TENNESSEE VALLEY AUTHORITY

Browns Ferry Nuclear Plant
Post Office Box 2000
Decatur, Alabama 35609-2000

January 29, 1990

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

Dear Sir:

TVA - BROWNS FERRY NUCLEAR PLANT (BFN) UNIT 1 - DOCKET NO. 50-259 - FACILITY OPERATING LICENSE DPR-33 - REPORTABLE OCCURRENCE REPORT BFRO-50-259/89028

The enclosed report provides details concerning the ESF actuation caused by a fault on the B phase shunt reactor of 500 kV union transmission line. This report is submitted in accordance with 10 CFR 50.73(a)(2)(iv).

Very truly yours,

TENNESSEE VALLEY AUTHORITY

J. R. Bynum
Vice President
Nuclear Power Production

Enclosures
cc (Enclosures):
Regional Administration
U.S. Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region II
101 Marietta Street, Suite 2900
Atlanta, Georgia 30323

INPO Records Center
Suite 1500
1100 Circle 75 Parkway
Atlanta, Georgia 30339

NRC Resident Inspector, BFN

1/1

IE22

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 UNIT 1	0 5 0 0 0 2 5 9	1 OF 0 5

TITLE (4)

ESF ACTUATION CAUSED BY FAULT ON B PHASE SHUNT REACTOR OF 500 KV UNION TRANSMISSION LINE

EVENT DAY (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
				SEQUENTIAL	REVISION				FACILITY NAMES	DOCKET NUMBER(S)
MONTH	DAY	YEAR	YEAR	NUMBER	NUMBER	MONTH	DAY	YEAR	BROWNS FERRY UNIT 2	0 5 0 0 0 2 6 0
1 2	2 8	8 9	8 9	0 2 8	0 0	0 1	2 9	9 0	BROWNS FERRY 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)			
		20.402(b)	20.405(c)	X 50.73(a)(2)(iv)	73.71(b)
POWER LEVEL		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)
(10)	0 0 0	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)
Steven Austin, Compliance Engineer, Site Licensing	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
X	YES (If yes, complete EXPECTED SUBMISSION DATE)	NO	0 5	3 0	9 0

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

On December 28, 1989 at 1238 hours, a unit 2 half scram occurred when the unit 2 reactor protection system (RPS) 2A bus tripped, resulting in engineering safety feature (ESF) actuations. The half scram was a result of transients placed on RPS when a manual initiation of the high-pressure fire protection system caused a fault to occur on the B phase of the 500 kilovolt shunt reactors on the union line. On December 28, 1989 at 1250 hours, the RPS was reset, and by 1306 hours, the affected ESF systems were returned to normal.

The event occurred during an attempt to flush debris from the high-pressure fire protection system automatic deluge valve, which resulted in a full flow fire protection discharge onto the 500 kV shunt reactors while energized. The cause of this event can be attributed to failure of the automatic high-pressure fire protection deluge valve to reset and the inability of the shunt reactor high-voltage bushing to withstand the fire protection discharge.

The immediate corrective actions were to stop the fire protection water flow and return the ESF equipment to standby status. The spray pattern of the high-pressure fire protection system on this shunt reactor will be evaluated. The Division of Nuclear Training's Program will be evaluated. Further corrective action will include disassembling and inspecting the automatic deluge valve to determine why the valve failed, determine why the shunt reactor bushing shorted, and provide a supplemental report.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
BROWNS FERRY UNIT 1	0 5 0 0 0 2 5 9	8 9	-- 0 2 8	-- 0 0	0 2 OF 0 5

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

Description of Event

On December 28, 1989 at 1238 hours, a unit 2 half scram occurred when the unit 2 reactor protection system (RPS) (EIIS system code JD) 2A tripped, resulting in engineering safety feature (ESF) (EIIS system code JE) actuations.

On December 28, 1989 at approximately 1000 hours, the high-pressure fire protection system (EIIS system code KP) deluge spray system for the 500 kV union line shunt reactor, part of the 500 kV switchyard system (EIIS system code FK), was placed back in service after repairing a freeze damaged line.

On December 28, 1989 at approximately 1200 hours, personnel observed the high-pressure fire protection system discharging on to the 500 kV shunt reactors, no system initiation annunciation was received in the main control room. No annunciation was required. The automatic deluge valve opened because of a mechanical input. There was no electrical input from the fire protection system present. At 1204 hours, a high-temperature alarm on the shunt reactors was received, and then reset immediately.

Electric motor-driven fire pump "B" was running providing water to the fire protection system. Investigating the spray down, the Assistant Operations Supervisor (ASOS) and the fire protection response team found the system had not fully actuated and the spray was not in a full pattern. After verifying there was no fire, the manual isolation valve, upstream of the automatic deluge valve, was closed. Closing this valve reduced the water flow, but did not stop it. An attempt to reset the system from the control room was made. This action did not fully stop the water flow. To clear any obstructions in the system that could be preventing full closure of the isolation valves, the ASOS and fire protection team leader decided to flush the system and then attempt to reset it. At 1236 hours, the manual isolation valve and automatic deluge valve were opened. The system reached full flow and electric motor-driven fire pump "A" auto-started.

On December 28, 1989 at 1238 hours, the power circuit breakers for 500 kV union line opened due to a fault that occurred when the "B" phase shunt reactor high voltage bushing shorted to ground.

