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SUBJECT: LER 90-013-00:on 900828,valve limit switch operation,due to unknown cause,results in condensate/feedwater transient.

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DUKE POWER

September 27, 1990

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

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 269/90-13

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 269/90-13 concerning valve limit switch operation, due to an unknown cause, results in condensate/feedwater transient and reactor trip.

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

Very truly yours,

H. B. Barron
Station Manager

/ftr

Attachment

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NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

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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 8

TITLE (4) Valve Limit Switch Operation, Due to an Unknown Cause, Results in Condensate/Feedwater Transient and Reactor Trip

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 8	2 8	9 0	9 0	0 1 3	0 0	0 9	2 7	9 0		0 5 0 0 0
										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)	X 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)	50.72(b)(2)(ii)
		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
Henry R. Lowery, Chairman Oconee Safety Review Group	AREA CODE 8 0 3 8 8 5 - 1 3 0 3 4

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	
F	S Q	X I S	U 0 7 5	Yes							

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)

ABSTRACT

On August 28, 1990, at 14:27:26 hours, while operating at 100% Power, the Unit 1 Reactor tripped due to high Reactor Coolant System (RCS) pressure. The unit was operating at a steady state prior to the trip. All four Reactor Protective System (RPS) Channels actuated on high RCS pressure due to the loss of the "B" Condensate Booster Pump (CBP) and the subsequent trip of the "A" Feedwater Pump. The Unit was brought safely to hot shutdown. The "B" CBP trip was caused by a "not open" signal from the pump's discharge valve 1C-84. Preventive maintenance had been completed on the valve less than five minutes prior to receiving the "not open" signal. The reason for the "not open" signal could not be determined, therefore, the root cause of this event is classified as "Unknown". Additionally, at the time of the "B" CBP trip, the "A" CBP was in standby and aligned for automatic start. The "A" CBP failed to start due to faulty bearing oil pressure instrumentation. Therefore, a contributing cause of this trip is "Equipment Failure/ Malfunction" due to the malfunction of the bearing oil pressure instrumentation which prevented the standby CBP from starting.

BACKGROUND

One of the main purposes of the Condensate System [EIIS:SQ] is to take condensate from the condenser hotwell and deliver it to the Feedwater (FDW) System [EIIS:SJ] for makeup to the Steam Generators [EIIS:SG]. Included in the condensate system are three parallel Condensate Booster Pumps (CBP) [EIIS:P] A, B & C. The CBPs are necessary for providing the total suction head requirements for the main Feedwater Pumps (FWP). One CBP is capable of providing fifty percent of the required flow. Therefore, during normal operation two CBPs operate while the third pump is in standby. The pump that is in standby is aligned to start automatically when the FWP suction header pressure drops below a preset value.

A CBP's bearings are lubricated during normal operation by an oil pump that is on the CBP shaft. When a CBP is in standby the bearing lubrication is provided by a motor-driven Auxiliary Oil Pump (AOP). A pressure switch on the AOP discharge line will not allow the CBP to start if the AOP discharge pressure is low.

Each CBP's discharge line contains a motor operated discharge valve equipped with a Limitorque operator with a rotor type four train limit switch. The switch has four rotors with four sets of contacts on each rotor. Each rotor can be adjusted independently of another, however the four contacts on a single rotor are fixed and must operate simultaneously when the rotor rotates. Two of the four contacts on a rotor are oriented to open as the remaining two close. Of the sixteen sets of contacts contained within each CBP discharge valve operator, one set provides an "open" signal to the Unit Operator Aid Computer (OAC). A second set of contacts, located on the same rotor, provides a signal to trip that valve's CBP through a completely separate electrical circuit when the valve starts closing. The "open" computer input contact is normally closed while the "trip" contact is normally open. In order to send a signal to the OAC indicating a change in valve position at the same time the signal is sent to trip the CBP, one contact must be opened at the same time the other is closed.

