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SUBJECT: LER 89-016-01:on 800215,design oversight results in potential for unanalyzed breach of containment isolation. W/8 ltr.

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December 15, 1989

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

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 269/89-16, Supplement

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is a supplement to Licensee Event Report (LER) 269/89-16 concerning design oversight results in potential for unanalyzed breech of containment isolation during a simultaneous LOCA/seismic event. This supplement includes further information regarding safety analysis and corrective actions.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(vii)(c). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

M. S. Tuckman

M. S. Tuckman
Station Manager

/ftr

Attachment

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(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit 1	0 5 0 0 0 2 6 9	1 OF 0 8

TITLE (4) Design Oversight Results in Potential for Unanalyzed Breach of Containment Isolation During a Simultaneous LOCA/Seismic Event

EVENT DATE (5) MONTH	DAY	YEAR	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	REPORT DATE (7) MONTH	DAY	YEAR	OTHER FACILITIES INVOLVED (8) FACILITY NAMES	DOCKET NUMBER(S)
0 2	1 5	8 0	8 0	0 1 6	0 1	1 2	1 5	8 9	Oconee, Unit 2	0 5 0 0 0 2 7 0
									Oconee, Unit 3	0 5 0 0 0 2 8 7

OPERATING MODE (9): N

POWER LEVEL (10): 0 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check one or more of the following)* (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)	X 50.73(a)(2)(vii)	OTHER *(Specify in Abstract below and in Text, NRC Form 366A)*
20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
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 AREA CODE	
Henry R. Lowery, Chairman Oconee Safety Review Group	8 0 3	8 8 5 - 3 0 3 4

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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EXPECTED SUBMISSION DATE (15): MONTH DAY YEAR

ABSTRACT *(Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines)* (16)

ABSTRACT

On October 17, 1989 Design Engineering (DE) notified the station that during a simultaneous LOCA/seismic event an unanalyzed breech of containment could result in the discharge of containment atmosphere to the environment. The problem was identified as a result of discussions between station and DE personnel. The problem has existed since Nuclear Station Modification (NSM) 1261 installed non-seismic Reactor Building Auxiliary Coolers (RBACs) in all three containment buildings, between 1980 and 1982. The design of NSM 1261 was based on LPSW design pressure versus actual system operating pressure. Portions of the NSM were consequently not designed to seismic requirements. These portions are located inside containment and if they were to fail while Reactor Building (RB) pressure was at the maximum design pressure (59.0 psig) during an accident, RB pressure could force containment atmosphere into the ruptured LPSW piping, out to the environment. Immediate corrective action was to isolate the "B" Reactor Building Cooling Unit (RBCU) which placed each unit in a 7 day Limiting Condition of Operation (LCO). Subsequent corrective action was to install flat plates in flanged connections in the LPSW piping to isolate the non-seismic piping from the seismic portions of the system and all units exited the LCO on October 19, 1989. Root cause is Design Deficiency, Design oversight due to failure to recognize the potential interaction between high RB pressure during a LOCA/seismic event and the relatively lower LPSW pressure. Planned corrective action is to seismically qualify the RBACs and associated piping. The units have operated in all modes while this condition existed.

☆U.S.GPO:1984-0-454-481/18759

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

BACKGROUND

The Low Pressure Service Water (LPSW) system [EIIS:BI] provides cooling water to various safety and non-safety related systems and components. LPSW is supplied from and discharges to the Condenser Circulating Water (CCW) system [EIIS:BS] which takes a suction from and returns to Lake Keowee. There are three Reactor Building Cooling Units (RBCUs) [EIIS:BK] and four Reactor Building Auxiliary Coolers (RBACs) [EIIS:BK] per unit. LPSW supply and return headers for the RBCUs are located outside of containment. Each RBCU has its own branch supply and return LPSW lines which penetrate containment [EIIS:NA] and can be isolated from the RBCU by Engineered Safeguards (ES) [EIIS:JE] motor operated valves, however the normal and ES positions for these valves is OPEN. Radiation monitor (RIA) [EIIS:IL] 31 monitors effluent from each RBCU train. A diagram of a typical 'B' RBCU train and LPSW piping is provided as Attachment 1.

The RBCUs provide containment cooling during normal and accident conditions. During an accident the RBCUs, in conjunction with the Building Spray system [EIIS:BE], work to maintain Reactor Building pressure less than the maximum design pressure of 59.0 psig.

The branch supply line to the 'B' train RBCU has a tap-off line which supplies LPSW through ES valve LPSW-565 to the RBACs. Each RBAC has separate supply and return lines. LPSW from the RBACs enters a combined return and then passes through LPSW-567, the discharge isolation check valve, before tieing into the 'B' RBCU return line.

