LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
TURKEY POINT UNIT 3	05000250	1 OF 6

TITLE (4) Automatic Reactor Trip due to Closure of the B Main Steam Isolation Valve

EVENT DATE (5)			LER NUMBER(6)			RPT DATE (7)			OTHER FACILITIES INV. (8)	
MON	DAY	YR	YR	SEQ #	R#	MON	DAY	YR	FACILITY NAMES	DOCKET # (S)
07	30	97	97	007	01	06	15	98		

OPERATING MODE (9)	1
POWER LEVEL (10)	100

10 CFR 50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER (12)

	TELEPHONE NUMBER
D. R. Lafleur, Licensing Engineer	305-246-7150

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	EPIX?	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	EPIX?
B	SB	RLY	W120	N	B	BA	TAC	D245	N

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

ABSTRACT (16)

On July 30, 1997, Florida Power & Light (FPL) Company's Turkey Point Unit 3 was operating in Mode 1 at 100% power. At 1506 hours, the 3B Main Steam Isolation Valve (MSIV) failed closed. The resultant level decrease in the 3B Steam Generator (SG) caused the reactor to trip automatically on low-low level in the 3B SG. All control rods fully inserted.

A 3B steam line Main Steam Safety Valve (MSSV) opened then reseated as expected during the initial transient, as pressure in the 3B SG exceeded the MSSV setpoint pressure of 1085 psig.

The A Auxiliary Feedwater (AFW) Pump tripped on overspeed during the event. Plant response was otherwise as expected.

The cause of the MSIV closure was attributed to a failed BFD22S relay. The six relays on the 3A, 3B, and 3C MSIV's were replaced.

The most probable cause of the A AFW pump overspeed trip was a spurious electronic overspeed signal caused by the A AFW pump tachometer module. A plant change was implemented to disable the electronic trip function of all three AFW pumps to enhance their reliability.

I. DESCRIPTION OF THE EVENT

On July 30, 1997, Florida Power & Light (FPL) Company's Turkey Point Unit 3 was operating in Mode 1 at 100% power. At 1506 hours, the 3B Main Steam Isolation Valve (MSIV) [SB:isv] failed closed. The 3B Steam Generator (SG) [SB:sg] level decreased as a result of the MSIV closure. Upon indications of MSIV closure, the reactor operator attempted to trip the reactor manually. However, the reactor tripped automatically on low-low level in the 3B SG approximately 11 seconds after MSIV closure and less than a second before the manual trip was actuated. All control rods fully inserted.

A Main Steam Safety Valve (MSSV) [SB:rv] on the 3B steam line opened as pressure in the 3B SG exceeded the 1085 psig safety valve setpoint. As pressure in the steam line decreased to below the setpoint, the MSSV reseated as expected.

The reactor operators started the 3B Charging Pump [CB:p] to maintain pressurizer [AB:pzr] level, and closed the MSIV's on the 3A and 3C SG's to stop the reactor coolant system average temperature from decreasing. Upon plant stabilization, the Emergency Operating Procedures (EOP's) were exited and General Operating Procedure, 3-GOP-103, was entered to place the plant in Hot Standby.

At 1509 hours, the A Auxiliary Feedwater (AFW) Pump [BA:p] (normally aligned to Train 1) tripped on mechanical overspeed. The 3A and 3B Steam Generator Feedwater pumps and the B and C AFW pumps (normally aligned to Train 2) continued to supply feed to the SGs. Plant response was otherwise as expected.

After stabilization of the plant, the A AFW Pump (and therefore Train 1) was declared out of service, placing the plant in Technical Specification LCO 3.7.1.2, Action Statement 1. The AFW system was realigned with the C pump on Train 1 and the B pump on Train 2, to provide for dual Train operation, exiting Action Statement 1 and entering Technical Specification LCO 3.7.1.2, Action Statement 3. This Action Statement requires that the AFW pump be restored to an Operable status within 30 days. This pump was returned to Operable status after replacement of the tachometer that supplies its electronic overspeed trip signal, exiting the LCO.

