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DUKE POWER

March 23, 1994

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

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 269/94-01

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 269/94-01, concerning a seismic/LOOP event may result in the loss of post accident cooling.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(v)(D). 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
U.S. Nuclear Regulatory Commission
Washington, DC 20555

INPO Records Center
Suite 1500
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Atlanta, Georgia 30339

Mr. P. E. Harmon
NRC Resident Inspector
Oconee Nuclear Site

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) SEISMIC/LOOP EVENT MAY RESULT IN THE LOSS OF POST ACCIDENT COOLING DUE TO DESIGN DEFICIENCY

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	21	94	94	-- 01 --	00	03	23	94	FACILITY NAME: OCONEE, UNIT 3	DOCKET NUMBER: 05000 287

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)		20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v) (D)	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)
L. 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)

	YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR

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

On December 30, 1993, during a walkdown of the Condenser Circulating Water (CCW) System, a System Engineer discovered that four CCW valves on each unit were not shown on the CCW flow diagrams and the valves were adjacent to buoyancy restraints. On February 17, 1994, with Oconee Units 1 and 2 at 100% Full Power and Unit 3 in a refueling outage, an operability evaluation was completed by Oconee Engineering. The evaluation revealed that the Emergency CCW System and the Low Pressure Service Water System had been inoperable during various periods from July 1991 to January 1994, due to a potential for interaction between the valves and restraints, during a seismic event. The root cause of this event is a Design Deficiency: Unanticipated Interaction of Components, (Design Oversight). Corrective actions include a review of all engineering documents and associated training will be conducted and revised/implemented as appropriate. Immediate corrective action was a modification which increased the distance between the restraints and instrument lines.

BACKGROUND

The Condenser Circulating Water (CCW) System [EIIS:BS] supplies the Low Pressure Service Water System (LPSW) [EIIS:BI] through the CCW crossover header. The CCW System also supplies other systems and components. The Emergency CCW is a part of the CCW System and performs two separate functions. One of these functions is to recirculate CCW to the intake canal following the loss of Lake Keowee. The second function is an unassisted siphon. This siphon has two distinct purposes; one supplies suction for the LPSW System and the other provides cooling water flow through the condenser. The CCW System includes four CCW Pumps and an associated discharge valves per unit. Each CCW Pump has a pump/valve interlock such that when the last CCW Pump is turned off or upon loss of power, its discharge valve will remain open to ensure siphon flow. All open valves stay open if all pumps stop at the same time.

The LPSW System provides cooling for components in the Turbine Building [EIIS:NM], the Auxiliary Building (AB) [EIIS:JE] and the Reactor Building (RB) [EIIS:NH]. Engineering Safeguards [EIIS:JE] equipment located in the AB and RB (such as the Low Pressure Injection System [EIIS:BP] and Reactor Building Cooling Units) is cooled by the LPSW System. The LPSW System is required to be operable per Technical Specification 3.3.7.

EVENT DESCRIPTION

On December 30, 1993, a System Engineer (SE) was reviewing a procedure which would test the Condenser Circulating Water (CCW) Pump discharge pressure. This review included a walkdown of the CCW system. During the walkdown, four instrument taps and valves on each unit were discovered which were shown on the CCW flow diagrams as test connections without the valves. The valves are located on the CCW piping immediately downstream of the CCW Pump discharge valves adjacent to the buoyancy restraints. The SE questioned the adequacy of these connections as seismic boundaries to prevent the loss of Emergency Condenser Circulating Water (ECCW) in case of a loss of power during a seismic event. The SE immediately notified Oconee Engineering (OE) personnel who began evaluating the finding. It was determined that these were instrument taps and valves for an instrument which had been removed when the buoyancy restraints were installed.

On January 10, 1994, a Design Engineer and the SE measured the clearance between the valves and buoyancy restraints. The clearance varied from zero to a maximum of one and three quarter inches.