Included in the FDW System are two parallel FWPs 1A and 1B which provide flow to the Steam Generators. One FWP is capable of supplying more than fifty percent of the required flow. Each of the FWP's suction headers has instrumentation that trips the associated FWP on low suction pressure. Additionally, an automatic run back of Reactor power to 65% is initiated on the loss of one FWP.

EVENT DESCRIPTION

On the morning of August 28, 1990, Maintenance Technicians A and B were assigned the task of performing preventive maintenance on several valves, including the "B" Condensate Booster Pump's (CBP) discharge valve, 1C-84. In preparation for the work, the Maintenance Technicians met with Operations personnel to review the scope of the work. Consideration was given to starting the "A" CBP so that the preventive maintenance could be performed with the "B" CBP in standby. However, the "A" CBP had a seal leak and it was decided not to start the "A" CBP. At that time, Operations personnel instructed the Maintenance Technicians not to operate valve 1C-84 during the performance of the preventive maintenance.

In the early afternoon Operations personnel de-energized the operator on valve 1C-84 to allow for the preventive maintenance work. However, this did not remove the computer and pump control power from the limit switch. The Maintenance Technicians proceeded to perform the maintenance work on the valve which included accessing the limit switch compartment, checking the terminals on the limit switch for loose connections, accessing the limit switch gear housing to check for adequate lubrication and clean the limit switch contacts. The Maintenance Technicians found no loose connections or contacts. They did find that the lubricant in one of the two limit switch gear housings had leaked into the limit switch compartment. The Maintenance Technicians replaced the lubricant in the gear housing. Maintenance Technician "A" then left the area to telephone Technical Support to get instructions on how to handle the lubricant that had leaked into the limit switch compartment. He was instructed to wipe the compartment clean. Maintenance Technician "A" returned to the valve and cleaned the compartment. He replaced the limit switch compartment cover and installed the bolts finger tight. Maintenance Technician "A" descended the scaffold and proceeded to the next valve location, leaving Maintenance Technician "B" to tighten the bolts on the cover. Maintenance Technician "B" completed the work on the valve and proceeded to the next valve which was approximately sixty feet away. The Technicians stated that, while they did clutch the operator into manual operation as required by the procedure, they did not operate the handwheel. Additionally, they stated that they had been away from the valve approximately three to five minutes when the Unit tripped. Quality Assurance personnel, who were working in the area, confirmed that the Maintenance Technicians were at another valve location when the unit tripped.

At 14:26:26, valve 1C-84 gave an indication to the Operator Aid Computer (OAC) that the valve was "not open". Additionally, the valve sent a signal to the "B" CBP, initiating the pump trip which was also recorded by the OAC. As the pressure in the Feedwater Pump (FWP) suction header decreased below the setpoint, a signal went to the "A" CBP to initiate a pump start. The pump did not start.

Thirteen seconds after the first indication of the change in state of valve 1C-84, the Utility Typer, which is fed by the OAC, indicated that the valve returned "open" for two seconds and then "not open" for three more seconds. Eighteen seconds after the initial indication, the Utility Typer indicated that the valve returned and remained open.

At 14:26:52, the "1A" FWP tripped due to low suction pressure. The Reactor began a runback to 65% power due to the loss of the FWP.

At 14:27:26 Reactor Protective System (RPS) [EIIS:JC] Channels A, B, C and D tripped on high Reactor Coolant System (RCS) [EIIS:AB] pressure. The plant post-trip response was as expected. The RCS stabilized at about 559 degrees Fahrenheit. The RCS pressure ranged from a maximum of 2328 psig to a minimum of 1850 psig prior to stabilizing at 2114 psig. The Pressurizer level increased to 257 inches immediately before the trip and decreased to 120 inches after the trip. The Pressurizer level stabilized at 162 inches. The pressure in Steam Generator "A" ranged between 1115 psig and 1000 psig prior to stabilizing at 1022 psig. The pressure in Steam Generator "B" ranged between 1085 psig and 987 psig. The pressure stabilized less smoothly at 1022 psig. The rough control on Steam Generator "B" is attributed to a combination of the turbine bypass valves closing with the seating, lifting and seating again of the main steam relief valves. The level in both Steam Generators dropped to 25 inches and were controlled smoothly. Although, the Emergency Feedwater [EIIS:BA] did not receive a signal to start the transient monitor graph of the flow for loop "A" erroneously showed that there was a 15 gpm flow before and after the trip. Additionally, the graph showed that the flow spiked at 154 gpm immediately following the trip.

