

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

John T. Herron
Vice President, Browns Ferry Nuclear Plant

May 12, 2000

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

10 CFR 50.73

Gentlemen:

In the Matter of)
Tennessee Valley Authority)

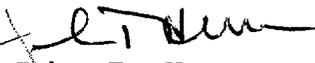
Docket No. 50-296

**BROWNS FERRY NUCLEAR PLANT (BFN) - UNIT 3 - DOCKET NO. 50-296 -
FACILITY OPERATING LICENSE DPR-68 - LICENSEE EVENT REPORT (LER)
50-296/2000-001-00**

The enclosed report provides details of the April 15, 2000, Unit 3 reactor scram on low reactor water level resulting from a control oil system problem on reactor feedpump 3C. Plant safety systems operated as designed in response to this event.

This report is submitted in accordance with 10 CFR 50.73 (a)(2)(iv) as an event that resulted in the actuation of an engineered safety feature, including the reactor protection system.

Sincerely,


John T. Herron

cc: See page 2

TE22

U.S. Nuclear Regulatory Commission
Page 2
May 12, 2000

Enclosure

cc (Enclosure):

Mr. William O. Long, Senior Project Manager
U.S. Nuclear Regulatory Commission
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852-2739

Mr. Paul E. Fredrickson, Branch Chief
U.S. Nuclear Regulatory Commission
Region II
61 Forsyth Street, S. W., Suite 23T85
Atlanta, Georgia 30303-3415

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

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503. If 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)

FACILITY NAME (1) Browns Ferry Nuclear Plant - Unit 3		DOCKET NUMBER (2) 05000296	PAGE (3) 1 of 6
--	--	-------------------------------	--------------------

TITLE (4)
Reactor Scram due to Feedwater Pump Control Oil System Problem

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER				FACILITY NAME	DOCKET NUMBER
04	15	00	2000	001	00	05	12	00	NA	
									NA	

OPERATING MODE (9) 1	POWER LEVEL (10) 70	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)								
		20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)(B)		50.73(a)(2)(viii)		
		20.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)		
		20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71		
		20.2203(a)(2)(ii)		20.2203(a)(4)	X	50.73(a)(2)(iv)		OTHER		
		20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A		
		20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)				

LICENSEE CONTACT FOR THIS LER (12)

NAME B. C. Morris, Senior Licensing Project Manager	TELEPHONE NUMBER (Include Area Code) (256) 729-7909
--	--

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
X	AA	ZIS	G080	Y						

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

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

On April 15, 2000, with Unit 3 in operation at 70% power, a low reactor water level scram occurred following a reactor feedpump 3C flow reduction. The feedpump 3C flow reduction was caused by a drop in control oil pressure due to a clogged control oil filter. Safety systems responded as expected. All control rods scrammed and fully inserted.

The event evaluation determined that recent maintenance activities on feedpump 3C, which involved an atypically large number of feedpump trips and resets, had increased the particulate concentration in the control oil. This caused the filter to clog at a much faster rate than experienced in the past. Corrective actions include installing control oil filter differential pressure indicators to provide online oil pressure monitoring capability. Additional operational guidance has been added to the Alarm Response Procedures for feedpump control oil system problems.

TVA is reporting this event in accordance with 10 CFR 50.73 (a)(2)(iv) as an event that resulted in an actuation of an engineered safety feature, including the reactor protection system.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION	
Browns Ferry Nuclear Plant - Unit 3	05000296	2000	-- 001	-- 00	2 of 6

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

I. PLANT CONDITIONS

Prior to the initiation of the event, Unit 3 was operating in Mode 1 at 70 percent power and Unit 2 was in Mode 1 at 100 percent power. Unit 1 was shutdown and defueled.

II. DESCRIPTION OF EVENT

A. Event:

During Unit 3 reactor operation on Saturday, April 15, 2000, at approximately 1200 hours Central Daylight Time (CDT), speed variations were observed on reactor feedwater pump [SJ] 3C by the Unit Operator (UO). Feedpump 3A was in service in automatic mode and feedpump 3B was in a planned maintenance outage. The feedpump 3C speed variations were causing reactor water level perturbations. The UO placed feedpump 3C in manual mode to better control pump speed and reactor level. At 12:26, the speed on feedpump C decreased markedly and feedpump 3C discharge head fell below reactor pressure. Feedpump 3A automatically increased flow, but was incapable of fully compensating for the loss of feedpump 3C injection flow. Reactor water level decreased and Unit 3 scrambled on a Reactor Vessel Low, Level 3 trip signal (528 inches above vessel zero).

