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SHINGLETON, E. B. Tennessee Valley Authority
ZERINGUE, O. J. Tennessee Valley Authority
RECIP. NAME RECIPIENT AFFILIATION

SUBJECT: LER 92-006-00: on 920728, automatic main turbine trip & reactor scram occurred from indicated high water level spike on two of three level channels. Caused by inaccurate evaluation & diagnosis. Event to be reviewed. W/920827 ltr.

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O. J. "Ike" Zeringue
Vice President, Browns Ferry Operations

AUG 27 1992

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

Dear Sir:

TVA - BROWNS FERRY NUCLEAR PLANT (BFN) UNIT 2 - DOCKET NO. 50-260 - FACILITY OPERATING LICENSE DPR-52 - LICENSEE EVENT REPORT LER-50-260/92006

The enclosed report provides details concerning a Unit 2 reactor scram on indicated high reactor water level that occurred on July 28, 1992. The indicated high water level was caused by a signal spike that occurred when a relay was replaced in the control circuit of the Feedwater Level Control System during troubleshooting.

This report is submitted in accordance with 10 CFR 50.73(a)(2)(iv).

Sincerely,

O. J. Zeringue

Enclosure
cc: See page 2

IE22
1/1

U.S. Nuclear Regulatory Commission

AUG 27 1992

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NRC Form 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

Approved OMB No. 3150-0104
Expires 4/30/92

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Browns Ferry Nuclear Plant (BFN) Unit 2	0 5 0 0 0 2 6	0 1 OF 0 6

TITLE (4) Reactor Scram on Indicated High Reactor Water Level Caused by Signal Spike During Feedwater Level Control System Troubleshooting.

EVENT DAY (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
									BFN Unit 1	0 5 0 0 0 2 5 9
0 7	2 8	9 2	9 2	0 0 6	0 0	0 8	2 7	9 2	BFN Unit 3	0 5 0 0 0 2 9 6

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following)(11)			
POWER LEVEL (10)	1 0 0	20.402(b)	20.405(c)	X 50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (AREA CODE)
E. B. Shingleton, Compliance Licensing Engineer	2 0 5 7 2 9 - 2 0 4 9

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

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 fifteen single-space typewritten lines) (16)

On July 28, 1992, at 1932 hours, during troubleshooting on the Unit 2 Feedwater Level Control (FWLC) System, Browns Ferry Unit 2 experienced an automatic main turbine trip and reactor scram from an indicated high water level spike on two of three level channels. Engineered safety feature actuations included Primary Containment Isolation System Group 2, 3, 6, and 8 logic and all trains of Standby Gas Treatment and Control Room Emergency Ventilation.

The level spike was induced by the replacement of a relay in the control circuit of the FWLC system. Subsequent investigation determined that the relay replacement was not required. The root cause of this event was an inaccurate evaluation and diagnosis of prior feedwater system trouble symptoms, and failure to anticipate the FWLC circuit response to the relay replacement.

Administrative controls will be provided to ensure high risk troubleshooting activities on certain plant systems receive an independent technical review in addition to that already done. TVA will review this event with appropriate personnel.

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

I. PLANT CONDITIONS

Unit 2 was at approximately 100% power. Browns Ferry Units 1 and 3 were defueled. Troubleshooting was in progress on the Feedwater Level Control system (FWLC). The FWLC controller and the 2A and 2B feedpumps were in manual.

II. DESCRIPTION OF EVENT

A. Event:

On July 28, 1992, at 1932 hours, during troubleshooting on the Unit 2 FWLC system [JB], Browns Ferry Unit 2 experienced an automatic main turbine trip and a reactor scram from an indicated high water level spike on two of three level channels. The replacement of a FWLC system control relay, which reestablished the circuit loop integrity, caused a full scale signal spike. This current spike caused the actuation of two level switches, thus, completing the necessary two out of three logic for main turbine trip and reactor feedpump (RFP) trip.

Since the plant was operating at greater than 30% power, direct actuation of the reactor protection system [JB] for reactor scram and recirculation pump trip occurred when the main turbine tripped. The main turbine bypass valves and four steam relief valves (SRVs) actuated to reduce and maintain reactor pressure following the trip. Additionally, the Alternate Rod Insertion (ARI) logic actuated on high reactor pressure. Primary Containment Isolation System (PCIS) [JM] Group 2, 3, 6, and 8 logic actuated as expected for this event.

All trains of Standby Gas Treatment [BH] and Control Room Emergency Ventilation [VI] started as expected. The reactor was brought to a hot shutdown condition pending investigation of the FWLC system. Unit Operators (UO) (Utility, licensed) reset Engineered Safety Feature (ESF) logic and restored ESF systems to their normal standby alignment by 1936 hours on July 28, 1992.

This event is reported in accordance with 10 CFR 50.73(a)(2)(iv) as an event or condition that resulted in a manual or automatic actuation of an ESF.

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

None.

C. Dates and Approximate Times of Major Occurrences:

July 28, 1992 at 1932 CDST	Main and feedpump turbines trip, reactor scram with recirculation pump trips. PCISs 2, 3, 6 and 8 actuated as expected.
July 28, 1992 by 1936 CDST	ESF logic reset and systems restored to standby alignment.
July 28, 1992 at 2316 CDST	A four hour report was made to NRC in accordance with 10 CFR 50.72(b)(2)(ii).

