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SUBJECT: LER 93-003-00:on 930810,determined that SSf reactor coolant makeup sys technically inoperable.Caused by deficiency. Procedure revised.W/930909 ltr.

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DUKE POWER

September 9, 1993

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

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 270/93-03

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 270/93-03, concerning the technical inoperability of the Reactor Coolant Makeup System.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(i)(B). 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

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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 8

TITLE (4) DESIGN DEFICIENCY RESULTS IN TECHNICAL INOPERABILITY OF THE REACTOR COOLANT MAKEUP SYSTEM

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
08	10	93	93	-- 03 --	00	09	09	93	Oconee, Unit 3	05000 287
									FACILITY NAME	DOCKET NUMBER
										05000

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)					
		20.402(b)		20.405(c)		50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)		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)	X	50.73(a)(2)(i)(B)		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)
S. G. Benesole, 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

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

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

On August 10, 1993, at 1515 hours, Oconee Units 2 and 3 were operating at 100 % Full Power. While preparing the Design Basis Document for the Standby Shutdown Facility (SSF), Oconee Engineering determined that the SSF Reactor Coolant Makeup (RCMU) System was technically inoperable. The inoperability was due to the RCMU system letdown line orifices being too small to pass adequate flow during certain SSF accident scenarios. Oconee Units 2 and 3 entered a seven day Limiting Condition for Operation (LCO) for SSF RCMU system inoperability. On August 13, 1993, at 2041 hours, the SSF RCMU systems for Oconee Units 2 and 3 were declared operable and the LCO was exited after compensatory procedure changes were made. These changes included the use of the Reactor Vessel Head Vent valves to control pressurizer level during an SSF event. The root cause of this event is design deficiency: functional mechanical design deficiency. Corrective actions include revising procedures, completing the Design Basis Document for the SSF and installing appropriately sized letdown line orifices.

BACKGROUND

The Standby Shutdown Facility (SSF) is designed to provide an alternate and independent means to achieve and maintain hot shutdown conditions for one or more of the three Oconee units. The SSF can maintain hot shutdown conditions on all three units for 72 hours following a loss of normal AC power associated with turbine building flooding, fire and physical security events. The SSF systems are not designed to meet the single failure criterion, but are designed such that failures in the SSF systems do not cause failures or inadvertent operations in the existing plant systems.

The SSF Reactor Coolant Makeup (RCMU) system uses a positive displacement RCMU pump located in each unit's Reactor Building. The RCMU pumps take suction from the Spent Fuel Pool and discharge to the Reactor Coolant Pump (RCP) [EIIS:P] seals. The purpose of the RCMU system is to protect the RCP seals, to recover the Reactor Coolant System (RCS) [EIIS:AB] volume, and to borate the RCS during an SSF event. To provide pressurizer water level control, the SSF RCMU system letdown line is used to letdown excess water. Letdown, when required, is returned to the Spent Fuel Pool (SFP). The letdown valves are powered from the SSF power system and are controlled from the SSF Control Room. The letdown line contains an orifice that functions to reduce pressure from the RCS to the SFP and to restrict flow while the letdown valve is open.

Technical Specification 3.18.4 requires the RCMU System to be operable when the unit is above 250 degrees F. It also provides a Limiting Condition for Operation that states: "If the RCMU is inoperable, it shall be restored to operable status within 7 days or the affected unit(s) shall be in hot shutdown conditions within the next 12 hours, and below 250 degrees F within the following 72 hours."

EVENT DESCRIPTION

On August 10, 1993, between 0900 and 1500 hours, an investigation of the design basis of the Standby Shutdown Facility (SSF) Reactor Coolant Makeup (RCMU) letdown orifices was in progress. During this time, a meeting was held to discuss a problem discovered while developing the SSF RCMU system Design Basis Document (DBD). Original design calculations of the letdown orifice for the SSF RCMU systems could not be found and current analysis indicated that the orifice was undersized. With full letdown through the letdown valves and full recirculation flow through the recirculation valves, there would be an increase in Reactor Coolant System (RCS) volume. Assuming no operator action, no RCS leakage, and little or no designed leakage through Units 2 and 3 Reactor Coolant Pump (RCP) seals, the

potential exists for overfilling the pressurizer in an SSF event. Overfilling the pressurizer could cause the pressurizer bubble to collapse. Once collapsed, RCS pressure control would be lost and RCS natural circulation would not function properly. Consequently, the pressurizer code safety relief valves would open. These valves are not designed to pass water and may not reseat. These concerns were not applicable to Unit 1 due to the designed leakage rate of greater than 2 gpm per RCP through the RCP seals.

On August 10, 1993, at 1515 hours, Oconee Units 2 and 3 entered a seven day Limiting Condition for Operation (LCO). The SSF RCMU systems were declared inoperable due to the undersized orifices in the letdown lines.

On August 11, 1993, at 0800 hours, a meeting was held to determine the course of action required to return the SSF RCMU systems to an operable status. Additional design calculations were necessary to determine adequacy of the proposed actions.