Nuclear Station Modification (NSM) 1261, which installed the RBACs and associated piping, was implemented due to problems with high Reactor Building (RB) temperatures which limited personnel stay times during outages. The design of NSM 1261 called for the addition of four separate RBACs per unit. The RBACs were not intended to fulfil any safety-related function, therefore only portions of the LPSW containment piping were designed to meet seismic qualifications. The remainder of the piping as well as the RBACs themselves were designed and constructed to non-QA, class G requirements.

EVENTS DESCRIPTION

Prior to 1980, Oconee Nuclear Station was experiencing problems with excessively high Reactor Building (RB) temperatures. The decision was made to add four Reactor Building Auxiliary Coolers (RBACs) to each unit. These coolers were to be for habitability improvement and had no safety-related function. As a result the design called for the RBACs and portions of the piping to be non-seismically qualified.

During the design of the Nuclear Station Modification (NSM) 1261, Design Engineering (DE) personnel failed to consider actual Low Pressure Service Water (LPSW) pressure and based the piping design on the system design pressure. Actual operating pressure was significantly lower than design pressure therefore assumptions made during the design that LPSW pressure would exceed postulated Reactor Building pressures during a simultaneous LOCA/seismic event were in error.

NSM 1261 design packages were prepared and reviewed by three separate individuals in DE. The 10CFR50.59 safety evaluations were also performed by the same individuals. Subsequent revisions to the NSM design and safety analyses did not reveal the errors in the assumptions.
After preparation, the design package was transmitted to the station for review and implementation.

Implementation of NSM 1261 was completed on; (Unit 1) February 15, 1980; (Unit 2) March 13, 1982; (Unit 3) August 9, 1982. The problem of the potential for an unanalyzed flowpath through containment has existed since installation of NSM 1261, for each unit.

On October 17, 1989, station Performance and DE personnel were discussing testing requirements for LPSW-567, a check valve in the LPSW return line from the RBACs. At the time of the discussions, LPSW-567 was not included in a containment leak rate testing program nor was it required to be periodically stroke tested. An active valve list which DE had transmitted to the station, and which included LPSW-567, had prompted the discussions. During the course of the discussions, DE personnel recognized the potential for an unanalyzed breech of containment which had resulted from installation of non-seismic piping in the RB and notified station management.

Immediate corrective action was to isolate LPSW from the RBACs. This was accomplished by closing LPSW-19 and 21, 'B' train RBCU supply and return isolation valves. Taking a train of the RBCUs out of service placed the units in a seven day Limiting Condition of Operation (LCO).

Removing the RBACs from service caused RB temperatures to increase. Temperatures exceeded the Final Safety Analysis Report assumptions of initial RB temperatures for containment analysis. DE provided operability evaluations which increased both the steady state and short duration RB temperature limits on all three units.

To allow the station to place the 'B' train RBCUs back in service and exit the LCO, a temporary modification (TM) was planned. The TMs, 660, 661, and 662, for units 1, 2, and 3, respectively, were to install flat plates (pancakes) in the pipe to expansion joint flanged connections in the RBAC return lines. The installation of the plates was to isolate the seismic QA condition 4 (QA-4), Duke class D piping from the non-seismic piping. In order to qualify the plate installation as QA-4, DE upgraded the existing pipe flanges, which mated to the expansion joint flanges in the RBAC return lines, to class D, seismic requirements. These pipe flanges had been installed during the implementation of NSM 1261 and were procured as class G, non-QA condition.

The installation of the temporary modifications was completed and the 'B' train RBCUs placed back in service on October 19, 1989. Placing the RBCUs in service allowed the units to exit their LCOs. Planned corrective action is to seismically qualify the RBACs and associated piping.

CONCLUSIONS

During the design of NSM 1261, assumptions made, with regard to relative Reactor Building (RB) and Low Pressure Service Water (LPSW) system pressures were in error. The root cause is Design Deficiency, Design oversight due to the failure to recognize the potential interaction between RB atmosphere and the LPSW system during a simultaneous LOCA/seismic event.

Oconee Nuclear units were constructed prior to the origination of Appendix J, containment leak rate testing program requirements. In order to comply with the intent of Appendix J requirements, Oconee Nuclear Station's safety analyses assume that seismically designed containment piping will not fail as a result of the effects (eg., missile damage and pipe 'whip') of a LOCA. The persons in Design Engineering (DE) who were responsible for the design and 10CFR50.59 safety analyses for NSM 1261 were not adequately knowledgeable of the containment requirements applicable to the NSM. The RBACs and associated new LPSW piping were additions to the existing LPSW containment piping and, as such, should have been designed to the same seismic requirements, or remote operated isolation valves should have been installed to allow isolation of the seismic and non-seismic portions of LPSW.

