NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit 1	0 5 0 0 0 2 6 9	1 OF 0 5

TITLE (4)

Reactor Trip on Loss of Main Feedwater

EVENT DATE (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)
0 4	2 5	8 5	8 5	0 0 7	0 0	0 5	2 8	8 5		0 5 0 0 0
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OPERATING MODE (9)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10) 0 9 4	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
Richard F. Haynes, Licensing	7 0 4 3 7 3 - 7 1 2 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	
X	E E	G E N	E 3 5 5	Y							
X	E E	X I S	E 3 5 5	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 fifteen single-space typewritten lines) (16)

On April 25, 1985 at 0533 hours, Oconee 1 tripped from 94% of full power when both main feedwater pumps tripped on high discharge pressure. The trip occurred due to a chain of events which began with consecutive failures of a static inverter and a related static transfer switch. Most of the Unit 1 control room statalarm panelboards and chart recorders were disabled by the failures, and this resulted in an "Alert" condition being declared for the facility at 0512 hours. The power system failures also caused a loss of power to the main feedwater pump turbine controls. When power was restored, feedwater flow oscillations developed, due to Integrated Control System action, and the feedwater pumps tripped shortly thereafter causing the anticipatory reactor trip.

The immediate corrective actions ensured that the unit was stabilized at hot shutdown conditions. The problem was investigated, and the failed components were identified and repaired. The reactor was critical again at 0851 hours.

The health and safety of the public were unaffected by this incident.

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FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Oconee Nuclear Station, Unit 1	0 5 0 0 0 2 6 9	8 5	— 0 0 7	— 0 0	0 2 OF 0 5

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

Background:

The 1KX Auxiliary Power System is a 240/120 volt AC single phase, uninterruptible power system. It consists of a static inverter, with redundant 125 volt DC (battery backed) supplied from separate 125 volt DC buses, circuit breakers, and distribution panelboards. The static inverter converts the 125 volt DC to a 120 volt AC single phase. The static inverter output is used to power the Auxiliary Power System distribution power panel board loads. A static transfer switch is provided as a means for an automatic transfer of the system loads to the alternate AC regulated power system should the static inverter become unavailable. The output of the static inverter is synchronized with the AC regulated power system through the static transfer switch in order to minimize transfer time from the inverter to the regulated supply.

The Main Feedwater Pump Turbines (MFWPTs) each have a speed controller which is powered from the 1KX power panelboard. The controller controls the speed of the MFWPTs with an integral plus proportional analog signal from the Integrated Control System (ICS). The controller controls the motor gear unit which controls the setpoint of the MFWPT speed, hydraulically. The ICS varies the MFWPT speed depending on what the difference of pressure is across the feedwater control valves. Essentially, the feedwater flow demand controls the MFWPT speed.

Description of Occurrence:

At 0448 hours on April 25, 1985 with Oconee 1 operating at 100% full power, alarms were actuated which indicated trouble on five separate static inverters. Investigation revealed that most of the statalarm panelboards in the control room were deenergized. Although available indication showed that the unit was remaining in a stable condition, a search was immediately begun to identify the cause of the power failure.

The investigation centered in a search for tripped breakers on the unterruptible power panelboards, and for indications of static inverter failures. At 0450 hours, it was found that the 1KX static inverter had a blown DC power fuse, this being evidence of inverter failure. Also, the 1KX static transfer switch showed that transfer had been made to the alternate AC regulated power source. Since the indication was that the 1KX switch had functioned properly, it was assumed that other power panelboard breakers were open or else other inverters had failed. When personnel were unable to locate any open breakers, voltage readings were taken which indicated that the 1KX static transfer had not occurred.

At 0512 hours, a station "Alert" condition was declared according to procedure, based on the loss of a substantial number of control room alarms. Appropriate notifications were made to offsite agencies, and the station manager was informed of the incident. A site assembly was initiated and the station Technical Support Center was activated. The instrumentation available to the operators was adequate for monitoring essential plant parameters and stable operation of the unit was maintained.

Prior to restoration of the 1KX panelboard power, main steam pressure had increased slightly and total feedwater flow had slightly decreased. Power to the 1KX panelboard was reestablished at 0531 hours by operation of a manual bypass switch. This resulted in the reenergizing of the control room statalarm panelboards and allowed the ICS to regain speed control of the MFWPTs. During the period in which the speed controllers were without power, a large integral error signal (representing feedwater demand) had developed as the pump speed had not responded to small changes in feedwater demand. When power was returned to the speed controllers, the ICS, acting on the large error signal, caused an abrupt increase in the speed of the MFWPTs. Control of feedwater valves and MFWPT speed was switched to manual in an attempt to control the ensuing feedwater transient. The MFWPTs speed control was returned to automatic, but the flow oscillations proceeded until high enough MFWP discharge pressures were reached to trip the pumps. An anticipatory reactor trip occurred at 0533 hours on loss of main feedwater. The reactor power was at 94% Full Power (FP).

