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SUBJECT: LER 93-007-01:on 930701,initiated evaluation of parameters that affect RCMU system operability due to functional mechanical design deficiency.Revised operations procedures to reflect new limits for RC makeup pump.W/940614 ltr.

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June 14, 1994

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

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 269/93-07, Revision 1

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is a supplement to Licensee Event Report (LER) 269/93-07, concerning the technical inoperability of the alternate Reactor Coolant Makeup System. This revision includes additional information discovered after the initial report was submitted.

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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LICENSEE EVENT REPORT (LER)

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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.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit One	05000 269	1 OF 7

TITLE (4) Design Deficiency Results In The Technical Inoperability Of The Alternate 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
										05000
07	01	93	93	07	01	06	14	94	FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)					
POWER LEVEL (10)	100	20.402(b)		20.405(c)		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)	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)
Lanny V. Wilkie, Safety Review Manager	(803) 885-3518

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

In May 1992, Oconee Engineering (OE) initiated an evaluation of the parameters that affect the Reactor Coolant Makeup (RCMU) system operability. The evaluation was initiated after an excessive Reactor Coolant (RC) pump seal leakage event on Unit 1 (LER 269/92-09). Specifically, the evaluation was to determine the adequacy of the RCMU system to supply the RC pump seals during a Standby Shutdown Facility (SSF) event. On July 1, 1993, with Unit 1 at 100% full power, OE determined that the Unit 1 SSF RCMU system had been inoperable in the past. The Unit 1 RC pump seal leakage rates have occasionally exceeded the newly established maximum allowed seal leakage rates. The root cause of the SSF RCMU system inoperability is a Design Deficiency, functional design deficiency, mechanical. A wiring error contributed to the event from March through May 1992. Corrective actions included completing the design calculation for allowable RC pump seal leakage rates, revising appropriate procedures and initiating modifications to install higher accuracy flow gauges and to correct wiring errors.

BACKGROUND

The Reactor Coolant (RC) system [EIIS:AB] consists of two parallel heat transfer loops connected to the reactor vessel. Each loop contains two Reactor Coolant (RC) pumps [EIIS:P]. During operation, the RC pumps circulate reactor coolant through the reactor vessel and the steam generators. Unit 1 RC pumps were supplied by Westinghouse and incorporate a three stage seal series arrangement to limit coolant leakage up the pump shaft.

The Reactor Coolant Makeup (RCMU) system is provided to supply makeup to the RCS in the event normal systems are inoperable due to any Standby Shutdown Facility (SSF) event (fire, flood, sabotage, or station blackout). The RCMU pump is capable of delivering 29 gpm to the RC system by taking suction from the Spent Fuel Pool and discharging to the RC pump seals. The flow resistance for each of the four RC pump seal injection lines is different. Therefore, the SSF RCMU pump does not deliver equal flow to each of the four RC pumps.

Technical Specifications require the RCMU system to be operable when the unit is above 250 F. They also provide a Limiting Condition for Operation which states that, if the RCMU system is inoperable, it shall be restored to operable status within 7 days or the unit shall be in hot shutdown conditions within the next 12 hours, and below 250 F within the following 72 hours.

EVENT DESCRIPTION

In May 1992, Unit 1 was shutdown to correct excessive seal leakage on a Reactor Coolant (RC) pump caused by the installation and premature degradation of obsolete seal parts (LER 269/92-09). A planned corrective action of the event was to perform an evaluation of the parameters that affect the Reactor Coolant Makeup (RCMU) system operability. After a preliminary evaluation by Oconee Engineering (OE) it was determined that adequate RC pump seal leakage rate limits were not provided. A Problem Investigation Process (PIP) report was initiated in July 1992, to document this problem. A 4.5 gpm maximum acceptable RC pump seal leakage rate was established to ensure that adequate seal injection flow be provided to the RC pump seals in time to avoid seal degradation and excessive seal leakage due to hot RC system fluid reaching the seals.