Two distinct Design Engineering groups now perform the design and safety evaluation functions previously performed by one group. As a result, incorrect assumptions made during the design process have an increased likelihood of being detected during the safety analysis process. In addition, planned corrective action, to help prevent similar errors, is to provide additional training in containment piping design requirements to responsible DE personnel.

This report involves no component failures and therefore is not NPRDS reportable. There were no radiation exposures, radioactive releases, or injuries associated with this event and the health and safety of the public was not affected. A review of previous incidents indicates this is not a recurring event.

CORRECTIVE ACTIONS

Immediate

1. Closed LPSW-19 and LPSW-21, Reactor Building Cooling Unit 'B', Low Pressure Service Water (LPSW) supply and return isolation valves.

Subsequent

1. Installed pancakes between the flanges at the outlet side of expansion joints in LPSW return lines from the Reactor Building Auxiliary Coolers (RBACs). This isolated the non-seismic LPSW piping.

2. Seismic upgrade was completed for Unit 3. All existing class G piping and welds have been evaluated to be acceptable for class D, seismic applications. A permanent station modification was completed which upgraded support restraints, replaced expansion joints with piping spool pieces, and strengthened the RBAC mounting. In addition, the RBACs and upgraded piping have been reclassified as ASME Section XI, class 2, and added to the Inservice Inspection Program.

Planned

1. Provide training to appropriate Design Engineering personnel in containment integrity considerations.

2. Unit 1 and 2 RBACs and associated LPSW piping will be upgraded to meet seismic qualifications through a combination of station modifications and DE calculations to qualify existing welds, components, and support restraints.

SAFETY ANALYSIS

During a simultaneous LOCA and seismic event, the potential existed for the intrusion of post-accident containment atmosphere into the Low Pressure Service Water (LPSW) system. This potential would have been realized only during a concurrent LOCA and a seismic event of sufficient strength to degrade the Reactor Building Auxiliary Coolers (RBACs) and/or associated piping. The reason for such a release would be that post-LOCA Reactor Building pressure could range anywhere up to 54.6 psig (worst case break with no Reactor Building cooling capability) which would be greater than the LPSW system pressures downstream of the RBACs. Because of the LPSW system's piping configuration and depending on the number of Condenser Circulating Water (CCW) pumps operating, the downstream pressure has been measured to be below atmospheric pressure. The difference between the containment atmosphere and the LPSW pressures at a postulated break would force containment atmosphere into the LPSW piping and then, subsequently, into the CCW system where it would be discharged to the environment.

If such a sequence of events had occurred, the only means of isolating the potential containment integrity breach would be operator action. The action required would have been the isolation of the "B" Reactor Building Cooling Unit (RBCU) which is accomplished by closing LPSW-19 and -21. Procedures direct the operators to take such action on the receipt of alarms actuated by radiation monitor RIA-31 or flow rate through the "B" RBCU and RBACs (the alarm is on differential flow increase or inlet flow decrease with the RBCU outlet full open).

The duration and magnitude of a release is difficult to postulate because of the many factors involved, such as the location and size of the LOCA, the exact type of damage to the RBAC's and piping, the time until the actuation of the radiation monitor or flow alarms, and the operator response time to the alarms (the most difficult factor to estimate in light of the fact that the operators are responding to a LOCA). If a break in the piping had occured, and with no operator action to isolate the leak, a reasonable estimate of the two-hour thryoid dose at the 1 mile exclusion boundary is approximately 25 rem, well less than the 300 rem limit given in 10CFR100.

Even though the RBAC's and associated piping are classified as non-seismic, qualitatively, it is judged that these components would have probably survived a seismic event without the postulated LPSW pipe break. This assessment is based on the following:

- These components are made of ductile materials, installed in a flexible configuration, such that they are inherently resistant to severe seismic damage.

- Seismic experience shows that piping and components of this type generally perform well during seismic events of the magnitude postulated for Oconee Nuclear Station.

Without sufficient damage to degrade containment integrity, the plant would mitigate any design basis accident without the threat of an open pathway from the containment atmosphere to the LPSW System. In addition to this point, it is recognized that the probability of a simultaneous LOCA and severe seismic event is extremely low. Such a scenario has never occurred; therefore, the health and safety of the public were not affected.

NRC Form 366A (9-83)

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

ATTACHMENT 1