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SUBJECT: LER 94-003-00:on 940728,unanticipated RPS trip occurred when unit in process of shutting down to repair SG tube leak.Unit in sub-critical & all control rods fully inserted.W/940825 ltr.

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TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

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PRIORITY 2 DOCUMENT

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August 25, 1994

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

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 270/94-03

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 270/94-03, concerning an unplanned reactor protective system actuation while sub-critical.

This report is being submitted in accordance with 10 CFR 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,

J. W. Hampton
Vice President

/ftr

Attachment

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NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
OCONEE NUCLEAR STATION, UNIT 2	05000 270	1 OF 10

TITLE (4) UNPLANNED REACTOR PROTECTIVE SYSTEM ACTUATION WHILE SUB-CRITICAL DUE TO DEFICIENT WORK PRACTICES

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
07	28	94	94	-- 03 --	00	08	25	94	FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	N
POWER LEVEL (10)	0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

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
20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	(Specify in Abstract below and in Text, NRC Form 366A)
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 (Include Area Code)
Lanny V. Wilkie, Safety Review Manager	(803) 885-3518

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
YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On July 28, 1994, Oconee Unit 2 was in the process of shutting down to repair a steam generator tube leak. With the unit sub-critical and all control rods fully inserted, an unanticipated Reactor Protective System (RPS) trip occurred at 0115 hours. Per procedure, the operators had placed the RPS in bypass at a Reactor Coolant System (RCS) pressure of approximately 1700 psig and decreasing, which shifted the high pressure trip setpoint to 1710 psig. At about the same time, a make-up valve had opened automatically to maintain the Pressurizer level at setpoint. This increased RCS pressure also. The control operator noted that RCS pressure was at 1690 psig, but failed to recognize that pressure had started increasing rather than decreasing. While the operator was reading procedure limits and precautions for the next step, the RCS pressure reached the trip setpoint. The primary root cause is Deficient Work Practices (Error Detection Practice: self-checking not applied to ensure expected response) with a secondary root cause of Supervisory Methods (job performance and self-checking standards not properly communicated). Corrective actions include personnel counselling, a procedure change, and clarification of management expectations.

BACKGROUND

The Reactor Protective System (RPS) [EIIS:JC] is a Nuclear Safety Related system designed to protect the fuel and fuel cladding from damage. The RPS also assists in protecting the Reactor Coolant System (RCS) [EIIS:AB] and the reactor building from damage.

The RPS monitors selected plant parameters related to safe plant operation and trips the reactor when predetermined setpoints are reached on two-out-of-four independent channels. During shutdown, the RPS is placed in shutdown bypass mode. The shutdown bypass switch enables several trip parameters to be bypassed, allowing control rod withdrawal after the reactor has been shut down and depressurized below the low RCS pressure trip setpoint (1810 psig.). One feature of this mode is that it establishes a new overpressure trip setpoint of 1710 psig. If pressure is increased above this setpoint with the bypass initiated, the channel will trip. Use of the shutdown bypass key switch is under administrative control.

The RCS pressure is monitored on several instruments available to the operator. RCS Narrow range (1700 to 2500 psig) pressure readings for all four RPS channels are available on the Operator Aid Computer (OAC) [EIIS:ID] , pressure/temperature displays and other displays. One selected channel is recorded on a chart recorder. RCS wide range (0 to 2500 psig) instruments are also available on the control board, OAC, etc. The scales for charts and OAC trend displays of RCS pressure are such that 50 psig pressure changes over five to ten minutes are discernable to the operator but are not "glaring".

OP/2/A/1102/10 (the controlling procedure for shutdown), Enclosure 4.2 (Hot Shutdown Conditions to 250F/350psig Conditions), specifies in earlier steps that the Pressurizer Spray valve is to be used to depressurize the RCS and the Turbine By-pass Valves are to be used to cooldown the RCS by controlling steam pressure. It also specifies that pressure, temperature, and cooldown rates are to be maintained within specified limits of Unit 2 RCS heatup/Cooldown Curves. Actual manipulation of these components is considered "skill of the operator".