An evaluation to determine the minimum allowed RC pump seal leakage rate based on a 220 F seal injection water temperature was pursued with the RC pump vendor (Westinghouse). This temperature requirement is based on the fact that during a Standby Shutdown Facility (SSF) event, decay heat from the spent fuel will not be removed by the Spent Fuel Pool Cooling system [EIIS:DA]. Therefore, the temperature of the water contained in the spent fuel pool will rise until the pool begins to boil at 212 F. The temperature of the spent fuel pool water will increase to a maximum of 220 F after passing through the SSF RCMU pump. The 220 F temperature is much hotter than the normal High Pressure Injection (HPI) [EIIS:BQ] seal injection water temperature. Also, Unit 1 RC pump seal leakage rates increase as seal injection water temperatures increase. Therefore, seal leakage rates during an SSF event could exceed the SSF RCMU system's ability to provide seal injection flow if RC pump seal leakage rates during normal operation are too high. The OE preliminary evaluation of the Westinghouse analysis results revealed that the seal leakage limit could be as low as 3.4 gpm based on a minimum of 26 gpm RCMU pump flow rate. Based on the preliminary results, Oconee Systems Engineering (OSE) began monitoring RC pump seal leakage to ensure the limit would not be exceeded before the evaluation was completed.

On June 1, 1993, prior to completing the evaluation, OSE discovered that the 1B1 RC pump seal leakoff was exceeding the recently established conservative limit of 3.4 gpm. The 1B1 RC pump seal leakoff was fluctuating between 3.45 and 3.50 gpm (with no adjustment for instrument error). OSE initiated a PIP report to document this problem.

In response to the PIP report, the OE evaluation concluded that 3.8 gpm RC pump seal leakage was acceptable if the RCMU pump delivers a minimum of 27 gpm. This was based on a conservative flow instrument error of +/- 2 gpm. Unit 1 RC pump seal and RCMU pump performance data and calculations concluded on June 3, 1993, that the actual seal leakage rates were acceptable.

On June 17, 1993, the calculations of the maximum allowed RC pump seal leakage rates and maximum allowed total combined RC system leakage for all three units were completed and approved. This calculation incorporated a .7 gpm allowance for RCMU pump flow instrument error. Therefore, a minimum required RCMU pump flow rate of 28.3 gpm can be achieved. For Unit 1, specifically, the maximum allowed RC pump seal leakage rates based on providing a minimum of 28.3 gpm to the RC pump seals are: 1A1 RC pump - 4.7 gpm, 1A2 RC pump - 4.5 gpm, 1B1 RC pump - 4.2 gpm, and 1B2 RC pump - 4.7 gpm. The maximum allowed total combined RC system leakage rate is 16.8 gpm for the Unit 1 SSF RCMU system to be considered operable. The RCMU system was considered to be presently operable since the leakage rates had

not exceeded the calculated rates determined in the newly approved engineering calculations.

An investigation was initiated to determine if the RC pump seal leakage had exceeded the new limits in the past. On July 1, 1993, it was identified that on one occasion, in November 1988, the seal leakage limits had exceeded the SSF Technical Specification Limiting Condition for Operation.

On November 9, 1993, while preparing for a modification of the SSF Diesel Engine control circuit, a relay was found wired incorrectly. A PIP Report was initiated to address the error. It was discovered that the wiring was installed in March 1992, and would cause a decrease in SSF power system frequency as the Diesel Generator is loaded. An engineering evaluation concluded that the RCMU pump speed and flow rate may be affected by the condition. The evaluation concluded that the RCMU system was inoperable based on the RC pump seal leakage for various times in March through May 1992. The initial evaluation was completed on November 29, 1993, but was subsequently revised. The last revision was approved April 27, 1994.

Engineering concluded that while the incorrect wiring contributed to the loss of capability, the RC pump seal leakage during the March through May time frame was the cause of the inoperability of the RCMU system.

Due to the day to day fluctuations in measured seal leakage, the RCMU system was technically inoperable many days between March and May 1992. The TS seven day LCO was exceeded during this period but was not recognized at the time.

Operation with high RC pump seal leakage is unusual, and plant personnel could not recall any similar previous occasions after installation of the SSF. However, prior to recognition of this problem, it is possible that the SSF RCMU system may have been inoperable for this reason and the associated LCO exceeded on other occasions.

CONCLUSIONS

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

The original design calculations had not properly taken into account the affect of spent fuel pool water temperature increases on the Reactor Coolant (RC) pump seal leakage. The design processes have been revised since the construction of the Standby Shutdown Facility (SSF). Guidelines for the calculations performed 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 is intended, in part, to identify this type of oversight. The corrective action from the May 1992 event (LER 269/92-09) led to the discovery of this problem. A corrective action from a previous event (LER 269/93-03) was to complete the Design Basis Document for the SSF.

The design calculation completed in June 1993 specifically identified the maximum allowable leakage for each pump through the number 1 seal. There was little or no leakage from the number 2 seal. Previous leakage had exceeded the maximum for a period that exceeded the Technical Specifications in November 1988. The June 1993 evaluation only evaluated the number 1 seal leakage because the leakage from that seal alone had exceeded the maximum allowed.