On January 20, 1994, OE (Civil) completed a seismic analysis on the affected portions of the CCW Systems for Units 1,2 and 3 to determine the potential movement of this piping during a seismic event. It was concluded from this analysis that movements could be more than the clearance between these valves and the CCW buoyancy restraints on five out of twelve instrument lines, with at least one affected line per unit. Therefore, it was assumed that a seismic event would cause damage to the instrument line, resulting in an opening equal to the inside diameter of the instrument pipe. As a result of this analysis, a modification was implemented which increased the clearance between the valves and the buoyancy restraints. The modifications were completed on February 11, 1994 for Units 1 and 2 and on February 18, 1994 for Unit 3.

An investigation into the event revealed that the buoyancy restraints were installed on July 18, 1991, October 14, 1992, and June 22, 1992 for Units 1, 2, and 3, respectively. A review of the Modification package used to install the restraints revealed that field personnel requested a change, which allowed a notch to be cut out in the restraints, due to interference with the CCW instrument valves. Apparently, the size of the notch was based on clearance under static conditions and did not consider clearances needed during a seismic event.

On February 17, 1994, OE (Mechanical) completed an operability evaluation of the ECCW system due to the potential seismic interaction between the instrument valves and the buoyancy restraints. This evaluation concluded that air in-leakage would be sufficient to cause a loss of the siphon effect. Actual affect on the system would be dependent on which CCW pumps were running during the postulated event. As a result, the ECCW system and the Low Pressure Service Water system were determined to be past inoperable during certain time frames between July 1991 and January 1994.

OE personnel involved in the seismic analysis completed on January 20, 1994, stated that they could not find any documentation of previous calculations for the lateral movements of the CCW Intake piping. They had specifically reviewed a Design Study (DS) (Loss of ECCW Suction Following a Seismic Event), completed in 1992 as a result of a Self Initiated Technical Audit (SITA). The objective of the DS was to perform the necessary analysis and propose the needed plant configuration changes and modifications to ensure that the siphon would be maintained following a seismic event.

CONCLUSIONS

The root cause of this event is a Design Deficiency, Unanticipated Interaction of Components, Design Oversight. During the design process of the Modification (installation of the buoyancy restraints) the lateral movement of the Condenser Circulating Water (CCW) Intake piping was not taken into account. Therefore, the potential for seismic interaction between the restraints and the valves was not discovered. If lateral movements of the CCW Intake piping had been calculated in the design process of the minor modification, this event may not have occurred.

The Design Study (DS) (Loss of Emergency CCW Suction Following a Seismic Event) failed to identify the seismic interaction because these instrument lines were not included in the DS. It was possible that the drawing was misinterpreted. The DS represented an opportunity to detect the current issue earlier; however, the DS would not have prevented the current problem.

A review of the past LERs, within the last two years, revealed three (LER 269/92-11, LER 269/92-16, and LER 269/93-04) events which involved design deficiencies from a failure to anticipate interaction of systems, design oversight. However, only one of these events involved the loss of Emergency CCW. LER 269/93-04 involved a potential single failure that could close all CCW Pump Discharge Valves on a single unit following a Loss of Coolant Accident/Loss of Offsite Power. This would result in the loss of Emergency CCW siphon flow. This problem is therefore considered to be recurring. However, the design for the modification resulting in this event occurred in 1991. These past events were identified in 1992 and 1993, therefore these corrective actions could not have prevented this event.

This event did not involve equipment failure and therefore was not NPRDS reportable. There were no radiological overexposures, radioactive releases or personnel injuries associated with this event.

CORRECTIVE ACTIONS

Immediate

None

Subsequent

1. A minor modification was implemented and completed for each unit, which increased the clearance between the buoyancy restraint and the instrument lines.

2. Operations added these valves to the appropriate procedures.

3. A system walkdown of all three Unit's Condenser Circulating Water Intake piping was performed to ensure that all attachments were shown on the drawings. No problems were noted during this walkdown.

Planned

1. Revise the flow diagrams and other appropriate design documents to include these valves.

2. 1994 reorganization will result in the combining of plant and design engineering into integrated work teams. Review of all engineering documents and associated training will be conducted and revised/implemented as appropriate.

3. Potential for this kind of incident will be considered in the review of the Minor Mod process and appropriate improvements to prevent recurrence will be made.