The NRC operations center was notified at 1621 on July 30, 1997, in accordance with 10 CFR 50.72 (b) (2) (ii), Reactor Protection System Actuation and Engineered Safety Feature Actuation.

An Event Response Team was formed to investigate the causes for the failure of the 3B MSIV and the overspeed trip of the A AFW Pump.

II. CAUSE OF THE EVENT

MSIV Closure

The cause of the MSIV closure was determined to be the failure of a Westinghouse BFD22S relay coil (tag number 3-AX/2605A) [SB:rly], which is part of the 3B MSIV actuator circuitry. FPL believes that the relay was installed in November of 1983. This relay is normally energized. When this relay is energized, it actuates a solenoid valve which delivers air to the MSIV actuator. When the relay deenergizes, the solenoid allows air to vent from the MSIV actuator, allowing the MSIV to close. Each MSIV has two relays, one for each actuation train, which perform this function. The failed relay coil was open and its casing was cracked, showing signs of thermal aging.

A AFW Pump Mechanical Overspeed Trip

Turkey Point plant design includes a common AFW system composed of three steam driven pumps, each designed to operate at 5900 rpm. Each pump turbine is protected by both an electronic and a mechanical overspeed trip. The electronic overspeed trip, set at 6200 RPM, uses a speed sensor to provide a trip signal to close the pump turbine steam inlet valve. The mechanical overspeed trip, set to actuate at 6500 RPM, uses a pin-type trip weight attached to the pump turbine rotor. When sufficiently displaced by centrifugal force, the trip weight will actuate a spring loaded lever to trip closed the pump turbine steam inlet valve.

When an AFW actuation signal is present, the electronic overspeed trip will automatically reset after actuation. During this event, approximately 1 minute after AFW initiation, the A AFW pump turbine cycled in this manner (from trip to reset) for approximately 70 seconds. Based on AFW flow recorder traces and operator reports, the A AFW pump tripped on electronic overspeed, then reset, several times. Pump speed increased due to this cycling process, eventually tripping on a mechanical overspeed trip.

The most probable cause for the electronic overspeed trip of the A AFW pump was a spurious electronic overspeed signal caused by the A AFW pump tachometer module (Dresser-Rand part #890009A03) [BA:tac]. This style module was installed in August of 1995, replacing the original Airpax module (Airpax part #FSS1416; Dresser-Rand part #890061A20).

A review of the circuitry was performed to compare the original Airpax module (Airpax #FSS1416; Dresser-Rand #890061A20) to the Dresser-Rand part #890009A03. The original Airpax module schematics identified an L-C filter network, which would effectively filter electric noise from its 125 Vdc vital power

supply. No schematics were available for the Dresser-Rand module #890009A03. However, visual inspection of the module revealed differences in the filtering capabilities of the module circuitry.

Review of the plant's AFW pump history indicates that the A AFW pump tripped on January 7, 1997, due to a spurious electronic trip with the Dresser-Rand tachometer module #890009A03 installed. No spurious electronic overspeed trips have been recorded for either the B or C AFW pumps, which have the original style tachometer module (Airpax #FSS1416; Dresser-Rand #890061A20).

The A AFW pump tachometer module was replaced with an Airpax 300 Series tachometer module which is the recommended replacement for the now obsolete original module (Airpax #FSS1416; Dresser-Rand #890061A20).

Industry research identified that in 1993, Vogtle Nuclear Station experienced problems with spurious tripping of an AFW pump due to electric noise introduced from 125 Vdc vital control circuits, with the same Dresser-Rand part number module (Dresser-Rand #890009A03). A 10 CFR Part 21 notification was made for this module (LER 50-425/93-007-00). FPL has found no record of having received this notification.

