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SUBJECT: LER 88-009-00:on 880705,reactor trip due to personnel error & equipment failure.

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EXPIRES: 8/31/88

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 1 0

TITLE (4)
Reactor Trip due to Personnel Error and Equipment Failure

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 5 0 0 0
0 7	0 5	8 8	8 8	— 0 0 9	— 0 0	0 8	0 4	8 8		0 5 0 0 0

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
Philip J. North, Licensing	7 0 4 3 7 3 - 7 4 5 6

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

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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 5, 1988, at 0827 hours while operating at 100% full power, Unit 1 experienced an anticipatory reactor trip due to the loss of both Main Feedwater Pumps. The trip was initiated when an Instrument and Electrical (I&E) Technician was preparing to calibrate a Unit 1 Turbine Header Pressure transmitter. The I&E Technician used an instrument which was in the current-measuring mode rather than in the voltage-measuring mode to obtain a pressure transmitter output reading. Use of the current-measuring mode caused a false high pressure indication to be fed into the Integrated Control System (ICS). When the ICS began adjusting plant parameters, a valve in the secondary system failed to open. The combination of the personnel error and of the valve failure resulted in the Unit 1 trip.

The immediate corrective action was to stabilize the unit at hot shutdown. The supplemental corrective actions included determining the causes of the unit trip, calibrating the turbine header pressure transmitters, providing disciplinary action to personnel involved, and repairing the valve that failed.

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☆ U.S.GPO:1984-0-454-481/18759

Background

The Turbine [EIIS:TRB] Header Pressure is measured by one set of electronic instruments which is used for plant control. The instrumentation includes two Motorola 56 PM transmitters [EIIS:PT] which monitor the pressure in each Main Steam [EIIS:SB] line. A signal is sent to the plant computer from both transmitters; however only one of the signals is sent from the transmitters to the Integrated Control System (ICS) [EIIS:JA]. Under normal conditions the Control Room Operator uses a key switch on the control board to manually select the transmitter which will provide the signal to the ICS. The transmitter signals are also monitored by a Smart Automatic Signal Selector (SASS). If the previously selected signal fails, the SASS automatically switches control to the other transmitter which then provides the signal to the ICS.

At the time of this event, the output from the two pressure transmitters which monitor the Unit 1 Main Steam Turbine Header Pressure was reading greater than 3% mismatch. A Main Steam pressure mismatch alarm occurs whenever the output from the two transmitters varies by greater than 3%. A work request is then generated to resolve the mismatch.

Valve 1C-61 [EIIS:FCV], Condensate Coolers/Generator Hydrogen Coolers [EIIS:TK] bypass valve functions according to system demands to regulate condensate [EIIS:SD] flow through the coolers. Valve 1C-61 is normally expected to trip open when the differential pressure across the coolers reaches 18 feet of water, thereby bypassing the coolers and supplying additional suction pressure to the Condensate Booster Pumps [EIIS:P]. The Condensate Booster Pumps, in turn, supply suction pressure to the Main Feedwater [EIIS:SJ] Pumps.

Digital Multimeters measure AC/DC voltage, AC/DC current or resistance. The Instrument and Electrical (I&E) technician utilizing the instrument must select the appropriate operating mode prior to beginning work.

SEQUENCE OF EVENTS

Date/Time	Description
June 30, 1988/1318	Operations generated a work request to resolve a Turbine Header Pressure transmitter mismatch on Unit 1.
July 5, 1988/0730	An Instrument and Electrical (I&E) Supervisor assigned work request to I&E Technicians "A" and "B" and a Vendor Technician.

SEQUENCE OF EVENTS (continued)

Date/Time	Description
July 5, 1988/0800	I&E Technician "A" discussed the work to be done with a Nuclear Control Operator (NCO).
	I&E Technician "A" and the NCO agreed that channel "A" transmitter would be calibrated first.
	The NCO manually selected the channel "B" transmitter to control the plant.
	I&E Technician "B" and the Vendor Technician reviewed controlled drawings associated with the Turbine Header Pressure transmitters.
0815	I&E Technicians "A" and "B" and the Vendor Technician went to job site and removed cover from the channel "A" transmitter.
0820	I&E Technician "A" left job site.
July 5, 1988/0825	I&E Technician "B" removed cover from the channel "B" transmitter.
0827:34	I&E Technician "B" plugged a Digital Multimeter (DMM) into the channel "B" transmitter.
0827:34	A false high turbine header pressure signal was sent to the ICS.
	The ICS began to reduce reactor demand and main feedwater flow.
0827:42	I&E Technician "B" removed the DMM from the "B" transmitter.
	Transmitter "B" sent actual Turbine Header Pressure signal to the ICS.
	The ICS began to increase reactor demand and feedwater flow.

