situations where HPCI is unavailable have been analyzed, and these analyses show that the consequences of such accidents can be mitigated, with wide safety margins, by the remaining complement of safety equipment. Also, because these analyses take no credit for certain other plant systems, additional mitigation margins realistically exist beyond those described in the analyses. These other systems (e.g., main feedwater and RCIC) can be very effectively used in mitigating such events.

Given the wide safety margins briefly described above, the health and safety of the public was not affected by the subject event.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

The HPCI system suction was restored to the CST and the system was filled/vented to assure keep-fill.

B. Corrective Actions to Prevent Recurrence[1]

- The faulty level switch interface wiring was replaced. Improved sleeving methods were used.
- Similar switches will be inspected for degradation.

VII. ADDITIONAL INFORMATION

A. Failed Components

Level Switch interface wiring insulation (Conax)

[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

None

C. Additional Information

Browns Ferry corrective action document PER 75274

D. Safety System Functional Failure Consideration:

This event involves a safety system functional failure as referenced in 10CFR 50.73(a)(2)(v), and it will be included in Performance Indicator reporting in accordance with NEI 99-02.

E. Loss of Normal Heat Removal Consideration:

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

VIII. COMMITMENTS

None