Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

May 13, 2003

Ashok S. Bhatnagar
Vice President, Browns Ferry Nuclear Plant

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Washington, D. C. 20555-0001

10 CFR 50.73

Dear Sir:

TENNESSEE VALLEY AUTHORITY - BROWNS FERRY NUCLEAR PLANT (BFN) - UNIT 2 - DOCKET 50-260 - FACILITY OPERATING LICENSE DPR-52 - LICENSEE EVENT REPORT (LER) 50-260/2003-002-00

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 turbine speed feedback signal.

In accordance with 10 CFR 50.73(a)(2)(v), 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,

Ashok S. Bhatnagar

cc: See page 2

IE22

Enclosure
cc (Enclosure):
(Via NRC Electronic Distribution)

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NRC FORM 366 (7-2001)

U.S. NUCLEAR REGULATORY COMMISSION

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 Nuclear Plant Unit 2	05000260	1 OF 6

4. TITLE
High Pressure Coolant Injection (HPCI) inoperability due to loss of turbine speed feedback signal

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME None	DOCKET NUMBER N/A
03	16	2003	2003	- 002 -	00	05	13	2003	FACILITY NAME None	DOCKET NUMBER N/A

9. OPERATING MODE: 1

10. POWER LEVEL: 035

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

	20.2201(b)		20.2203(a)(3)(ii)		50.73(a)(2)(ii)(B)		50.73(a)(2)(ix)(A)
	20.2201(d)		20.2203(a)(4)		50.73(a)(2)(iii)		50.73(a)(2)(x)
	20.2203(a)(1)		50.36(c)(1)(i)(A)		50.73(a)(2)(iv)(A)		73.71(a)(4)
	20.2203(a)(2)(i)		50.36(c)(1)(ii)(A)		50.73(a)(2)(v)(A)		73.71(a)(5)
	20.2203(a)(2)(ii)		50.36(c)(2)	x	50.73(a)(2)(v)(B)		OTHER
	20.2203(a)(2)(iii)		50.46(a)(3)(ii)		50.73(a)(2)(v)(C)		specify in Abstract below or in
	20.2203(a)(2)(iv)		50.73(a)(2)(i)(A)	x	50.73(a)(2)(v)(D)		NRC Form 366A
	20.2203(a)(2)(v)		50.73(a)(2)(i)(B)		50.73(a)(2)(vii)		
	20.2203(a)(2)(vi)		50.73(a)(2)(i)(C)		50.73(a)(2)(viii)(A)		
	20.2203(a)(3)(i)		50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)		

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	BJ	CON	A380	Y					

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

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

On March 16, 2003, Operations personnel were performing a surveillance procedure on the High Pressure Coolant Injection (HPCI) system. At 0525 hours CST, during conduct of this procedure, an automatic Primary Containment Isolation System (PCIS) Group 4 actuation occurred upon startup of the HPCI system. The isolation occurred because of an actual high HPCI system steam flow which was above the steam flow isolation setpoint of 200% nominal steam flow. This high flow rate was detected by sensors which input to the PCIS, and the PCIS logic actuated to isolate the system by closing the inboard and outboard HPCI steam line isolation valves. The isolation signal also resulted in a HPCI turbine trip. The HPCI turbine overspeed trip setpoint was not reached.

Following the isolation event, a failed connector in the turbine speed feedback circuitry was identified and repaired. Subsequent to the necessary post-maintenance testing and completion of the appropriate surveillance procedures, the HPCI system was declared operable at 1405 hours CST on March 17, 2003.

Connector failure due to age, excessive wear, and vibration was the event root cause. Corrective actions included repair of the connector, establishment of improved post-maintenance testing methods, and establishment of preventive maintenance activities to ensure connector integrity.

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).

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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 35 percent reactor power (approximately 1200 megawatts thermal) during power ascension following the cycle 12 refueling outage. Unit 3 was in Mode 1 at approximately 100% power (3458 megawatts thermal), and the unit was unaffected by this event. Unit 1 was shutdown and defueled and also was unaffected by the event.

II. DESCRIPTION OF EVENT

A. Event:

On March 16, 2003, Operations personnel [utility - licensed] were performing the High Pressure Coolant Injection (HPCI) [BJ] system surveillance procedure 2-SR-3.5.1.7, HPCI Main and Booster Pump Set Developed Head and Flow Rate Test at Rated Reactor Pressure. At 0525 hours CST, during conduct of this procedure, an automatic Primary Containment Isolation System (PCIS) [JM] Group 4 actuation occurred upon startup of the HPCI system. The isolation occurred because of an actual high HPCI system steam flow which was above the steam flow isolation setpoint of 200% nominal steam flow. This high flow rate was detected by sensors which input to the PCIS, and the PCIS logic actuated to isolate the system by closing the inboard and outboard HPCI steam line isolation valves. The isolation signal also resulted in a HPCI turbine trip. The HPCI turbine overspeed trip setpoint was not reached.

It was determined that the connector between the turbine speed sensor and the electronic governor module (EGM) was making only poor and erratic connection. When the HPCI system was started up, no speed feedback was seen; therefore, the EGM responded by calling for a fully-open turbine governor valve in an attempt to raise turbine speed. This fully opened governor valve allowed a high steam flow rate through the HPCI turbine steam supply piping.

Following the isolation event, the failed connector was identified and repaired. Subsequent to the necessary post-maintenance testing and completion of the appropriate surveillance procedures, the HPCI system was declared operable at 1405 hours CST on March 17, 2003.