SEQUENCE OF EVENTS (continued)

Date/Time	Description
	Condensate Coolers/Generator Hydrogen Coolers bypass valve (1C-61) failed to open.
	Main Feedwater Pumps (MFWP) and Condensate Booster Pumps (CBP) suction pressure began decreasing.
0827:43	I&E Technician "B" plugged the DMM into transmitter "A".
0827:44	"B" BTU limit statalarm was received.
0827:45	"A" BTU limit statalarm was received.
July 5, 1988/0827:47	Third CBP started automatically.
0827:48	"CBP suction pressure low" alarm received.
0827:49	The NCO took manual control of the Main Feedwater Valves.
0827:51	All CBP's tripped due to low suction pressure.
	The MFWP's tripped causing an anticipatory trip of the Reactor.
0835	I&E Technician "B" and the Vendor Technician returned to I&E shop.
	I&E Supervisor assigned I&E Technicians "A" and "B" to review Transient Monitor (TM) plots.
0930	I&E Technicians "A" and "B" gained access to TM.
	The NCO discussed Unit trip with I&E Technicians "A" and "B".
1045	I&E Technicians "A" and "B" and I&E Engineer determined that I&E Technician "B" activities initiated the Unit 1 trip.

SEQUENCE OF EVENTS (continued)

Date/Time	Description
1330	Turbine Header Pressure transmitters "A" and "B" were calibrated.
2352	The Reactor was returned to critical.
July 6, 1988/0328	The Turbine Generator was placed on-line.
0940	Reactor power increase was stopped to investigate valve 1C-61 operation.
July 7, 1988/0318	Valve 1C-61 repairs were completed.

Description of Incident

On June 30, 1988, Operations generated a work request to resolve a mismatch between the Unit 1 "A" and "B" Main Steam Turbine Header Pressure transmitters. The "B" transmitter was reading about twenty (20) pounds lower than the "A" transmitter. On July 5, 1988, at 0730 hours, an I&E Supervisor assigned I&E Technicians "A" and "B" and a Vendor Technician to resolve the pressure transmitter mismatch. Unit 1 was at 100% full power with Turbine Header Pressure at a steady state value of approximately 890 psig. I&E Technician "A" was designated as the lead technician for the job. Prior to assigning the task, the I&E Supervisor reviewed Employee Training and Qualifications System (ETQS) records to determine personnel qualified to calibrate the Turbine Header Pressure transmitters. I&E Technicians "A" and "B" were qualified to perform the task and both had calibrated the subject transmitters at least twice. The Vendor Technician was assigned to assist the I&E Technicians and to work only as directed during this task.

At approximately 0800 hours, I&E Technician "A" and a NCO discussed the work request and the procedure to be used to calibrate the transmitters. I&E Technician "A" and the NCO agreed to calibrate the channel "A" Main Steam Header Pressure transmitter first. They also agreed to manually select the channel "B" transmitter to supply input to the ICS to control the plant. It was agreed that after the "A" transmitter was calibrated, I&E Technician "A" would notify the NCO. The NCO could then select the "A" transmitter to control the plant while the "B" transmitter was being calibrated. I&E Technician "B" and the Vendor Technician reviewed the drawings associated with the transmitters and gathered equipment required to perform the procedure.

At approximately 0815 hours, I&E Technician "A" arrived at the job site and removed the cover from the "A" pressure transmitter. I&E Technician "B" and the Vendor Technician arrived at the job site with the required test equipment. I&E Technician "A" realized that several steps in the procedure were not applicable to the calibration of the pressure transmitters. He also realized that his supervisor's concurrence was necessary to "N/A" these steps. Before leaving the job site to obtain his supervisor's concurrence, I&E Technician "A" told I&E Technician "B" and the Vendor Technician not to begin work until he returned to the job site. I&E Technician "A" took the crew's only copy of the procedure with him when he went to have the appropriate procedure steps N/A'ed and initialed by the I&E Supervisor.