D. Other Systems or Secondary Functions Affected:

None.

E. Method of Discovery:

The reactor scram and ESF actuations were immediately recognized by the Unit Operator upon receipt of indications in the Control Room.

F. Operator Actions:

Operations personnel promptly responded to the turbine trip/reactor scram and maintained complete control of the unit during the shutdown sequence.

G. Safety System Responses:

ESF actuations occurred as designed on a high reactor water level scram. PCIS Group 2 (shutdown cooling mode of residual heat removal [BO]), 3 (reactor water cleanup [CE]), 6 (primary containment purge and vent [JM]), and 8 (Traversing In-core Probe [IG]) logic actuated as expected for this event. All trains of Standby Gas Treatment and Control Room Emergency Ventilation systems started as expected. Additionally, the ARI logic actuated on high reactor pressure.

The plant response to the transient was as expected, except the Traversing In-core Probe (TIP) ball valves were found in the open position, the supply breaker to the 480 Volt Reactor Motor Operated Valve (RMOV) Board 2C tripped, and the SRV tailpipe temperature chart recorder paper jammed.

The TIP ball valves were found in the open position during scram recovery actions due to a local TIP isolation logic reset pushbutton switch being stuck in the reset position.

III. CAUSE OF THE EVENT

A. Immediate Cause:

The turbine trip/reactor scram on high reactor water level was caused by a current spike that occurred when a relay was replaced in the FWLC circuit during troubleshooting activities. Installation of the replacement relay reestablished the circuit loop integrity and caused a full scale signal spike that actuated the electronic level switches in the loop. The proportional amplifiers in the circuit were saturated when the circuit was opened and caused the current spike when the circuit was closed. This completed the necessary two out of three logic for main turbine trip and reactor feedpump trip.

B. Root Cause:

Subsequent investigation determined that the relay replacement was not required. The root cause of this event was an inaccurate evaluation and diagnosis of prior feedwater system trouble symptoms and failure to anticipate the circuit response. There were no administrative controls that required independent technical review of the troubleshooting activity.

The FWLC system design was considered a contributor to the event. The current FWLC system is very sensitive to signal perturbations and to single failures. The signal disturbances induced by the troubleshooting activity were of short duration and the system design was such that both loops had to be worked on simultaneously.

IV. ANALYSIS OF THE EVENT

This event, a reactor scram resulting from a trip of the main turbine from 100% power, is fully within the design basis of the plant. The Safety Analysis Report also assumes the failure of the main turbine bypass valves to open in conjunction with this event. The event occurred from a plant initial condition that is practically the most severe for events of this type, and without assuming additional equipment failure, the stress to the plant was near maximum for this type of event. The plant response to the transient was as expected, except as described above. No degradation of plant operating or safety margins occurred. The event did represent a challenge to reactor safety systems, however, nuclear safety was not decreased by this event.

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

V. CORRECTIVE ACTIONS

A. Immediate Corrective Actions:

1. The original control relay was tested and found acceptable.

2. TVA verified that the removal and reinsertion of the relay causes a current spike.

3. The master FWLC controller was tested and proper operation was verified.

4. The TIP ball valve failure to close was investigated and a stuck reset pushbutton switch was identified and corrected.

5. The supply breaker for the 480 VAC RMOV Board 2C was replaced as a precautionary measure prior to restart. This problem had occurred previously and was under investigation at the time of this event.

B. Corrective Actions to Prevent Recurrence:

1. Administrative controls will be provided to ensure high risk troubleshooting activities on certain plant systems have action plans reviewed by technical personnel independent of the original plan development.

2. TVA will review this event with appropriate personnel.

3. As previously committed in LER 50-260/92004, TVA will evaluate implementation of the Scram Frequency Reduction Committee recommendation to design and install a digital feedwater control system.

Although not considered a part of the corrective action for the reportable event, TVA plans to pursue further corrective actions to eliminate the potential for TIP pushbutton switch jamming and to correct the SRV tailpipe temperature recording chart paper jamming problem.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
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Browns Ferry Unit 2	0 5 0 0 0 2 6 0	9 2	— 0 0 6	— 0 0	0 6 OF 0 6

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

VI. ADDITIONAL INFORMATION

A. Failed Components:

None.

B. Previous LERs on Similar Events:

The FWLC design has previously been identified as a major contributor to scram frequency at BFN. As a whole, the system is intolerant of upset and includes many places where a single component failure or maintenance activities can cause a serious plant transient or shutdown. Records collected by the BFN Scram Frequency Reduction Team show a total of 13 reactor scrams from FWLC problems between 1978 and 1985. One additional scram occurred on Unit 2 from a master FWLC controller failure on April 27, 1992 (Reference LER 50-260/92004). Three of these events occurred from sensed or actual high water level, but none resulted from signal spiking during maintenance or troubleshooting.

VII. COMMITMENTS

1. TVA will implement administrative controls to ensure high risk troubleshooting activities on certain plant systems have action plans reviewed by technical personnel independent of the original plan development. This will be completed by October 15, 1992.

2. TVA will review this event with appropriate personnel. This will be completed by October 30, 1992.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].