In March 1992 a new electronic governor was installed in the SSF Diesel Generator by a vendor. As part of this modification, a relay was rewired. The drawing showing the wiring indicated wires to terminal 1. The wires were actually landed on terminal 4. An engineering generated Post Modification test plan was not adequate to verify the correctness of the modification performed by the vendor. The November 1993 evaluation took into account the total seal leakage (both number 1 and 2 seals) for the March through May time frame to accurately account for the affect of the reduced frequency on the RCMU pump. The Manufacturing Deficiency; (Fabrication Deficiency; vendor) contributed to this event. The Post Modification test plan should have detected the error. There has been additional reviews and training on the Modification process since the error occurred. The programmatic enhancements that have been made to the post modification testing should identify this type of error in the future.

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. Because the RC pump seal leakage design deficiency has existed since the original operability of the SSF in 1980-1981, and since there has been no reason to reanalyze the RC pump seal leakage calculations until the event in May 1992 (LER 269/92-09), no corrective action from these previously discovered events could have prevented it.

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

CORRECTIVE ACTIONS

Immediate

None

Subsequent

1. Revised operations procedures to reflect the newly calculated operating limits for the Reactor Coolant Makeup pump, Reactor Coolant pumps and Reactor Coolant system.

2. A minor modification was implemented and completed to correct the wiring errors.

Planned

1. Change the present Reactor Coolant Makeup Pump flow gauges to gauges having a higher accuracy.

SAFETY ANALYSIS

The High Pressure Injection (HPI) and Component Cooling (CC) [EIIS:CC] systems provide cooling flows to the Reactor Coolant (RC) pump seals during normal plant operation. If these systems are unable to provide seal cooling, the Reactor Coolant Makeup (RCMU) system can be used to provide RC pump seal cooling, in addition to replenishing the RC system to offset seal leakage and RC system shrinkage during cooldown to hot shutdown. Each RC pump contains approximately 55 gallons of relatively cool (130-150 F.) water between the RC pump seals and the RC system. The cool water acts as a buffer between the hot RC system water and the RC pump seals. If this cool water leaks off before seal flow can be reestablished, the RC pump seals may degrade and the seal leakage rates may increase.

The seal leakage limit for the 1B1 RC pump was established at 4.2 gpm for a RCMU pump flow rate of 28.3 gpm after completing the design calculation. The design calculation in June 1993 specifically identified the maximum allowable leakage for each pump. Previous leakage had exceeded the maximum allowable leakage at various times but not for an extended period. The longest time that the leakage had been excessive was eight days, from November 16, 1988 to November 23, 1988. When the wiring was installed incorrectly, it effectively reduced the maximum allowable total seal leakage. Both seal leakages were combined to determine the operability. When the wiring problem was considered it resulted in the maximum allowable

seal leakage being exceeded for March, April and May 1992. The leakage rate removed the assurance that the RC pump seals would not fail before the RCMU flow could be established. If the normal RC pump seal cooling systems had failed, then the degradation of the RC pump seals was possible. The resulting unisolable leakage from the RC system would be greater than the makeup capacity of the RCMU pump, resulting in a RC pump seal loss of coolant accident (LOCA). However, the probability that all normal seal cooling would have been lost during this time has been evaluated and found to be small (on the order of 1.0E-5 or lower). Thus, it was highly improbable that the SSF would have been necessary to provide RC pump seal cooling during the time that excessive seal leakage was present.

The Oconee Final Safety Analysis Report (FSAR) analyzes LOCA events, for a spectrum of break sizes that envelope RC pump seal LOCA's. The FSAR analyses demonstrate that the core will remain covered and radiological releases will remain within 10CFR100 limits, for seal LOCAs with HPI safety injection. RC pump seal LOCA events without HPI safety injection are not analyzed in the FSAR, because no plausible single failure would fail the HPI and CC systems. However, this type of accident has been analyzed in support of safety evaluations for a station blackout (SBO). For a SBO of 4 hours duration with a postulated 25 gpm seal leakage per RC pump, the core will remain covered. With the core remaining covered, the radiological consequences of a RC pump seal LOCA are expected to be bounded by the FSAR Chapter 15 LOCA analyses.

The health and safety of the public were not compromised by this event. Also, this event did not result in the release of any radioactive materials, radiation exposures or personnel injuries.