I&E Technician "B" realized that transmitter output would need to be measured prior to calibration of each transmitter. Because the "A" transmitter was to be calibrated first, I&E Technician "B" decided to measure the "B" transmitter output, and then measure the "A" transmitter output. Thereby the output measurements would have been performed and the Digital Multimeter (DMM) would have been connected to the "A" transmitter, ready to begin calibration.

I&E Technician "B" removed the cover from the "B" pressure transmitter at approximately 0825 hours. He remembered that one of the drawings he reviewed prior to the job indicated that the pressure transmitter circuit was from 4 to 20 milliamps. He switched the DMM to measure current. However, the transmitter output should be measured in voltage. At 0827:34 hours, I&E Technician "B" plugged the DMM into the "B" pressure transmitter. This sent a false high Turbine Header pressure signal of 1343 psig to the ICS. The ICS began reducing reactor demand and main feedwater flow to reduce the Turbine Header Pressure. The Turbine Header Pressure trend recorder, used for indication in the Control Room, stuck and continued indicating steady-state values. The 1B Feedwater Flow trend recorder also failed and indicated offscale-high values. At 0827:42 hours, I&E Technician "B" unplugged the DMM from the "B" pressure transmitter. The "B" pressure transmitter began sending actual system pressure indications to the ICS. Actual system pressure was approximately 860 psig, which was approximately 30 psig lower than the steady-state pressure. The ICS began increasing feedwater flow and reactor demand to raise Turbine Header Pressure to a steady state level. It is suspected that at this point, valve 1C-61 did not open to bypass the coolers and provide the necessary suction pressure to the Condensate Booster Pumps (CBP). The Main Feedwater Pumps (MFWP) and CBP suction pressure began decreasing immediately as a result of the failure of valve 1C-61 to open.

At 0827:43 hours, I&E Technician "B" plugged the DMM into the "A" pressure transmitter. I&E Technician "B" was unaware that his actions had initiated a transient. At 0827:44 hours and 0827:45 hours, respectively, "B" and "A" Steam Generator [EIIS:SG] BTU limit statalarms were received in the Control Room. At 0827:47, a third CBP automatically started to increase MFWP suction pressure, further reducing CBP suction pressure. The starting of the third

CBP, in conjunction with the failure of 1C-61 to properly regulate CBP suction pressure, caused CBP suction pressure to be abnormally low. At 0827:48 hours, a CBP low suction pressure events recorder alarm was received. At 0827:49 hours, the NCO noticed the Main Feedwater Valves closing, so he assumed manual control of the valves. Although NCO was aware that the BTU limits runback had previously been eliminated at greater than 20% full power, he thought that the BTU limits may be malfunctioning and causing the transient. The NCO opened the valves to their normal 100% full power position. Because the Turbine Header Pressure trend recorder was not functioning properly, the NCO did not realize that the transient had been initiated by a false high Turbine Header Pressure transmitter signal.

At 0827:51 hours, all three CBP's tripped due to low suction pressure, approximately three seconds after the CBP low suction pressure events recorder alarm was received. A timer in the CBP trip circuitry is intended to cause a CBP trip five seconds after a low suction pressure trip condition occurs, this allows a short time for Operator intervention to reduce unnecessary CBP trips which result in Unit trips. The operation of this timer is not currently checked by procedure. Because the CBP's tripped, the MFWP's tripped on low suction pressure which caused the corresponding Turbine trip and Reactor trip.

Upon hearing the Main Steam Relief Valves open, I&E Technician "B" unplugged the DMM from the "A" pressure transmitter. I&E Technician "B" and the Vendor Technician returned to the I&E shop, which is standard practice for I&E Technicians after a Unit trip. Upon arriving at the I&E shop at approximately 0835 hours, I&E Technician "B" told I&E Technician "A" that he had plugged the DMM into both pressure transmitters, but did not indicate that the DMM was selected to measure current. I&E Technician "B" was not yet aware that plugging the DMM selected to measure current into the transmitter initiated the trip. The I&E Supervisor assigned I&E Technicians "A" and "B" to review Transient Monitor (TM) plots and to assist station engineers in determining the cause of the Unit trip.