The procedure requires additional actions at certain pressure/temperature plateaus, but it does not provide guidance with respect to stopping depressurization to perform these actions. Specifically, steps 2.4 and 2.5 are both to be performed at approximately 1700 psig. Step 2.7 specifies that Engineered Safeguards [EIIS:JE] channels 3 and 4 be placed in bypass between 900 psig and 600 psig. Conversely, step 2.6 does not specify the pressure for resetting the control rod drive breakers and withdrawing group

1 control rods. There is no intermediate step to resume the depressurization either before or after step 2.6.

Operations Management Procedure 2-1, "Duties and Responsibilities of On Shift Operations Personnel," Enclosure 4.4, "Responsibilities of the SRO in the Control Room", specifies that the Control Room Senior Reactor Operator shall "ensure the safe operation of the Unit(s) from the control room, maintain a "big picture" overview of the operation of the assigned unit, supervise the Reactor Operators (ROs), and oversee the activities in the control room.

Enclosure 4.5, "Responsibilities of the Reactor Operators", specifies that:

> Prior to making any changes in unit status, Reactor Operators will refer to all applicable procedures, including the controlling procedure, to ensure that all prerequisites for the change are met.
>
> All Reactor Operators shall ensure that his/her normal or selected instruments monitoring their associated parameters are responding as expected for the existing condition.

Furthermore, for the "Operator at the Controls" (OATC):

> Under the direction of the Control Room SRO, the OATC shall have the responsibility for the operation of the assigned unit.
>
> The OATC shall provide surveillance of operations and instrumentation monitored from the Control Room to ensure the safe operation of the Unit.

EVENT DESCRIPTION

On July 27, 1994, Operators initiated a shutdown of Oconee Unit 2 in order to repair a steam generator [EIIS:SG] tube leak. The control rods were inserted to make the reactor subcritical and cooldown and depressurization of the Reactor Coolant System (RCS) was begun. When the RCS pressure reached 1810 psig, a planned Reactor Protective System (RPS) low pressure trip occurred which tripped the control rod drive breakers.

The operators held pressure at approximately 1775 psig while awaiting the result of chemistry samples to verify RCS boron concentration and shutdown margin. On July 28, 1994, at approximately 0050 hours, these verifications were completed and the Operator at the Controls, Reactor Operator A (RO A), opened the Pressurizer [EIIS:PZR] Spray valve momentarily to reduce pressure. He noted an immediate decrease in pressure. At 0055 hours, with

RCS pressure approximately 1700 psig, RO A placed Engineered Safeguards Channels 1 and 2 in BYPASS, per procedure. At 0056 hours, he closed the spray valve and established a cooldown\depressurization rate by adjusting Turbine By-pass Valve position. He observed that pressure began to ramp down as expected.

The Control Room Senior Reactor Operators (CRSROs) for Units 1 and 2, (SRO A and SRO B, respectively), took Enclosure 4.2 (Hot Shutdown Conditions to 250F/350psig Conditions), the applicable enclosure, of OP/2/A/1102/10 (the controlling procedure for shutdown) to the RPS cabinets in the back of the control room and placed all four channels of the RPS in Shutdown BYPASS between 0109 and 0111 hours. RO A was required to acknowledge control room alarms indicating the change of status. RO A did not note that RCS pressure was approximately 1660 psig at this time. SRO A and SRO B returned to the control room and gave the procedure enclosure back to RO A. At 0112 hours, RO A reset the Control Rod Drive (CRD) [EIIS:AA] breakers by pressing a reset button on the control panel as directed by the next step in the procedure. RO A stated that at this time he observed the RCS pressure readings and noted an indication of approximately 1690 psig.

