

June 15, 2005

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop OWFN, P1-35
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) 50-260/2005-004-00**

The enclosed report provides details of a plant condition which involved a leakage path between the residual heat removal (RHR) system and the RHR Service Water (RHRSW) system inside a Unit 2 RHR heat exchanger.

In accordance with 10 CFR 50.73(a)(2)(ii)(B), TVA is reporting this event as an unanalyzed condition that could have significantly degraded plant safety. This event is also reportable under 10 CFR 50.73(a)(2)(v)(C) as a condition affecting the control of the release of radioactive material.

There are no commitments contained in this letter.

Sincerely,

Original signed by B. M. Aukland for:

Mike D. Skaggs

cc: See page 2

U.S. Nuclear Regulatory Commission
Page 2
June 15, 2005

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

U.S. Nuclear Regulatory Commission
Page 3
June 15, 2005

WDC:DTL:PSH:BAB

Enclosure

cc (Enclosure):

B. M. Aukland, POB 2C-BFN
A. S. Bhatnagar, LP 6A-C
J. C. Fornicola, LP 6A-C
N. M. Moon, BR 4T-C
R. F. Marks, PAB 1C-BFN
R. G. Jones, NAB 1A-BFN
J. R. Rupert, NAB 1A-BFN
K. W. Singer, LP 6A-C
M. D. Skaggs, POB 2C-BFN
E. J. Vigluicci, ET 11A-K
NSRB Support, LP 5M-C
INPO:LEREvents@inpo.org
EDMS WT CA - K

S:\lic\submit\lers\260-2005-04.doc

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 Browns Ferry Unit 2	2. DOCKET NUMBER 05000260	3. PAGE 1 OF 6
--	-------------------------------------	--------------------------

4. TITLE
Primary to Secondary Leakage in Residual Heat Removal Heat Exchanger in Excess of Analyzed Limits

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
04	16	2005	2005-004-00			06	15	2005	none	N/A
									FACILITY NAME	DOCKET NUMBER
									none	N/A

9. OPERATING MODE 1	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)		X 50.73(a)(2)(ii)(B)	50.73(a)(2)(viii)(B)
10. POWER LEVEL 50	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)		X 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 Paul S. Heck, Nuclear Engineer, Licensing and Industry Affairs	TELEPHONE NUMBER (Include Area Code) 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	BO	HTX	PERFEX	Y					

<input type="checkbox"/> YES (if yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR

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

On 4/17/05, preliminary indication of a leakage of contaminated water into the residual heat removal service water (RHRSW) system was observed. Activities were undertaken to identify the source of the leak, which was localized to the residual heat removal (RHR) system heat exchanger 2A. On 4/22/05, engineering evaluations concluded that relatively small leakage rates could result in unacceptable radioactive material release to the environment in post-accident situations if significant fuel damage was assumed to have occurred. At that time, the RHRSW flowpath through the RHR 2A heat exchanger was isolated. The RHR 2A containment cooling functions of suppression pool cooling, suppression pool spray, and drywell spray were declared inoperable, and the appropriate Technical Specification Limiting Condition for Operation actions were invoked.

Testing was then performed to locate the specific source of the leak within the RHR 2A heat exchanger. Following an interval for work planning and the staging of material, work was successfully completed to repair the heat exchanger leak. During the interval from 4/16/05, when reactor startup had commenced, to 4/22/05, had an event occurred which involved significant fuel damage, utilization of this heat exchanger for reactor or containment cooling could have resulted in a release of radioactive material to the environment beyond that analyzed. Plant safety is deemed to have been potentially significantly degraded during this approximate 6-day interval.

The root cause of this condition was raw water corrosion of the soft iron gasket and gasket seating surfaces at the heat exchanger floating head/tubesheet interface. Corrective actions included revising relevant maintenance procedures and evaluating RHR heat exchanger maintenance histories.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
Browns Ferry Nuclear Plant Unit 2	05000260	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 6
		2005	-- 004	-- 00	