After the Unit was stabilized, management developed a plan for the investigation of 1C-84, with emphasis on determining the "as found" state of the valve limit switch contacts. However, it was found that a Operations person, conducting an independent investigation, had manually operated the valve after the Unit trip. Therefore, it was impossible to determine what the valve and contact positions had been immediately following the trip. The valve and its limit switch contacts were inspected and no defects or abnormalities were found. Additionally, it was determined that after the valve is opened electrically it would take four and one half turns on the handwheel in the "closed" direction to move the limit switch from the "open" position.

In conjunction with the investigation on the valve, representatives from the Instrument and Electrical group proceeded to investigate the reason why the standby CBP did not start. It was found that the contracts in the pressure switch that monitors the bearing oil pressure were open and prevented the pump from starting. Further investigation revealed that the switch setpoints were unstable and out of adjustment. Also, there was air

found in the impulse line supplying the switch. After bleeding the air from the impulse line, exercising the switch contacts and adjusting the setpoints, the switch performed properly. During the restart of the Unit, the "C" CBP would not start due to a similar pressure switch problem.

There was no apparent RCS leakage during this event. There was no actuation of the Engineered Safeguards System [EIIS:JE] or Pressurizer relief valves during this trip. The Reactor reached criticality at 2026 hours and the Unit returned to service at 2320 hours on August 28, 1990.

CONCLUSIONS

Preventive Maintenance (PM) was performed on valve, 1C-84 just prior to the Unit trip. There were no abnormalities found during this PM other than grease that had leaked from the limit switch gear housing. During a PM on a valve operator there are two possible ways to accidentally cause a limit switch actuation. The first way is to engage the clutch for handwheel operation and then turn the handwheel causing the limit switch to actuate. The second way to cause an accidental actuation is to short out and/or manipulate the limit switch contacts while working within the limit switch compartment. In both of these situations an actuation would cause an immediate trip of the Condensate Booster Pump (CBP). The Maintenance Technicians that performed the PM on the valve stated that they were working on another valve and had been away from valve 1C-84 approximately three to five minutes prior to the Unit trip. A Quality Assurance Inspector, that was working in the area, confirmed that the craftsmen were working on another valve at the time the Unit tripped. The Inspector could not confirm how long the craftsmen had been at the other valve location. The duration from the time the last change in valve position was recorded by the Operator Aid Computer (OAC) to the time that the Unit tripped was thirty-six seconds. It does not seem likely that the craftsmen could descend an eight foot high scaffold with their tools, travel sixty feet across the Turbine Building basement and ascend another scaffold within thirty-six seconds.

Another possible cause of the actuation of the valve limit switch contacts is vibration. This would be possible if the contacts were on the edge of actuating. Although, the Maintenance Technicians stated that they did not turn the handwheel, they did de-clutch the valve from motor operation. This would relieve the restraining pressure of the motor from the operator internals. While vibration seems a likely cause of this event, it cannot be confirmed because the post trip investigation could not verify what the position of the valve limit switch contacts were immediately following the trip due to the manipulation of the valve by an Operations person. Because the valve limit switch position could not be confirmed and the valve operated normally after the trip it is concluded that the root cause of the event is "Unknown".

