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DUKE POWER

March 22, 1993

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

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

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 239/93-03, concerning the technical inoperability of the alternate 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

xc: Mr. S. D. Ebneter
Regional Administrator, Region II
U.S. Nuclear Regulatory Commission
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Mr. L. A. Wiens
Office of Nuclear Reactor Regulation
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Mr. P. E. Harmon
NRC Resident Inspector
Oconee Nuclear Site

IE22

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 1	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
									Oconee, Unit 2	05000 270
02	18	93	93	-- 03 --	00	03	22	93	FACILITY NAME Oconee, Unit 3	DOCKET NUMBER 05000 287

OPERATING MODE (9)	N
POWER LEVEL (10)	100%

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)
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

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 February 18, 1993, at 1145 hours, Oconee units 1, 2, and 3 were at 100% full power. Oconee Engineering determined that the Standby Shutdown Facility (SSF) Reactor Coolant Makeup (RCMU) pump was inoperable. The technical inoperability was due to excessive nitrogen pressures in the suction stabilizer bladder which could have prevented the stabilizer from functioning properly during SSF scenarios. All three units entered a seven day Limiting Condition for Operation (LCO) for SSF RCMU system inoperability. On February 21, 1993, the pressure was vented off each units' SSF RCMU pump suction stabilizer and the RCMU system LCOs were exited. The root cause of this event is design deficiency: unanticipated environmental interaction, temperature. Corrective actions include venting the pressure from the RCMU pump suction stabilizers, revising procedures and completing the Design Basis Document for the SSF.

BACKGROUND

The Standby Shutdown Facility (SSF) is a separate building which houses the systems and components necessary 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 is designed to fulfill the safe shutdown requirement for fire protection, turbine building flooding, and physical security. The SSF has the capability of maintaining hot shutdown conditions on all three units for approximately three days (72 hours) following a loss of normal AC power.

The SSF Reactor Coolant Makeup (RCMU) system uses three positive displacement RCMU pumps, one located in each unit's Reactor Building, which 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 seals of the RCPs, recover the Reactor Coolant System (RCS) [EIIS:AB] volume, and borate the RCS during an SSF event. A path to return the RCS letdown is provided.

The Suction Stabilizer is located on the suction side of the RCMU pump and consists of a ten gallon outer shell assembly incorporating the inlet and outlet connections. Contained within the shell is a bladder cage containing the bladder. The bladder is charged with nitrogen gas to provide a cushion to limit the amplitude of pressure pulsation produced by the pumping action or other influences. The Suction Stabilizer provides a ready reserve of low velocity liquid at the pump inlet to provide adequate NPSH and promote pumping efficiency.

Technical Specification (TS) 3.18 was effective since May 11, 1992 and requires that the RCMU system be operable when above an RCS temperature of 250 F. TS 3.18 further states that, if inoperable, the SSF RCMU system will be restored to operable status within seven days or the affected unit(s) will be placed in hot shutdown conditions.

EVENT DESCRIPTION

On December 21, 1992, with unit 1 shutdown for refueling, Instrument and Electrical technicians were performing preventative maintenance (PM) on the suction stabilizer of the unit 1 Standby Shutdown Facility (SSF) Reactor Coolant Make-Up (RCMU) Pump. The suction stabilizer pressure was inadvertently released due to a malfunction in the test equipment. The pressure was released before the "as found" reading could be taken. However, for conservatism, the technicians noted the "as found" pressure as 0 psig. The suction stabilizer was pressurized and checked for leaks and none were found.

On February 10, 1993 Component Engineer A was reviewing the work order package for the PM performed during the outage. Due to a previous history of the stabilizer losing pressure, Component Engineer A (CE-A) contacted Design Engineer A (DE-A) to question him concerning the minimum acceptable pressure in the RCMU pump suction stabilizer bladder.

DE-A was working on the Design Basis Document for the SSF and had planned to analyze the RCMU system, specifically the RCMU pump Net Positive Suction Head (NPSH) requirements and acceptable bladder pressures. In response to the questions of CE-A, DE-A began the analysis of various nitrogen pressures (minimum and maximum) in the suction stabilizer and it's effect on the RCMU pump Net Positive Suction Head (NPSH) during worst case conditions.

On February 18, 1993 DE-A identified that inflation of the suction stabilizer bladder to 8 psig, as specified by the vendor and as required by procedure, could prevent the stabilizer from performing its intended function during a worst case SSF design basis scenario. The function of the suction stabilizer is to ensure proper NPSH is maintained for the RCMU pump by reducing acceleration head loss. Acceleration head loss is reduced by the bladder contracting on the discharge stroke and expanding during the suction stroke of the RCMU pump piston. In the design scenario the Spent Fuel Pool (SFP) level decreases and temperature increases which lowers available NPSH. DE-A determined the original design accounted for this effect except for the effect of higher temperature on the nitrogen pressure. His calculations showed that if the bladder was filled to 8 psig with cold nitrogen the temperature increase could result in the nitrogen pressure exceeding pressure on the water side of the bladder. The bladder would become "pressure locked" against its cage when the pressure on the water side of the bladder drops below the pressure on the nitrogen side of the bladder during an SSF event. The bladder becoming "pressure locked" against its cage causes the SSF RCMU pump to have inadequate NPSH. Therefore, the SSF RCMU system would be inoperable with 8 psig nitrogen pressure in the suction stabilizer bladder.

At 1145 hours, a seven day Limiting Condition for Operation was entered per Technical Specification 3.18.

It was determined that the RCMU pump suction stabilizer may not have performed its intended function properly, in the past, due to previous times that the bladder was charged to a greater pressure than that required for operability of the pump.