A second part of that step directs the operator to withdraw control rod group 1 to 50% withdrawn to provide a contingency for negative reactivity insertion. This portion of the step required branching into another procedure (OP/0/A/1105/09, Control Rod Drive System). RO A began reading the limits and precautions of this procedure. At 0114:58 hours, while RO A was reading, RPS Channel A tripped. At 0115:08 hours, Channels B, C, and D also tripped, tripping the CRD breakers. Because all control rods were already fully inserted, there was no rod motion and no transient on the RCS system due to the trip.

Responding to RPS channel trip alarms, the operators observed that RCS pressure had increased above the trip setpoint and, at 0118 hours, RO A reopened the pressurizer spray valve and dropped pressure down to approximately 1625 psig. The RPS was reset at 0119 hours and the CRD breakers reset at 0121 hours. The shutdown was resumed.

The operators and the Shift Work Manager (who has Shift Technical Advisor responsibility) continued to evaluate the RPS trip by reviewing data from the Transient Monitor [EIIS:IQ] and the alarm typer output from the Operator Aid Computer. Use of the Pressurizer spray valve had caused the pressurizer inventory to cool and shrink. At 0106 hours (approximately nine minutes prior to the trip), the initial pressure decrease had begun to level out. In part this was due to the Pressurizer level control sub-system. As pressurizer level dropped below setpoint, 2HP-120, the Pressurizer make-up control valve, automatically opened to restore level. This increase in inventory caused system pressure to level out, then go up

slowly. At about 0108 hours, pressure had bottomed out at about 1660 psig. The Transient Monitor data confirmed that RCS pressure was at 1690 psig when RO A reset the CRD breakers at 0112 hours. Both Pressurizer level and RCS pressure continued to increase. The pressure reached 1710 psig and the trip occurred at 0115 hours. Pressure continued to increase to 1727 psig, when RO A again opened the spray valve at 0118 hours.

Discussion with the Unit Supervisor (SRO C) indicated that a known hardware problem may have contributed to the event. Valve 2HP-7, a letdown control valve, has been inoperable throughout this fuel cycle. As a result, letdown flow has been routed through a by-pass line which restricts letdown flow. This has the effect of reducing the required make-up flow. The make-up control valve 2HP-120 normally operates in a throttled position. Due to the reduced flow rate, it was operating in a range where it tended to open and shut, rather than remaining open. According to SRO C, 2HP-120 control became more sluggish as RCS pressure dropped further and further from normal operating pressure. SRO C feels that this contributed to the event because pressurizer level (and therefore pressure) control became more erratic as the valve would open, fill the pressurizer rapidly, then shut. SRO C concludes that the pressure increase was faster than the operators would normally expect.

During a subsequent interview, RO A stated that he was aware of the by-pass overpressure trip setpoint. He was consciously thinking about a previous event where a similar trip had occurred due to setpoint shifts when resetting the CRD breakers with certain controls in automatic rather than manual. He had confirmed a definite downward trend in pressure earlier after he closed the pressurizer spray valve. Prior to resetting the CRD breakers, he observed the RCS pressure and verified that it was below the trip setpoint. However, he stated that he did not recognize that RCS pressure was trending upward when he made that observation.

CONCLUSIONS

The primary root cause of this event is operator lack of attention to detail. It is classified as Deficient Work Practices (Error Detection Practice: self-checking not applied to ensure expected response).

A. The Operator Training module on shutdown from hot shutdown to 250F/350psig had been revised following a previous incident (listed below) to reinforce the fact that the Operator at the Controls (OATC) must not allow anything to distract them from monitoring the control boards while depressurizing the Reactor Coolant System (RCS). RO A received training on this module in October, 1993. During this event, RO A initially established and verified a decreasing trend in

RCS pressure. However, RO A subsequently allowed himself to be distracted and failed to adequately monitor system parameters. This allowed pressure to reach the trip setpoint without being observed.

RO A did not recognize that RCS pressure had been as low as 1660 psig. Therefore, when he observed that RCS pressure was at 1690 psig as he reset the Control Rod Drive (CRD) breakers, he did not recognize that a re-pressurization was in progress. It is reasonable to conclude that RO A should have verified the system pressure when the Reactor Protective System (RPS) was placed in shutdown bypass (at 1660 psig) so that he would have been aware of the margin to the new trip setpoint (1710 psig). Had he done so, he could have recognized the decreased margin when he subsequently observed the 1690 psig reading.