Vessel water level continued to decrease and, aggravated by the scram induced prompt water level drop, resulting in momentarily reaching the Reactor Vessel Low Low, Level 2 (470 inches above vessel zero) trip point. This caused an initiation of the High Pressure Coolant Injection (HPCI) [BG] system and the Reactor Core Isolation Cooling [BN] (RCIC) system. Both HPCI and RCIC responded and injected as designed. The Low Low Level signal also caused both recirculation pumps [AD] to trip and actuated the Alternate Rod Injection (ARI) system as expected.

The operation of HPCI, RCIC, and feedpump 3A quickly recovered vessel level which was returned to normal operating level within 75 seconds of the scram. Control of feedpump 3C was also regained shortly after the scram following the swap of the feedpump 3C control oil filters. The condenser [SG] remained in service throughout the event.

The scram resulted in the expected automatic actuations or isolations of the following Primary Containment Isolation System [JE] (PCIS) systems and ventilation components on the Low, Level 3 trip. Some of these components are in their isolated positions during normal operations. The scram signal was reset at 12:35 hours and the systems were returned to normal alignment.

- PCIS group 2, Shutdown cooling mode of Residual Heat Removal (RHR) [BO] system; drywell floor drain isolation valves; drywell equipment drain isolation valves [WP].
- PCIS group 3, Reactor Water Cleanup (RWCU) system [CE].
- PCIS group 6, primary containment purge and ventilation [JM], Unit 2 reactor zone ventilation [VB]; refuel zone ventilation [VA]; Standby Gas Treatment system [BH]; Control Room Emergency Ventilation system [VI].
- PCIS group 8, Traversing Incore Probe (TIP) [IG].

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION	
Browns Ferry Nuclear Plant - Unit 3	05000296	2000	001	00	3 of 6

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

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

Reactor feedpump 3B had been removed from service on April 13, 2000, for a planned maintenance outage.

C. Dates and Approximate Times of Major Occurrences:

- April 15, 2000, at 0710 hours CDT A reactor feedpump 3C high control oil delta-p alarm was received in the control room
- April 15, 2000, at ~ 1200 hours CDT UO observed turbine speed fluctuations on feedpump 3C
- April 15, 2000, at ~ 1215 hours CDT UO placed feedpump 3C in manual control to dampen feed flow fluctuations
- April 15, 2000, at 1226 hours CDT Feedpump 3C speed decreased rapidly and discharge head reduced below reactor pressure; vessel water level started decreasing
- April 15, 2000, at 1226 hours CDT Reactor scrammed on Reactor Vessel Low, Level 3 trip
- April 15, 2000, at 1226 hours CDT HPCI and RCIC initiated, both recirculation pumps tripped, and ARI actuated on Reactor Vessel Low Low, Level 2
- April 15, 2000, at 1228 hours CDT Reactor level restored to normal
- April 15, 2000, at 1235 hours CDT Scram reset

D. Other Systems or Secondary Functions Affected:

None.

E. Method of Discovery:

Operators observed water level decreasing and a reactor scram at Level 3.

F. Operator Actions:

Operation actions in response to the event were in accordance with applicable plant procedures.

G. Safety System Response:

All required safety systems operated as designed.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION	
Browns Ferry Nuclear Plant - Unit 3	05000296	2000	-- 001	-- 00	4 of 6

TEXT (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 low reactor water level resulting from a reduction in feedwater flow.

B. Root Cause:

The cause of the event was a time delay in swapping the control oil filters on 3C feedpump. The root cause for the delay was concluded to be the lack of differential pressure indication instrumentation across the feedpump control oil filters. Had instrumentation been installed, the operators could have monitored the trend in the delta-p and taken action prior to encountering feedpump 3C control problems.

C. Contributing Factors:

None.

IV. ANALYSIS OF THE EVENT

BFN Unit 3 has three steam driven turbine feedpumps which return condensate water to the reactor vessel. Each feedpump has a separate oil system, which supplies both lubrication oil and system control oil for feedpump operation. To minimize the chances of particulate matter suspended in the oil from obstructing proper operation of system servo valves, the control oil is filtered by dual in-line filters. Only one of the oil filters can be aligned for service at a time. The filters can be swapped with the feedpump in service using Operating Instructions. A differential pressure (delta-p) alarm is installed across the filters, however, there are no local or remote differential pressure indicators.

At 7:10 CDT on April 15, 2000, a high control oil delta-p alarm was received on reactor feedpump 3C. Feedpump 3A was in service in automatic mode at the time and feedpump 3B was in a planned maintenance outage. The delta-p alarm was discussed and a decision was made to delay swapping the 3C control oil filters until reactor feedpump 3B was returned to service later in the same shift. The availability of the third feedpump (3B) would ensure that sufficient feedwater flow would be available to avoid a reactor trip if problems were encountered during the online swap of the feedpump 3C filters. In addition, previous operating experience was that operation could continue for an extended period of time with the delta-p alarm in.