DE-A determined that the RCMU system of each unit would be operable if the RCMU pump suction stabilizer bladder nitrogen pressure is reduced to atmospheric. Therefore, design documents and station procedures were initiated to accomplish the lowering of the RCMU pump suction stabilizer bladder pressure to atmospheric.

On February 21, 1993, at 0844 hours, Oconee unit 1 reduced power and the reactor building was entered to vent the pressure from the RCMU pump suction stabilizer. At 1442 hours, Oconee unit 3 reduced power and the reactor building was entered to vent the RCMU pump suction stabilizer pressure. At 1532 hours, the unit 2 reactor building was entered to vent the RCMU pump suction stabilizer pressure. At 1800 hours, all three units RCMU pump work was completed, the pumps tested satisfactorily and the LCO exited.

Upon further review DE-A determined that the initial review was overly conservative. Sufficient NPSH exists with the bladder filled with a minimum of 1.3 gallons of nitrogen at atmospheric pressure. DE-A continued the evaluation and determined that an acceptable maximum pressure on the RCMU pump suction stabilizer is 5 psig.

CONCLUSIONS

The root cause of this event is design deficiency: unanticipated environmental interaction, temperature. The design oversight occurred during the original design of the Reactor Coolant Make-up (RCMU) System in 1980-1981.

When the original design was performed, the effect of temperature on the nitrogen pressure in the Standby Shutdown Facility (SSF) suction stabilizer was not considered. This oversight occurred initially in the vendor calculations and was not detected by Duke Power Engineering. The design processes have been revised since the construction of the 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 scope of the Design Basis Document (DBD) for the SSF included an evaluation of the criteria for the RCMU pump NPSH requirements including bladder pressure.

It can be concluded that these types of oversights are less likely to occur in future designs due to programmatic improvements as evidenced by the fact that the current DBD process discovered this problem.

This event is considered recurring. There have been various design deficiencies noted over the past two years. Some of the deficiencies have been discovered through the DBD process. LER 269/91-10 identified that, due to a design deficiency, the operating limit curve for Letdown Storage Tank pressure versus level was inadequate. LER 269/91-12 identified a functional design deficiency related to a low setpoint on a RCMU pump relief valve. LER 269/91-13 noted a design deficiency, identified by a vendor in response to concerns raised by Duke Engineering, concerning boron precipitation inside the core occurring sooner than previously analyzed after certain Loss of Coolant Accident scenarios. Because the design oversight in this event has existed since the original operability of the SSF in 1980-1981, no corrective action from these previously discovered events could have prevented it.

This event did not involve a release of radioactive material, radiation overexposure, or personnel injury. There were no NPRDS reportable equipment failures involved.

CORRECTIVE ACTIONS

Immediate

1. Compensatory actions for an inoperable Standby Shutdown Facility were taken.

2. An evaluation was initiated to determine the acceptable limit of the Reactor Coolant Makeup (RCMU) pump suction stabilizer bladder pressure.

Subsequent

1. The excess pressure was vented from the Standby Shutdown Facility (SSF) RCMU pumps suction stabilizer bladders.

Planned

1. Procedures associated with each Oconee units' SSF RCMU pump suction stabilizer will be revised to indicate the revised acceptable nitrogen pressure range.

2. Complete the Design Basis Document for the SSF.

SAFETY ANALYSIS

The Standby Shutdown Facility (SSF) Reactor Coolant Makeup (RCMU) system is designed to maintain makeup to the Reactor Coolant Pump (RCP) seals in an event requiring the SSF (fire, flood, or sabotage). It is one of a number of systems used to maintain hot shutdown conditions during these events.

The SSF RCMU pump suction stabilizer bladders on all three Oconee units have been pressurized too high since the original operability of the SSF in 1981. Technical Specification 3.18 became effective May 11, 1992 and requires hot shutdown conditions within seven days if the RCMU system cannot be returned to operability. Operability was restored by releasing the pressure on each bladder for all three Oconee units.

The SSF RCMU pump plays a significant role in the Oconee Probabilistic Safety Assessment. Therefore, it is deemed appropriate to review the potential degradation of this pump for risk significance. If the suction stabilizer bladders were pressurized at greater than 5 psig and the Spent Fuel Pool (SFP) level dropped below 825 feet (15 feet below normal SFP level) then the RCMU pumps Net Positive Suction Head (NPSH) may not have been maintained for the design basis worst case scenario. These conditions could have prevented the RCMU pumps from adequately protecting the Reactor Coolant Pump (RCP) seals for the design duration (72 hours) of accidents requiring the SSF. If the seals subsequently failed the resultant leakage would be beyond the design capability of the RCMU pump.

If makeup water were added to the SFP before SFP levels dropped low enough to cause pressure on the water side of the bladder to drop below the nitrogen pressure inside the bladder, the SSF RCMU system suction stabilizer would have been capable of performing its function for a full 72 hours. The minimum time frame for the described degradation to occur is 41 hours, based on conservative assumptions of a large heat load in the spent fuel pool combined with a high nitrogen pressure in the pump suction stabilizer bladder. This time frame would provide sufficient time for mitigating actions to be taken for most possible severe accident sequences. Obviously, action would be taken to restore power and/or normal seal injection as rapidly as possible after the initiating event. Additionally, the SSF Emergency Operations Procedure specifically directs that action should be taken to restore SFP level if possible. Therefore, the conditions necessary for this degradation may not occur.

Also, due to the observed loss of pressure from the bladder over time, pressure could be expected to occasionally be below the upper pressure limit required for the described pump degradation scenario to be possible. This further reduces the probability of this problem.

It is the conclusion of this review that the risk significance of the potential degradation of this pump (as described in this LER) is negligible. Therefore, the described past inoperability has been qualitatively dismissed as not being risk significant.

The health and safety of the public have not been compromised by this event. The event did not involve personnel overexposure, release of radioactivity, or personnel injury.