SAFETY ANALYSIS

The emergency function of the Condenser Circulating Water (CCW) system is to provide a source of water to the Low Pressure Service Water (LPSW) system, which, in turn, provides water for the Low Pressure Injection (LPI)(Decay Heat Removal) System, the Reactor Building Coolers (RB Ventilation), and various motor, oil, and auxiliary heat exchangers.

In the event of a Loss of Off-site Power (LOOP), the CCW pumps would be tripped either by undervoltage relays or by the Emergency Power Switching Logic "Load Shed" feature. In either case, the intent of the system design

is that the CCW pump discharge valves would remain open to provide a path for gravity/siphon flow, which would be adequate for all emergency functions.

However, the potential existed that a seismic event could result in an interaction between the buoyancy restraints attached to the Intake Structure and vent valves located on the CCW intake piping. This interaction was assumed to cause air in-leakage to the CCW piping and break the siphon. There are several applicable scenarios:

1. In scenarios where the LOOP does not affect all three Oconee units, isolation valves could be opened to cross connect the affected unit to the CCW system of one of the unaffected Oconee units.

2. LOOP on three units, without a Loss of Coolant Accident (LOCA).

   If the emergency power systems work as described in the Final Safety Analysis Report (FSAR), power is restored to the Main Feeder Busses within approximately 48 seconds. The seismic interaction could break the instrument line, allowing air inleakage which would eventually result in loss of siphon flow. Manual operator action would be required to repower one CCW pump to restore pumped flow. The applicable Emergency Procedure contains steps to perform this action within 1.5 hours. Without a LOCA, the Emergency Feedwater system would be removing decay heat rather than the LPI/LPSW systems. Therefore, this scenario should not have any significant effect on decay heat removal.

3. LOOP on three units, with a LOCA on one unit.
   NOTE: A LOCA with a concurrent seismic event is beyond the Oconee Design Basis. The probability of a LOCA/LOOP occurring is very low.

   If the emergency power systems work as described in the FSAR, power is restored to the Main Feeder Busses within approximately 48 seconds. The seismic interaction could break the instrument line, allowing air inleakage which would eventually result in loss of siphon flow. Manual operator action would be required to repower one CCW pump to restore pumped flow. The applicable Emergency Procedure contains steps to perform this action within 1.5 hours. If, for some reason, a CCW pump cannot be restarted on the unit without siphon flow, the operators could cross connect to a unit with siphon flow as described in scenario 1. Siphon CCW flow for one unit would be adequate to provide required flow and Net Positive Suction Head for the LPSW system on the affected unit.

LPSW does not provide any significant contribution to core cooling until the water inventory in the Borated Water Storage Tank is depleted and the LPI system is placed in recirculation mode to take suction from the Reactor Building emergency sump. This is typically several minutes into the LOCA scenario, and should occur after a CCW pump has been restored to service. Therefore, prompt operator action can prevent any significant effect on decay heat removal capability due to this scenario.

4. "Blackout" LOOP on three units, with LOCA on one unit.

NOTE: A station blackout concurrent with a LOCA is beyond the licensing basis for Oconee.

Due to the blackout, power would not be available for Engineered Safeguards systems such as LPI and significant core damage would occur. Loss of siphon flow would have no additional impact.

5. "Blackout" LOOP on three units, without LOCA (e.g. Appendix R event)

Depending upon the exact scenario, the Turbine Driven Emergency Feedwater Pump may be available for decay heat removal to maintain the unit at hot shutdown. Alternatively, the Standby Shutdown Facility (SSF) is a separate seismically qualified 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 Oconee Units. The SSF was designed to resolve 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 following a loss of normal AC power. The SSF takes its water supply from the Unit 2 CCW line, so that it would be affected by this design deficiency only if the seismic interaction occurred on Unit 2. A submersible pump is also available and can be employed within 3.5 hours through damage control procedures to add water to the Unit 2 CCW intake piping.

The potential for loss of a safety system due to this design deficiency is significant. However, a LOOP/Seismic event is not considered to be a highly probable event. No LOOP/Seismic events occurred during this period. Therefore, the inoperability of the Emergency CCW System did not adversely affect the health and safety of the public.