About 12:00 CDT, feedpump C began to demonstrate increasing speed and flow fluctuations. Feedpump 3B was still being prepared for return to operation at the time. Since feedpump 3C control was being affected, the Outside Unit Supervisor (a Senior Reactor Operator) was directed to swap the feedpump 3C control oil filters online. At 12:26 CDT, feedpump 3C speed decreased markedly and the reactor scrambled on low vessel level. Control of feedpump 3C was regained shortly after the reactor scram once the oil filters were swapped.

Following the scram, the control oil filters were removed from feedpump 3C and oil samples were taken from all three Unit 3 feedpumps. The control oil filter that was in service on feedpump 3C prior to the scram was visibly dirty. Also, the oil sample on feedpump 3C showed a particulate concentration that was notably higher than samples taken on feedpumps 3A or 3B. An engineering evaluation determined that the behavior

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION	
Browns Ferry Nuclear Plant - Unit 3	05000296	2000	-- 001	-- 00	5 of 6

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

exhibited by feedpump 3C was consistent with low oil control pressure that would result from a clogged oil filter. As noted above, control of feedpump 3C was regained once the filter had been swapped. Therefore, it was concluded that the feedpump 3C flow control problem was the result of a clogged oil filter.

Previous operating and maintenance history for the Unit 2 and 3 feedpumps was reviewed with particular emphasis on pump 3C. Experience indicated that the control oil filters had a typical service life of 3 months at a minimum. Routine periodic oil samples showed good oil quality was being consistently maintained between filter replacements.

The feedpump 3C control oil filters had been changed out during the previous week as part of a scheduled maintenance outage which ended on April 13, 2000. The feedpump 3C maintenance outage was longer than scheduled due to several problems, and the return-to-service testing involved several adjustments to the oil system pressure regulators and an atypically large number of feedpump trips and resets. It was concluded that the testing activities during the 3C maintenance outage raised the concentration of particulates and corrosion products suspended in the feedpump oil, which caused the filter to clog at a much faster rate than experienced in the past. Likewise, the dirty oil shortened considerably the time period following the delta-p alarm and the onset of feedpump control problems compared to past operating history. Since differential pressure indicators were not installed, Operators did not have indication of the faster rate of oil filter clogging. Therefore, the root cause was concluded to be the lack of differential pressure indication instrumentation across the feedpump control oil filters. Had instrumentation been installed, the operators could have monitored the trend in the delta-p and taken action prior to encountering feedpump 3C control problems.

V. ASSESSMENT OF SAFETY CONSEQUENCES

The evaluation of plant system and component responses to the event concluded that responses were as expected. The normal heat removal path was not lost during this event since the condenser was used for decay heat removal and no main steam relief valves opened. Personnel performance in response to the scram was also evaluated and found to be satisfactory for an event of this type. In addition, there was no radioactive material released, and there were no actual or potential safety consequences as a result of this event.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions:

The Operations crew stabilized the reactor following the scram using the appropriate operating instructions. Control of feedpump 3C was restored following the swap of control oil filters and pump 3C was used to control water level following the scram.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION	
Browns Ferry Nuclear Plant - Unit 3	05000296	2000	-- 001	-- 00	6 of 6

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

B. Corrective Action to Prevent Recurrence:

1. Control oil filter differential pressure indicators were installed on all three Unit 3 feedpumps during the refueling outage in April 2000. These will also be installed on Unit 2.¹
2. The Alarm Response Procedures for control oil high delta-p have been revised to provide additional detail regarding filter swaps.
3. Operator Training will be conducted on the event.¹

VII. ADDITIONAL INFORMATION

A. Failed Components:

The control system on reactor feedpump 3C experienced degraded performance due to loss of control oil pressure. The feedpump control system was designed by General Electric.

B. Previous Similar Events:

On September 27, 1999, reactor feedpump 2C tripped during the change-out of a control oil filter. Although the cause of this event was not the same as that presented in this report, it did heighten operator sensitivity to risks associated with manipulating control oil filters online.

C. Additional Information:

This event did not result in loss of the normal heat removal path as described in NEI 99-02 Revision 0, since the condenser remained available throughout the event and was used for decay heat removal.

D. Safety System Functional Failure:

This event did not result in a safety system functional failure in accordance with NEI 99-02, Revision 0.

VIII. COMMITMENTS

None.

¹TVA does not consider these corrective actions as regulatory commitments. Completion will be tracked in TVA's Corrective Action Program.