During the fault, the 2C1 RPS circuit protector tripped and deenergized the 2A RPS bus. It was deenergized causing a half scram, the startup of standby gas treatment (SBGT) trains A, B, and C (EIIS system code BH), control room emergency ventilation (CREV) trains A and B (EIIS system code VI), and reactor zone (EIIS system code VA), refuel zone (EIIS system code VG), and primary containment system (EIIS system code VB) isolations.

At 1250 hours on December 28, 1989, the RPS system was reset, and by 1306 hours the affected ESF systems were returned to normal.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
BROWNS FERRY UNIT 1	0 5 0 0 0 2 5 9	8 9	-- 0 2 8	-- 0 0	0 3 OF 0 5

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

During the event, unit 2 was in cold shutdown with irradiated fuel in the reactor vessel. Units 1 and 3 were defueled. This event is being reported under 10 CFR 50.73(a)(2)(iv), an event or condition that resulted in the manual or automatic actuation of any ESF.

Analysis of Event

The fire protection deluge spray system is designed to quench any fire that may occur on the shunt reactors. It deluges the shunt reactor with a dense fog of water which starves the fire of oxygen and thereby extinguishes the fire. Just before the event a discussion took place between the ASOS and the fire protection team leader. During that discussion, the decision was made to flush the deluge spray system and then attempt to reset it. The decision centered on the fact that the system had fully actuated four days before with no adverse affects on the equipment and on their understanding of the guidelines established in Plant Managers Instruction, "Conduct of Operations." A section to that instruction states, "If leakage is detected after a valve has been properly closed and conditions permit, open the valve and allow the flow to clean the seating surfaces." Based on this discussion the manual isolation valve and the automatic deluge valve was reopened and the automatic deluge system manually actuated.

The RPS system is designed to protect the reactor from operational transients. The RPS power supplies are not class IE (EIIS system code EB); however, class IE circuit protectors are installed between each of the power supplies and its associated distribution bus. The circuit protectors protect the RPS circuitry from sustained abnormal voltage or frequency conditions.

During the electrical transient caused by the shunt reactor fault, the 2C1 circuit protector actuated as expected from this electrical transient and deenergized RPS bus 2A. Subsequent ESF actuations occurred as designed, placing the plant in a conservative mode.

The shunt reactor high-voltage bushing is an electrical insulation device that is designed to isolate the high voltage carried by the shunt reactor from ground. An electrical arc propagated up the bushing and caused the fault.

Cause of Event

The cause of this event can be attributed to failure of the high-pressure fire protection automatic deluge valve. The inadvertent partial actuation coupled with the inability to reset led to the full actuation that caused the event. The automatic deluge valve will have to be disassembled and inspected to determine why the valve would not reset.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
BROWNS FERRY UNIT 1	0 5 0 0 0 2 5 9	8 9	-- 0 2 8	-- 0 0	0 4 OF 0 5

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

The shunt reactor high-voltage bushing shorted to ground during the event. An electrical arc propagated up the bushing and caused the fault. This bushing is designed to be used in outside environment and can withstand the environmental conditions. A review of this system must be performed to determine why the bushing shorted.

Corrective Action

The immediate corrective actions taken were to isolate the high-pressure fire protection system to stop the waterflow. The SBGT and CREV were returned to standby systems and the reactor and refuel zones ventilization systems were returned to normal. The shunt reactors and fire protection system was placed under administrative holds. The fire protection group performed a logic functional test on the suppression system and found no problems with the logic. The affected equipment on the 500 kV shunt reactors were checked out to ensure no problem existed.

The automatic deluge valve will be disassembled and inspected to determine why the valve did not reset.

As part of previously identified work, Nuclear Engineering is going to issue Design Change Notices to modify the RPS circuit protector underfrequency trip circuitry.

As part of the overall fire protection improvement plan, the flow control valves are going to be replaced.

Review the reactor shunt system and determine why the deluge from the high-pressure fire protection system caused the high-voltage bushing on the B phase shunt reactor to short.

The spray pattern of the high-pressure fire protection for the shunt reactor will be evaluated to ensure the pattern is within applicable requirements.

The Division of Nuclear Training's program on transformer fire suppression will be evaluated to ensure it delineates not to actuate fire suppression systems on energized equipment except during emergencies.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
BROWNS FERRY UNIT 1	0 5 0 0 0 2 5 9	8 9	-- 0 2 8	-- 0 0	0 5 OF 0 5

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

Previous Similar Events

In the past there have been several half scrams on RPS but none have been attributed to a fault on switch yard equipment. There was a similar incident on the same shunt reactor in September 1978; however, no data can be obtained that describes the event.

Commitments

The automatic deluge valve will be disassembled and inspected to determine the reason the valve did not reset. This will be completed by April 30, 1990. A supplemental report will be provided by May 30, 1990.

Evaluate the B phase shunt reactor and determine what caused the high-voltage bushing to short. This will be completed by April 30, 1990.

The spray pattern of the high-pressure fire protection for the shunt reactor will be evaluated to ensure the pattern is within applicable requirements. This will be performed by April 2, 1990.

The Division of Nuclear Training's program on transformer fire suppression will be evaluated to ensure it delineates not to actuate fire suppression systems on energized equipment except during emergencies. This evaluation will be completed by March 16, 1990.

The fire protection control valves will be replaced. This will be completed prior to restart of unit 2.

Design change notices will be issued to modify the RPS ciruit protector underfrequency trip circuitry. This will be performed prior to restart of unit 2.