The plant was stabilized at hot shutdown after the main steam pressure was dropped to approximately 825 psig to reseat Main Steam Relief Valves (MSRVs) 1MS-2, 1MS-4, 1MS-8, and 1MS-10. The site assembly and the TSC were secured and the emergency "Alert" condition was terminated. The 1KX static inverter and static transfer switch were repaired during the day and the 1KX static inverter was transferred back in service at 1831 hours. The reactor went critical the next day at 0851 hours and the generator was on line at 1250 hours.

Cause of Occurrence:

The initial failure of the 1KX static inverter was found to have been caused by a short circuit between two wires with deteriorated insulation on an amplifier buffer card in the inverter.

The subsequent failure of the static transfer switch was found to have been caused by two loose transistors in the static switch logic module.

A review of past incident reports indicated one 1KX inverter malfunction on September 15, 1983. A review of the Nuclear Plant Reliability Data System indicated four previous buffer simplifier card failures in the Exide, Model 120/7.5 F1 inverters; 1KX static inverter is a Model 120/9.3 F1. No similar failures have been reported for Oconee Nuclear Station. This incident is not considered a recurring problem.

Analysis of Occurrence:

In the period for which 1KX power was unavailable, from 0448 hours to 0531 hours, the unit operated as expected with all control stations in automatic. The failures resulted in loss of control to both the main turbine control valves and the main feedwater pump (MFWP) speed controllers. After the loss of power occurred, both main steam pressure and feedwater flow underwent small approximate step changes, and then remained nearly constant up to the time 1KX power was restored. Over the interval, main steam pressure increased from 895 to 910 psig, and total feedwater flow decreased from 1.075×10^7 lbm/hr to 1.063×10^7 lbm/hr, causing increased feedwater demand. With the lack of control over feedwater pump speed, the ICS caused the feedwater valves to open fully in accordance with the increased demand. When 1KX power was returned, total feedwater demand had increased approximately 4% over its original value.

At near 0532 hours, power to the MFWP speed controllers was restored. With all control stations in automatic, the ICS increased pump speed (flow) to meet feedwater demand. Subsequently, control of feedwater valves and MFWPT speed were taken to manual within 10 seconds after power was restored. A little more than 40 seconds later, the control of MFWPT speed was returned to automatic. Only seconds thereafter, in the vicinity of 0533 hours, both MFWPs tripped on high discharge pressure. An anticipatory reactor trip on loss of main feedwater occurred a few seconds afterward.

In general plant posttrip response was normal. Primary system parameters were well controlled. The average temperature decreased to a minimum of near 532°F; minimum pressure was approximately 1800 psig, and minimum pressurizer level was 60 inches. Steam pressure peaked at approximately 1070 psig immediately after the trip, and decreased to a minimum of approximately 900 psig in loop A, and 835 psig in loop B as the operators lowered the pressure setpoint to fully reseat the sticking MSRVs. The three emergency feedwater pumps started properly and steam generator levels were controlled at about 25 inches.

The pressurizer relief valves were not challenged. There were no Engineered Safeguard actuations and no release of radioactivity to the environment. No Technical Specifications were exceeded. The health and safety of the public were not affected by this event.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
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Oconee Nuclear Station, Unit 1	0 5 0 0 0 2 6 9	8 5	— 0 0 7	— 0 0	0 5 OF 0 5

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

Corrective Action:

The immediate corrective action taken was to stabilize the unit at hot shutdown conditions. Supplemental corrective actions identified the problems with the static inverter and static transfer switch, and repaired the affected compenents. The 1KX static inverter was put back in service. The 1KX manual bypass switch was tested during the troubleshooting of the invertor. It tested out several times with no malfunction. Other additional corrective action included checking and adjusting the relief setpoints for MSRVs 1MS-2, 1MS-4, 1MS-8 and 1MS-10, so as to bring them within acceptable ranges.

Planned corrective action will include an analysis of this incident, and the effects of actions taken in response to it, in order to determine any necessary changes to alarm response procedures and training programs. Also, preventive maintenance procedures will be reviewed to ensure the adequacy of inspections for defective components. Additionally, a means will be sought to prevent deterioration of the wire insulation located on the amplifier buffer card in the static inverter.

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May 28, 1985

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

Subject: Oconee Nuclear Station, Unit 1
Docket Nos. 50-269, -270, -287
LER 269/85-07

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a) (1) and (d), attached is Licensee Event Report 269/85-07 concerning a Unit 1 reactor trip on loss of main feedwater following the failure of a static inverter on April 25, 1985. This report is submitted in accordance with §50.73(a)(2)(iv). This event was considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

H.B. Tucker /BS

Hal B. Tucker

RFH:slb

Attachment

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