B. SRO B is required to oversee and supervise control room activities. He had put the RPS into shutdown bypass, returned to the main control area, and gave the controlling procedure back to RO A. He also did not adequately monitor the margin to the new trip setpoint and/or observe the trend in increasing pressure.

An additional root cause is Deficient Supervisory Methods (job performance and self-checking standards not properly communicated).

A. SRO B is required to oversee and supervise control room activities. One management expectation for the OATC is to "not allow anything to distract them from monitoring the control boards while depressurizing the RCS." SRO B did not recognize and/or communicate that it was a distraction when RO A became involved in reading the Limits and Precautions and performing the steps in the referenced procedure.

B. Reading the Limits and Precautions of a referenced procedure prior to performing steps in that procedure is a task requirement. However, there was a conflict between two management expectations: 1. reading Limits and Precautions and performing subsequent steps of the governing or support procedures and, 2. monitoring system parameters without becoming distracted. On August 1, 1994, Operations management met with Operations supervision to clarify these expectations, and to communicate appropriate work practices. Management stated an expectation that the OATC must turn over the 'watch' whenever taking on any task that has the potential to distract from watchstanding.

An additional deficiency that did not directly contribute to the event was noted. The controlling procedure was determined to be deficient (Written

Communication: Content-Not designed for less practiced users) for the following reasons:

The procedure specifies that steps 2.4 and 2.5 be performed at approximately 1700 psig, but it does not require the operator to stop or slow depressurization while these steps occur. There is no pressure range given for step 2.6, the step to reset the CRDs and partially withdraw Group 1. Therefore, the operators are free to use their own judgement with respect to either continuing or stopping depressurization while performing these tasks. Specifically, they can decide to continue depressurization while pulling group 1 rods or to hold pressure at a point sufficiently below 1700 psig to avoid routine fluctuations. RO A could have prevented this event by depressurizing significantly below the shutdown bypass setpoint prior to performing step 2.6.

However, it should be noted that, if the operators place the RPS in Shutdown Bypass per step 2.5.2 at a pressure "near" 1700 psig, the margin to the overpressure setpoint is very small, and routine system pressure fluctuations can cause pressure to reach 1710 psig with little or no warning. Therefore, specifying a lower pressure plateau for step 2.6 alone would not positively prevent recurrence of this type of event.

Therefore, the procedure could be enhanced by explicitly requiring that step 2.5.2, the step to place RPS in shutdown bypass, and step 2.6 to reset the CRD breakers and to partially withdraw Group 1 rods be performed at a lower pressure, so that a reasonable pressure margin exists.

The fact that 2HP-7 was inoperable was considered and evaluated with respect to its contribution to the event. The inoperability of 2HP-7 was a known problem: Unit 2 was shutdown for refueling outage 2EOC13 with corrective maintenance planned for 2HP-7. On June 19, 1993, after the unit had been heated up to hot standby for physics testing at the end of 2EOC13, work requests were initiated on 2HP-7 when it was found to still have packing leaks and possible internal blockage. Management elected to continue restart with 2HP-7 inoperable and additional corrective maintenance was scheduled for 2EOC14. Letdown flow was routed through a manual by-pass valve which has lower flow capability. The inoperability of 2HP-7 may have contributed by affecting the normal operating point of 2HP-120 and its response to control demand. This may have caused Pressurizer level, and therefore, RCS pressure, to increase more rapidly than normal. This possible affect on system pressure response had apparently not been recognized prior to this event. However, the increase in system pressure

occurred over a period of approximately seven to eight minutes. While the problem with 2HP-7 may have contributed to a faster pressure increase during make-up than normally expected, the rate of increase was still less than the possible rate of increase due to other anticipated transients which the operators are trained to identify and handle. Therefore, it is concluded that any effect on pressure response due to 2HP-7 and 2HP-120 should have been detected by RO A.