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

I. PLANT CONDITION(S)

At the time the condition was identified, Unit 2 was in Mode 1 at approximately 50% power during power ascension following its Cycle 13 refueling outage. 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 April 17, 2005, preliminary indication of a leakage of contaminated water into the residual heat removal service water (RHRSW) [BI] system was observed. Plant activities were undertaken to identify the source of the leak, and on April 18, 2005, the leak was localized to the residual heat removal (RHR) [BO] system heat exchanger 2A. Engineering evaluations were commenced to determine the safety impact of such leaks under different scenarios. On April 22, 2005, these evaluations concluded that relatively small leakage rates could result in unacceptable radioactive material release to the environment in post-accident situations if significant fuel damage was assumed to have occurred. At that time, the RHRSW flowpath through the RHR 2A heat exchanger was isolated via a motor operated valve (discharge side) and a check valve (inlet side). The RHR 2A containment cooling functions of suppression pool cooling, suppression pool spray, and drywell spray were declared inoperable, and the appropriate Technical Specification (TS) Limiting Condition for Operation (LCO) actions were invoked.

Diagnostic testing was then performed to locate the specific source of the leak within the RHR 2A heat exchanger. Subsequently, following an interval for work planning and the staging of material, work was successfully completed to repair the heat exchanger leak. During the interval from April 16th, when reactor startup had commenced, to April 22nd, had an event occurred which involved significant fuel damage, utilization of this heat exchanger for reactor or containment cooling could have resulted in a release of radioactive material to the environment beyond that analyzed in the BFN design and licensing bases. Plant safety is deemed to have been potentially significantly degraded during this approximate 6-day interval.

This condition created a radioactive material release path greater than analyzed, resulting in short-term plant operation in an unanalyzed condition that under certain scenarios could have significantly degraded plant safety. The condition is reportable in accordance with 10 CFR 50.73 (a) (2) (ii) (B). Reporting under 10 CFR 50.73(a)(2)(v)(C) also applies as this condition affected systems which impact the control of the release of radioactive material.

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

None

C. Dates and Approximate Times of Major Occurrences:

April 16, 2005	0249 hours CDT	U2 start-up for Cycle 14 operations commenced
April 17, 2005	0445 hours CDT	Chemistry sampling detected contamination in RHRSW A samples. Off-site Dose Calculation Manual (ODCM) concentration limits were not exceeded.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
Browns Ferry Nuclear Plant Unit 2	05000260	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	3 OF 6
		2005	-- 004	-- 00	

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

April 18, 2005	2258 hours CDT	RHR and RHRSW system pressure responses to equipment manipulations indicated a possible leak in RHR heat exchanger 2A.
April 22, 2005	1220 hours CDT	Operations notified by Engineering that evaluations had determined operation with unquantified leakage rates was outside the plant design and licensing bases. RHRSW to the heat exchanger was isolated, and Operations declared RHR 2A inoperable for the functions requiring RHRSW support (suppression pool cooling, suppression pool spray, and drywell spray) and entered the applicable 30-day LCO.
April 28, 2005	1436 hours CDT	A manual isolation valve on the heat exchanger RHRSW inlet piping was closed to provide another barrier to leakage in addition to the inlet check valve.
April 30, 2005	1800 hours CDT	Testing was completed to specifically identify the leak location as the floating head flange of the RHR 2A heat exchanger.
May 4, 2005	0100 hours CDT	7-day low pressure coolant injection (LPCI) LCO 3.5.1.A entered and the RHR 2A train removed from service to effect repairs to the heat exchanger.
May 9, 2005		Technical Specifications amendment requested by BFN was approved by NRC for one-time use to extend the LPCI LCO completion time to 14 days.
May 15, 2005	1038 hours CDT	Repairs and post-maintenance testing completed satisfactorily. RHR 2A heat exchanger and train declared operable and LPCI and containment cooling LCO's exited.

D. Other Systems or Secondary Functions Affected

None

E. Method of Discovery

Chemical analysis identified a possible leak into the RHRSW system. Operations personnel subsequently manipulated the RHR and RHRSW systems, and the observed RHR and RHRSW system pressures were consistent with a leak internal to the RHR 2A heat exchanger.

F. Operator Actions

Operator action in response to this condition was appropriate. Operations requested evaluation from Engineering after being informed of the possible leak, and Operations properly performed system manipulations to allow specifics of the leak to be diagnosed. Recommendations resulting from the Engineering evaluations were promptly implemented.

G. Safety System Responses

N/A

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
Browns Ferry Nuclear Plant Unit 2	05000260	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	4 OF 6
		2005	-- 004	-- 00	

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 condition was the failure of the metallic gasket at the heat exchanger floating head/tube sheet interface.