Bench testing was performed on the Dresser-Rand tachometer module (Dresser-Rand #890009A03) to determine the overspeed trip's susceptibility to noise. During the testing, the tachometer and dc to dc power supply were subjected to various electrical noise sources. Only the inductive surge produced by a de-energizing dc relay was able to trip the tachometer's overspeed bistable. The testing did not replicate exact plant conditions. The test results were considered to be inconclusive.

Discussions with nineteen other plants utilizing equivalent or identical AFW pumps and/or turbines confirmed that an electronic trip is not a standard installation and that such a trip is not considered neccessary. Two other plants had removed the electronic trip function following similar spurious tripping events.

A plant change was implemented to disable the electronic trip function of all three AFW pumps. By disabling the trip function, spurious trip signals will be eliminated thereby enhancing the reliability of the pumps. Each AFW pump is protected from overspeed by the Woodward mechanical governor [BA:65] and the mechanical overspeed trip device [BA:12]. The relibility of these devices is assured by regular maintenance activities and has been demonstrated through scheduled testing.

III. ANALYSIS OF THE EVENT

A reactor trip due to a low-low level in a steam generator is a previously analyzed event. Upon closure of the 3B MSIV, the sudden loss of steam flow from the 3B SG caused an increase in pressure in that SG. The pressure increase resulted in a decrease of water level in the 3B steam generator to the low-low level reactor trip setpoint of 10% narrow range level.

The Updated Final Safety Analysis Report (UFSAR) assumes a loss of normal feedwater to all steam generators due to the loss of the steam generator feed pumps or valve malfunction. The analysis shows that following a loss of normal feedwater, the AFW system is capable of removing the reactor's stored and residual heat assuming that only one pump is available. Since the normal feedwater flow as well as two of the three AFW pumps were available for removing stored and residual heat, the event did not compromise the health and safety of the public.

IV. CORRECTIVE ACTIONS

1. The failed Westinghouse BFD22S relay 3-AX/2605A, as well as equivalent relays on each actuation train of all three MSIV's (3-AX/2605B, 3-AX/2604A,3-AX/2604B, 3-AX/2606A, and 3-AX/2606B) were replaced with Westinghouse BFD65 relays. These relays are of an improved dual-coil design which uses a lower wattage (producing a lower operating coil temperature) to hold the relay when energized.

2. Equivalent function relays on Unit 4 MSIVs were replaced during the 1997 Unit 4 outage.

3. Use of normally energized Westinghouse BFD relays were reviewed to determine if other normally energized relays required replacement. The evaluation concluded that no other BFD relays required replacement.

4. A review of the plant Preventative Maintenance (PM) program indicated that the MSIV relays were not included in the program. The relays have been scheduled for periodic replacement.

5. An investigation was performed to determine if a 10 CFR Part 21 report would be required for the Dresser-Rand part #890009A03 tachometer module. Industry research identified that in 1993, Vogtle Nuclear Station issued a 10 CFR Part 21 notification for the same part (LER 50-425/93-007-00).

6. Bench testing was performed on the Dresser-Rand module (Dresser-Rand #890009A03) to determine the overspeed trips' susceptibility to noise. During the testing, the tachometer

and dc to dc power supply were subjected to various electrical noise sources. Only the inductive surge produced by a de-energizing dc relay was able to trip the tachometer's overspeed bistable. The testing did not replicate exact plant conditions. The test results were considered to be inconclusive.

7. Electronic overspeed trip functions were disabled on all AFW pumps to improve their reliability by eliminating the cause of repetitive failure identified as spurious trip signals due to inductive noise.

V. ADDITIONAL INFORMATION

Licensee Event Report 251/89-020, dated 1/18/90, reported a reactor trip due to an inadvertent closure of an MSIV. That closure was due to corrosion of a terminal block supplying 125 Vdc vital power to the MSIV actuator solenoids.

EIIS Codes are shown in the format [EIIS SYSTEM: IEEE component function identifier, second component identifier (if appropriate)].