Performance Engineers were using the TM to accumulate data for the Post Trip Review Report and to help determine the cause of the Unit trip. At approximately 0930 hours, I&E Technicians "A" and "B" gained access to the TM. The NCO discussed his actions prior to the trip with the I&E Technicians. At approximately 1015 hours, Operations personnel, I&E Technicians "A" and "B" and an I&E Engineer determined that plugging the DMM into the controlling transmitter could have initiated the trip. A TM plot of the "B" pressure transmitter output prior to the Unit 1 trip indicated approximately 1340 psig. This value is over 400 psig greater than steady state pressure and is equivalent to the total output capability of the subject pressure transmitter. The abnormally high pressure indication results when a current reading is taken in place of a voltage reading. At approximately 1045 hours, I&E Technicians "A" and "B" and the I&E Engineer plugged a DMM selected to measure current into pressure transmitter "B". The test indicated that the current measurement caused the high pressure output signal from the transmitter which initiated the transient.

I&E Technicians "A" and "B" and the Vendor Technician calibrated both pressure transmitters "A" and "B" at 1330 on July 5, 1988. The Reactor was returned to critical at 2352 hours that same day. The Turbine Generator was placed on line at 0328 hours on July 6, 1988 and power escalation began.

At 0940 hours power increase was stopped to investigate problems with valve 1C-61 operation which was restricting condensate flow to the CBP's. Control Room gauges indicated a differential pressure across 1C-61 of approximately 21 feet of water. 1C-61 should have tripped open at a differential pressure of 18 feet of water. Operations personnel manually tapped on the valve to free it from its stuck position. The valve then began operating sufficiently to resume power escalation. Operations wrote a work request to repair the valve. I&E Technicians determined that both the differential pressure trip switch and transmitter were out of calibration. Mechanical Maintenance Technicians also lubricated the valve stem.

Cause of Occurrence

The root causes of this event were determined to be personnel error and equipment failure. The event which initiated the Unit 1 transient was the improper selection of instrument mode to measure transmitter output due to personnel error. However, if Valve 1C-61 had operated properly during the transient, the Unit would not have tripped.

A review of the Employee Training and Qualifications System indicated that I&E Technician "B" was qualified to calibrate the Turbine Header Pressure transmitters. I&E Technician "B" also had previously calibrated several transmitters identical to the Turbine Header Pressure transmitters and had calibrated the Turbine Header Pressure transmitters at least twice before. Through previous training and experience, I&E Technician "B" was familiar with the various operating modes of the Digital Multimeter. He was also aware that use of the wrong mode could cause a transient that could result in a Unit trip. However, he remembered that the system drawings, which he had reviewed previously, indicated that the pressure transmitter circuit was from 4 to 20 milliamps, which caused him to believe that current should have been measured. I&E Technician "B" also did not have a copy of the applicable procedure at the job site when he took the transmitter readings.

During the system transient, after the ICS began to increase feedwater demand suction pressure to the Condensate Booster Pumps (CBP) immediately began decreasing. Suction pressure decrease did not stop until it reached 0 psig, at approximately four seconds before the Unit trip. If 1C-61 had opened, adequate suction pressure to the CBP's would have been maintained, thus avoiding the trip. Additionally, during power escalation after the trip, Operations discovered that 1C-61 was sticking and did not open as required. Gauges in the Control Room indicated a differential pressure of approximately 21 feet of water across 1C-61. The valve should have tripped open at a differential pressure of 18 feet of water. Therefore, 1C-61 did not operate properly during the transient and was a major factor causing the Unit trip.

The failure of the Turbine Header Pressure trend recorder and of the "1B" Feedwater Flow trend recorder hampered the NCO from immediately determining and mitigating the cause of the transient. If the trend recorders had operated properly, the NCO could have realized the cause of the transient and taken manual action to correct the situation, possibly avoiding the Unit trip.

The trip of the CBP's was hastened by a timer in the trip circuitry which tripped the pumps approximately three seconds after the CBP low suction pressure conditions occurred, instead of after the required five seconds. If the timer had allowed the required five seconds, Operator action could have reduced the chances of the CBP's tripping.