B. Root Cause

The root cause of this condition was raw water corrosion of the soft iron gasket and gasket seating surfaces at the heat exchanger floating head/tubesheet interface.

C. Contributing Factors

None

IV. ANALYSIS OF THE EVENT

There are four RHR trains on each BFN unit, with each train consisting of a pump and heat exchanger. The pumps provide LPCI flow to the reactor during accident scenarios, and the heat exchangers are used to reject reactor coolant or primary containment heat to the RHRSW system during both normal operations or accident conditions. Under most operating conditions, the operating pressure of the RHR system will be higher than that of the RHRSW system at the heat exchangers, therefore any leakage between the systems will flow from RHR into the RHRSW system. Radiation monitors capable of alarm are installed on the RHRSW piping to detect such leakage, and if the monitors are out of service, compensatory sampling is instituted. These features guard against the existence of sustained leakage from RHR into the RHRSW system through the RHR heat exchangers. For the condition under consideration, both the relevant radiation monitor and compensatory sampling indicated the existence of a small leak.

Following localization of the leak, the floating head gasket and gasket seating surfaces were examined. The soft iron gasket was oxidized with approximately eight inches of significant wastage in the area where leakage was observed during testing. The root cause was determined to be corrosion of the soft iron floating head gasket as a result of prolonged exposure in a wetted environment. In addition, the raw water corrosion resulted in some degradation of the gasket seating surfaces.

V. ASSESSMENT OF SAFETY CONSEQUENCES

The RHR heat exchangers serve as a barrier between water from the reactor coolant system and primary containment and the cooling water which is discharged to the Tennessee River. During the timeframe of the heat exchanger leak, effluent activity was detected in concentrations well below the effluent concentration limits (ECL) and dose limits given in 10CFR20.

The BFN Unit 2 baseline core damage frequency (CDF) from all internal event causes is 1.25E-6 events/year. Over the 6-day interval where leakage to the environment could have occurred during a core damage event, the estimated event frequency is: $6/365 \times 1.25E-6 = 2.1E-8$ events. Stated as a probability, this corresponds to 1 chance in approximately 49 million of a core damaging event occurring within this 6-day span of time. Since the above frequency estimates include incidences of relatively small amounts of core damage, the probability of an accident involving significant core damage is therefore more unlikely still. However, if an event involving significant core damage is postulated to

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
Browns Ferry Nuclear Plant Unit 2	05000260	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	5 OF 6
		2005	-- 004	-- 00	

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

have occurred during this small timeframe, releases could have increased above the limits of 10CFR50.67 resulting in an unanalyzed condition. Considering the extremely low occurrence probability of any core damage event during this limited period of time, it is concluded that this condition had a negligible impact on the health and safety of the public.

There were no releases above regulatory limits, and, based on the above discussion, it is apparent there was no adverse safety impact of this event. There was no effect on the health and safety of the public.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

The service water flow path through the 2A RHR Heat Exchanger was isolated. Planning was commenced for diagnosing the leak source and repairing the leak. During the repair activity the RHR 2A heat exchanger floating head gasket was replaced using a modified split ring and seal weld.

B. Corrective Actions to Prevent Recurrence⁽¹⁾

- Revised maintenance procedures to include instructions for replacing the RHR heat exchanger floating head.
- Review RHR heat exchanger repair history on all three BFN units to determine dates of floating head gasket replacements and to identify heat exchangers with the original design soft iron floating head gasket installed.

VII. ADDITIONAL INFORMATION

A. Failed Components

PERFEX (now Thermal Engineering, Inc.) CES 51-6-240 heat exchanger floating head gasket

B. Previous LERs on Similar Events

None. It is noted that BFN has previously incurred RHR heat exchanger leakage in events reported to NRC in the late 70's and early 80's, however, the leakage in these events resulted from issues of maintenance of bolting preload and not gasket material failure.

C. Additional Information

Browns Ferry corrective action document PER 81236

D. Safety System Functional Failure Consideration:

The condition being reported involves a safety system functional failure which is being reported as a performance indicator data element in accordance with NEI 99-02. One safety function of the RHR system is to act as an extension of primary containment, and the condition identified herein represents a failure of this function.

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

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
Browns Ferry Nuclear Plant Unit 2	05000260	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	6 OF 6
		2005	-- 004	-- 00	

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

E. Loss of Normal Heat Removal Consideration:

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

VIII. COMMITMENTS

None