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

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

C. Dates and Approximate Times of Major Occurrences:

March 16, 2003	0000 hours CST	Operations commenced performance of surveillance procedure 2-SR-3.5.1.7
	0400 hours CST	HPCI was declared inoperable in accordance with the procedure
	0525 hours CST	HPCI steam line auto-isolation occurred when the HPCI system was initiated in accordance with the test procedure
	0958 hours CST	Required eight-hour report was made via telephone to the NRC Operations Center
March 17, 2003	1405 hours CST	Unit 2 HPCI declared operable following connector repairs and completion of appropriate system testing

D. Other Systems or Secondary Functions Affected

None

E. Method of Discovery

This event was immediately identified in the control room by the operators performing the surveillance procedure through multiple indications and alarms.

F. Operator Actions

All operator actions taken in response to the isolation of the HPCI system and in its restoration following maintenance and testing were appropriate. These actions included entering the appropriate Technical Specifications (TS) limiting conditions for operation and prioritizing the work necessary to restore HPCI to operability.

G. Safety System Responses

All equipment (the flow sensing instruments, the PCIS logic, the HPCI turbine trip logic, and the HPCI steam line isolation valves) operated in accordance with the plant design during this event. No operational transient was induced by the automatic isolation of the HPCI system. The unit remained in steady state power operation during the system transient.

III. CAUSE OF THE EVENT

A. Immediate Cause

The immediate cause of this HPCI inoperability event was the unexpected isolation of the HPCI system during system testing. The isolation was caused by the failure of the speed feedback sensor connector. With no speed being sensed, the HPCI control system called for a fully-open HPCI turbine governor valve in an attempt to accelerate the turbine to reach the programmed speed. This action caused an increased steam flow down the HPCI steam supply line, and the increased flow was interpreted as a possible steam line break by the flow instruments which input to the PCIS. The PCIS responded by closing the steam supply line isolation valves.

B. Root Cause

The event root cause was a connector failure resulting from age, excessive wear, and vibration.

C. Contributing Factors

None

IV. ANALYSIS OF THE EVENT

The HPCI system is designed to deliver a large volume of water at high pressure to the reactor in situations where reactor coolant inventory is being lost while the reactor pressure remains high. The system uses a turbine-driven pump powered by reactor steam, and its active electrical components primarily use direct current (DC) supplied by plant batteries. These design features allow the system to operate in the short term without the availability of on-site or off-site alternating current (AC) power. The system is designed to mitigate small pipe break loss-of-coolant events, and it is also useful in other situations, such as station black out events or loss of feedwater events, where other reactor inventory make-up systems are unavailable or are of limited effectiveness. The reactor steam is taken from a main steam line connection inside the primary containment, passed through a primary containment penetration, and is then routed to the HPCI turbine in the reactor building. Two isolation valves are provided, one in-board and one out-board of the primary containment boundary, to isolate the HPCI steam line in the event that the piping fails at some point in the reactor building. Such a piping failure is detected by various flow, temperature, and pressure instruments, and these instruments input to the PCIS logic. If the appropriate combination of inputs is received, the PCIS will output signals to close these HPCI steam line isolation valves and to trip the HPCI system.

In this event, the speed signal feedback to the HPCI turbine control circuitry had failed. Upon system start-up no turbine speed was sensed, and the control system continually called for a maximum control valve position in an attempt to establish the desired speed ramp rate. The fully open turbine control valve caused a high HPCI steam line flow to occur. The high steam flow was correctly sensed by instrumentation, and the PCIS logic functioned to isolate the HPCI system and trip the turbine. Since no break in the HPCI steam line or attached piping had occurred, there was no release of energy or contamination into the secondary containment spaces where this equipment is located.

The attendant instrumentation and the associated isolation logic performed properly to isolate the system when abnormal system parameters were sensed. There was no damage to the system or to the surrounding plant equipment as a result of this event.

V. ASSESSMENT OF SAFETY CONSEQUENCES

The Browns Ferry Unit 2 TS allow for power operation of the reactor 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 it was not possible to determine the exact time at which the speed feedback connector had failed. The system had been last successfully tested on January 21, 2003, following planned maintenance. At some point subsequent to this successful testing, but prior to the initiation of the HPCI system at the time of this event, the connector integrity was lost. In cases such as this, where the actual failure time cannot be determined, the Reactor Oversight Process Performance Indicator reporting methodology assumes that a function is unavailable for one half of the time between the last known successful operation and the time of the failure discovery. Using this methodology, an unavailability time of 411.2 hours is assumed. This length of time is slightly longer than 17 days. Calculations performed using the BFN probabilistic safety assessment (PSA) model indicate that this amount of HPCI unavailability time would result in changes in core damage frequency (CDF) and large early release frequency (LERF) of substantially less than 1.0E-6 CDF and 1.0E-7 LERF. The values obtained indicate that this event was of very low safety significance.

Additionally, other ECCS equipment remained operable in compliance with TS requirements throughout the period where the HPCI system was potentially unavailable. 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. Because these analyses take no credit for certain other systems, such as the main feedwater system or the reactor core isolation cooling (RCIC) system, 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 turbine speed feedback connector was repaired and its continuity verified. The system was fully tested and demonstrated to be functional before the system was declared to be operable.

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B. Corrective Actions to Prevent Recurrence[1]

1. The integrity of similar connectors will be verified on the Unit 3 HPCI and Unit 2 and Unit 3 RCIC systems.
2. Relevant procedures will be revised to ensure the connector is visually inspected for damage, and the post-maintenance testing instructions will be revised to ensure connector continuity is thoroughly demonstrated.
3. Preventive maintenance activities will be developed to ensure the connector is replaced on a periodic basis for the HPCI and RCIC systems.

VII. ADDITIONAL INFORMATION

A. Failed Components

Speed feedback sensor connector - Amphenol 97-3106A-10SL-04S

B. Previous LERs on Similar Events

None

C. Additional Information

None

D. Safety System Functional Failure Consideration:

This event constitutes 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

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