Safety Analysis and Oconee Engineering calculations indicated that coolant inputs to the pressurizer would have to continue for > 9 hours before the pressurizer would be overfilled (beyond the cylindrical region). This duration would allow adequate time to connect power cables and controls from the SSF to control the Reactor Vessel Head Vent (RVHV) valves and prevent the pressurizer overfill.

Oconee Engineering completed an Environmental Qualification review for the RCMU pumps, RVHV valves and other SSF equipment in the reactor building to verify this equipment can satisfactorily function for this particular scenario, which is slightly different than the original SSF scenario.

Oconee Engineering determined that the following conditions must be met to declare the RCMU system operable:

1. Pressurizer level must be maintained within a $\pm$ 5 inch band throughout the SSF event, while the RVHV valves and the SSF letdown lines are in use,
2. Station procedures must be modified to ensure the RVHV valves become operational within 8 hours of the initiation of an SSF event on Units 2 and 3,
3. Operations to initiate a training package concerning the changes to AP/O/A/1700/25 (SSF Emergency Operating Procedure),

On August 13, 1993, the following procedures were revised: RP/O/B/1000/22 (Procedure for Site Fire Damage Assessment and Repair) and AP/O/A/1700/25 (SSF Emergency Operating Procedure). These changes provided for quicker

response of operator actions to establish an alternative letdown path, and for the installation of the necessary equipment to provide power and control for the RVHV valves from the SSF within the specified 8 hours.

At 2041 hours, Oconee Units 2 and 3 exited the seven day LCO. Oconee Units 2 and 3 SSF RCMU systems were declared operable after the appropriate station procedure changes were made. The RVHV valves will be used as required to control pressurizer level during an SSF event.

CONCLUSIONS

The root cause of this event is a Design Deficiency, functional mechanical design deficiency, which occurred during the original design of the Reactor Coolant Makeup (RCMU) system in 1980-1981.

The original design calculations did not appropriately consider the effect temperature has on Reactor Coolant Pump (RCP) seal injection volume flow rates, the flow imbalances between the RCP injection lines, and the zero RCP seal leakage assumptions.

Final Safety Analysis Report section 9.6, Table 9.15 states that the Reactor Vessel Head Vent (RVHV) valves should be closed while the SSF is maintaining the plant at hot shutdown. This is to ensure that the RCMU pump can provide adequate makeup to compensate for normal RCS leakage and RCS shrinkage. Current analysis has shown that with no RCS leakage and current sizing of the RCMU system letdown orifice, the RCMU pump will deliver too much water to the RCS resulting in an increasing pressurizer level. Operation of the RVHV valves will be required after approximately 8 hours to prevent losing pressurizer pressure control. Power is normally isolated from the RVHV valves to prevent spurious opening of these valves. Power cables for the RVHV valves will be run from the SSF, during an SSF event in which use of the RCMU system is required. The normal power source to the RVHV valves will be removed and the valves will be reconnected to SSF power. Cabling and controls for the RVHV valves will not be affected by a turbine/auxiliary building fire as defined in the "Appendix R" program.

This event is considered recurring. LER 269/91-12 identified a functional design deficiency related to a low setpoint on a RCMU pump relief valve. LER 269/93-03 identified the technical inoperability of the RCMU system due to excessive nitrogen pressures in the RCMU pump suction stabilizer bladder. LER 269/93-07 identified the past inoperability of the SSF RCMU system due to excessive RCP seal leakage.

Because these design deficiencies have existed since the original operability of the SSF no corrective action from these previous events could have prevented this event. The design processes have been revised since the construction of the Standby Shutdown Facility (SSF). Guidelines for performing calculations currently require a review of Quality Assurance Requirements for the Design of Nuclear Power Plants (ANSI N45.2.11) as an aid in the inclusion of all the applicable criteria. Duke Power has also established the Design Basis Document process which will, in part, identify this type of oversight. The corrective action from LER 269/92-09 led to the discovery of this problem. A corrective action from previous events (LER 269/93-03 and LER 269/93-07) was to complete the Design Basis Document (DBD) for the SSF.

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

CORRECTIVE ACTIONS

Immediate

1. None

Subsequent

1. Revised RP/O/B/1000/22 (Procedure for Site Fire Damage assessment and Repair) and AP/O/A/1700/25 (SSF Emergency Operating Procedure)
2. Performed Environmental Qualification review for the Reactor Coolant Makeup Pump, Reactor Vessel Head Vent (RVHV) valves other Standby Shutdown Facility (SSF) equipment located in the reactor building to ensure this equipment can satisfactorily function while operating in the RVHV valve letdown mode.
3. Completed calculations to determine time available to establish power to the RVHV valves.
4. Determined that the RVHV valves have an unlimited cycling frequency.
5. Initiated a training package to train the operators on the changes to AP/O/A/1700/25 (SSF Emergency Operating Procedure). Operators on shift reviewed the training package on return to the first working shift and all other operators must complete the review within thirty days.