The "A" CBP was aligned to automatically start when the Feedwater Pump suction pressure fell below a preset level. The pump did not start due to faulty auxiliary oil pressure instrumentation. While one FWP is capable of supplying the required flow for the Unit with the Reactor operating at 65% power, one CBP is capable of supplying only 50% of the required flow. One CBP could not be expected to handle the feedwater flow requirements for the Unit on a runback to 65% power. When the pressure in the Reactor Coolant System reached the appropriate setpoint value, the Reactor Protective System properly tripped the Reactor. Because the Reactor trip may have been averted if the standby CBP had started this event is assigned a contributing cause of "Equipment Failure/ Malfunction".

After reviewing the LERs over the past two years several events were found to have been initiated by unknown causes. None of these events involved the same equipment, work function or personnel. A review of LERs for equipment failures revealed no other cases of pressure switch failure. Therefore, under the reporting guidelines for recurring items this would be considered a non-recurring event. However, a review of maintenance records for the auxiliary oil pressure instrumentation shows that maintenance was performed on thirteen occasions over the past two years for either air in the impulse line, switch out of calibration or some unknown cause. On three of the thirteen occasions that maintenance was performed the associated CBP would not start due to pressure switch malfunction. The malfunction of the United Electrical Controls pressure switch, Model UE-J302-454, is NPRDS reportable.

There was no apparent RCS leakage during this event. There was no actuation of the Engineered Safeguards System or Pressurizer relief valves during this trip. No personnel injuries, radiation exposures, or releases of radioactive material resulted from this Unit trip. The health and safety of the public was not compromised as a result of this event.

CORRECTIVE ACTIONS

Immediate

The Unit was stabilized at hot shutdown.

Subsequent

1. A post-trip investigation was performed on the cause for the event that included evaluating why valve 1C-84 indicated that it was "not open" and the failure of the "A" Condensate Booster Pump to start.

2. The Post-Trip Managers meeting was conducted to summarize the investigation results which concluded that the cause for the valve limit switch actuation could not be determined and the "A" Condensate Booster Pump's failure to start was caused by the malfunction of the Auxiliary Oil Pumps pressure instrumentation.

3. The pressure switch for the "A" Condensate Booster Pump was exercised, adjusted, purged of air and returned to service.

4. A work request was written to calibrate the "A" Loop Emergency Feedwater Flow transmitter and investigate the post trip spike.

5. Operations person who manipulated the valve prior to post-trip investigation was cautioned not to take independent actions prior to post-trip investigations.

Planned

1. Implement additional preventive maintenance to ensure reliability of existing pressure switches, UE-J302-454 or replace the switches with more reliable pressure switches.

2. Develop a verification test, to be preformed on a regular bases, to ensure the operability of the Condensate Booster Pumps.

3. Evaluate the requirement for the trip feature on the CBP discharge and suction valves.

4. Include in the valve preventive maintenance procedure a verification of the position of the limit switch rotors to assure that they are correctly positioned to help prevent vibration induced actuation.

SAFETY ANALYSIS

Following the loss of the "B" Condensate Booster Pump (CBP) and the subsequent loss of the "1A" Feedwater Pump (FWP), the Integrated Control System responded properly. One FWP is capable of supplying the required flow for the Unit with the Reactor operating at 65% power. However, one CBP is capable of supplying only 50% of the required flow. One CBP could not be expected to handle the feedwater flow requirements for the Unit on a runback to 65% power. When the pressure in the Reactor Coolant System reached the appropriate setpoint value, the Reactor Protective System properly tripped the Reactor. No Engineered Safeguards System or

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

APPROVED OMB NO. 3150-0104
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TEXT *(If more space is required, use additional NRC Form 366A's)* (17)

Pressurizer relief valve actuation occurred. No Reactor Coolant System leakage occurred during the event. The Operations Control Room personnel safely controlled the Unit during the event. All emergency systems were available to assist in the control of the Unit, however, the systems were not required to be used and were not activated. All the Unit parameters were maintained within expected values. There were no abnormal occurrences as a result of this trip and no safety limits were exceeded. All the Unit's systems responded properly except the "A" CBP. Therefore, the health and safety of the public were not jeopardized as a result of this event.