There have been three events in recent years where operators have experienced unanticipated RPS actuations while using Enclosure 4.2 of the shutdown procedure.

LER 287/91-01 reported an event where the RPS tripped prior to insertion of Group 1 Control Rods (i.e. out of the proper sequence of steps). The cause was that an operator was monitoring a wide range RCS pressure instrument rather than narrow range instrumentation and the narrow range instruments reached the 1810 psig low pressure trip setpoint before he stopped the pressure decrease.

LER 287/91-08 reported an event where the unit was being shutdown due to excessive RCS leakage. During the shutdown the unit experienced a trip when taking a feedwater pump off line at low power and an additional RPS actuation during depressurization. The RPS actuation occurred because the operator at the controls left the turbine by-pass valve controls in automatic (contrary to the procedure) when he reset the CRD breakers per Enclosure 4.2. This removed a post-trip setpoint bias and resulted in an unintended decrease in pressure. The operator responded by raising pressure and reached the shutdown bypass high pressure trip setpoint of 1710 psig.

LER 269/93-02 reported an event where the operator began depressurizing per Enclosure 4.2 and allowed himself to become involved in another task not directly related to the depressurization. Due to lack of attention, the unit reached the 1810 psig low pressure trip setpoint prior to the insertion of Group 1 Control Rods.

All three of these events involved unintended RPS actuations during the performance of the same procedure with root causes related to improper actions (work practices) by control operators. Therefore, this event is considered recurring.

Operator Training for this evolution was also reviewed. The training included performance of a "normal" shutdown on the simulator. The training package had been revised to incorporate "lessons learned" from the three prior events listed above. The revisions included additional emphasis on

the requirements to maintain control of turbine by-pass valves in manual, to monitor appropriate instruments, and to "not allow anything to distract them from monitoring the control boards while depressurizing the RCS." The shift personnel involved had received periodic re-qualification training on this evolution during October and November, 1993. However, these corrective actions were not effective in preventing this event. In this case, RO A stated that he had maintained the turbine by-pass valves in manual and used appropriate instrumentation when he did monitor pressure. He observed a definite depressurization rate several minutes prior to the actuation, and assumed depressurization was still occurring. Although he did become distracted from monitoring the system, the "distraction" was an attempt to perform the next step in the governing procedure, unlike the most recent previous event where the distracting activity was not directly related to the shutdown.

There were no equipment failures, radiation exposures, releases of radioactive materials, or personnel injuries associated with this event.

CORRECTIVE ACTIONS

Immediate

1. Pressure was decreased, the Reactor Protective System (RPS) was reset, and the shutdown continued.

Subsequent

1. Operations management held a meeting of Operations Shift Managers to discuss this event. It was emphasized that the designated Operator at the Controls (OATC) must ensure that the control board/unit is being monitored at all times. Management stated an expectation that the OATC must turn over the 'watch' whenever taking on any task that has the potential to distract from watchstanding.

2. RO A and SRO B have been counseled on the importance of maintaining awareness of plant parameters and close observation of control room activities, especially relative to changing plant status.

Planned

1. Procedure changes will be made to all three unit shutdown procedures (OP/1,2,3/A/1102/10) to enhance guidance for resetting the RPS while in Shutdown Bypass. This will include determining an appropriate lower pressure for placing the RPS in By-pass and adding an informational note to remind the operator of the Shutdown Bypass high pressure trip setpoint.

2. RO A and SRO B will share the lessons learned from this event with all five shifts of operators.

3. Repair of 2HP-7 is scheduled for 2EOC14 refueling outage.

SAFETY ANALYSIS

There were no adverse consequences of this event. The control rods had been fully inserted prior to this event so that there was no net effect on the reactor. The shutdown by-pass high pressure trip performed its intended function by initiating a trip in response to a return to high pressure conditions, thus assuring that such pressure increase would not be due to an increase in reactor power.

The health and safety of the public were not affected by this event.