Planned

1. Replace, at the next available outage, the Standby Shutdown Facility Reactor Coolant Make Up System Letdown Orifices on Oconee Units 1, 2 and 3 with the appropriately sized orifices.

SAFETY ANALYSIS

The Standby Shutdown Facility (SSF) Reactor Coolant Make Up (RCMU) system letdown orifices on all three Oconee units have been incorrectly sized since the original operability of the SSF in 1984. Technical Specification 3.18 became effective May 11, 1992 and requires that the affected unit be at hot shutdown conditions within seven days if the RCMU system cannot be returned to operability. Operability was restored by procedure changes requiring pressurizer level to be maintained within a $\pm$ 5 inch band throughout an SSF event, and requiring the Reactor Vessel Head Vent (RVHV) valves to be made operable within 8 hours of the initiation of an SSF event, and by operator training given on the procedural changes.

Actions to restore power to the RVHV valves and actions to align power to the 4160v High Pressure Injection pumps from the Stand-by Busses (emergency on-site power) via a mobile "Appendix R" switch gear are referenced in procedure OP/O/A/1102/04 (Operational Guidelines Following A Fire in the Auxiliary Building, Turbine Building or Vital Area).

Oconee Probability Risk Assessment (PRA) results indicate that the probability of an event requiring the SSF RCMU pump is about 3.0 E-04 per year. This probability is dominated by external events. These external events are a turbine building fire or a seismic event.

If the RCMU system is available, supplying full letdown through the letdown valves and full recirculation flow through the recirculation valves, the potential exists for overfilling the pressurizer during an SSF event, assuming no operator action, no RCS leakage, and little or no designed leakage through Units 2 and 3 RCP seals. Pressurizer overfill would cause the pressurizer bubble to collapse, resulting in loss of RCS pressure control. If the pressurizer goes solid, pressurizer Safety Relief Valves (SRV) could be challenged. The RCMU pumps have sufficient pressure output to pressurize the RCS, thus opening the SRVs. If a pressurizer SRV sticks open, a steam bubble could be formed in the RCS loops, terminating natural circulation flow in the RCS. If the natural circulation cooling method is lost, the method for cooling the RCS would be Boiler Condensing Mode. This method of core cooling is not within the licensing bases of the SSF. If the SRVs stayed open, Emergency Core Cooling System flow (via 4160v High Pressure Injection pumps) would have to be recovered to avoid core damage.

Analysis indicates that there are at least 9 hours in the described scenario to take mitigating action. If an SSF event had occurred prior to the discovery of this problem, the SSF operator would have been faced with a situation not adequately covered by procedure. In such a situation, the site Emergency Plan specifies that the Technical Support Center (TSC) should be consulted. The function of the TSC is to provide technical expertise during an emergency condition. The TSC would have several options by which to control pressurizer level. One option to control pressurizer level is to perform an RCS cooldown so that the volume reduction due to density changes would compensate for the inadequate letdown rate. Technically, this is a viable option. A second alternative is to vent the RCS through the Reactor Vessel Head Vent valves.

Therefore, even though adequate procedural guidance did not exist, it is highly probable that technically adequate actions would have been taken to mitigate inadequate letdown flow had an SSF event occurred in the past.

Due to the nature of the PRA analysis, there is more uncertainty in the evaluation of external events than in most other parts of the PRA. Because of this uncertainty and because of the long time frame of the scenario described above, the Duke severe accident analysis group does not consider this event to be an accident sequence precursor.

No accidents different from those already evaluated in the Final Safety Analysis Report Chapter 15 are postulated. The function of the SSF RCMU system has not changed. The compensatory action of opening an additional letdown path is required to prevent pressurizer overfill. With this compensatory action, the ability of the SSF RCMU system to supply makeup water to the Reactor Coolant System (RCS) is not adversely affected, therefore, the consequences of the SSF design events are not increased.

The consequences of the additional letdown flowpath have been analyzed with respect to its effect on containment pressures and temperatures. The postulated environmental conditions to occur inside the reactor building, while operating units 2 and 3 from the SSF in the RVHV letdown mode, are expected to be as follows: at the end of 3 days temperature has reached 242 degrees F, pressure has reached 28 psig, and humidity at 100 %. Based on an evaluation made by Oconee Engineering, these conditions are not as harsh as the conditions expected during a Loss of Coolant Accident (LOCA) and should not present any operating problems to the SSF equipment located therein.

Also, an evaluation has concluded that cycling of the Reactor Vessel Head Vent (RVHV) valves will not cause premature valve failure nor present any undue transients in RCS pressure that could lead to a loss of subcooled margin; therefore, single phase natural circulation will be unaffected.

Since, the RVHV valves arrangement consist of two safety related valves in series, if one valve fails to close, the other valve should operate. The probability of a small break LOCA will not be increased. Furthermore, inadvertent loss of RCS inventory upon spurious operation of the RVHV valves is not likely because the power cables to the RVHV valves will be run after the postulated Appendix R event.

This problem was not associated with an actual event and did not result in the release of any radioactive materials, uncontrolled radiation exposures, or personnel injuries. The health and safety of the public was not compromised.