The transmitters and switches associated with valve 1C-61 are tested and calibrated on a refueling outage basis or more frequently as required. The mechanical portions of the valve will be included on a regular periodic maintenance schedule. The failure of valve 1C-61 is NPRDS reportable. Valve 1C-61 is a model number 7610-486U-15 butterfly valve manufactured by Fisher Controls.

A review of past Licensee Event Reports reveals that there have been other unit trips in the past three years. However, none of the Unit trips were similar to this event. Therefore, this event is considered to be nonrecurring. Approximately 5.5E-5 Curies of radioiodine and 5.4E-3 Curies of noble gas was released when the Main Steam Relief Valves opened. This release of radioactivity is a result of Unit 1 operating with a Steam Generator tube leak. No personnel injuries resulted from this trip. No radiation exposures in excess of Technical Specification limits resulted from this trip. This event is reportable pursuant to 10CFR50.73(a)(2)(iv).

CORRECTIVE ACTIONS

The immediate corrective action was to stabilize the unit at hot shutdown conditions.

Subsequent corrective actions were to:

Calibrate the Turbine Header Pressure transmitters prior to startup;

Repair the Turbine Header Pressure trend recorder;

Repair the Feedwater Flow trend recorder;

Provide disciplinary action to Instrument and Electrical Technician "B";

Calibrate the differential pressure trip switch and transmitter associated with valve 1C-61 and lubricate the valve stem.

Planned corrective actions are for:

Instrument and Electrical Management to review work requests written on the control room trend recorders supplied by the same manufacturer as the charts that failed during the transient to identify any generic problems and to implement corrective actions;

Instrument and Electrical Management to review the Condensate Booster Pump timer trip setpoints to ensure adequacy and ensure that these setpoints are checked by procedure;

Mechanical Maintenance Management to integrate valve C-61, into the periodic maintenance program;

Operations and Mechanical Maintenance Management to review condensate and feedwater control valves to determine if any additional valves should be included in the periodic maintenance program.

ANALYSIS of OCCURRENCE:

The ICS responded properly during the transient. The Control Room personnel safely controlled the Reactor following the trip. Unit 1 had been operating with a Steam Generator tube leak at the time of the trip. Dose calculations from the release of Main Steam indicate that air dose due to noble gasses was approximately 2.5E-8 mrad from gamma radiation and 6.3E-8 mrad from beta radiation. The highest calculated dose to a member of the public was 7.8E-4 mrem to the thyroid of an infant. Because the dose received by the public as a result of this trip was well below Technical Specification 3.10 limits, it is concluded that the health and safety of the public were not adversely affected by this event. No actuations of ES systems [EIIS:JE] or pressurizer [EIIS:PZR] relief valves occurred, and no Reactor Coolant System (RCS) [EIIS:AB] leakage was induced.

In general, plant response was normal. The 1A and 1B Motor Driven Emergency Feedwater [EIIS:BA] Pumps actuated upon loss of feedwater at 0828:12 and the Turbine Driven Emergency Feedwater Pumps actuated at 0828:12 as indicated by the Alarm Typer. The maximum Control Rod Drive breaker opening time was 57 milliseconds, which was within required limits.

RCS inventory was adequately maintained by opening (1HP-26), Reactor Coolant Loop "A" High Pressure Injection [EIIS:BQ], with the 1A High Pressure Injection (HPI) pump in operation for normal makeup. The 1B HPI pump was manually started at 0828:46. The minimum pressurizer level was 73 inches. Steam Generator post-trip levels were maintained at approximately 30 inches. Main steam pressure was lowered to approximately 955 psig to reseat two Main Steam Relief Valves. This response did not degrade post-trip performance and no safety concerns were generated. As such, the health and safety of the public was not affected by this incident.

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HAL B. TUCKER
VICE PRESIDENT
NUCLEAR PRODUCTION

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August 4, 1988

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

Subject: Oconee Nuclear Station
Docket No. 50-269, -270, -287
LER 269/88-09

Gentlemen:

Pursuant to 10CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 269/88-09 concerning a July 5, 1988 reactor trip.

This report is being submitted in accordance with 10CFR 50.73(a)(2)(iv). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

PJN/366/bhp

Attachment

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