UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 171 TO

FACILITY OPERATING LICENSE NO. NPF-6

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT NO.2

DOCKET NO. 50-368

1.0 INTRODUCTION

By application dated April 4, 1995, as supplemented by letter dated October 12, 1995, Entergy Operations, Inc. (the licensee) requested an amendment to the Arkansas Nuclear One, Unit 2 (ANO-2) operating license. The proposed amendment would revise the facility Technical Specifications (TSs) to increase the minimum allowable response time for initiation of containment cooling systems in the event of an accident involving a loss of offsite power. The proposed change is from "≤43.1 seconds" to "≤51 seconds." It is needed to reflect an upcoming plant modification intended to prevent the occurrence of the water hammer phenomenon in cooling water systems. Additional information and clarification was provided by the licensee in a letter dated October 12, 1995, and during a conference call that was conducted on October 18, 1995, in response to questions that were raised by the NRC staff. This additional information consisted of more detailed technical data which was not outside the scope of the notice and did not change the no significant hazards evaluation and publishied in the Federal Register.

2.0 DISCUSSION AND EVALUATION

2.1 CONTAINMENT COOLING SYSTEM

The safety function of the Containment Cooling System and the Containment Spray System is to rapidly reduce containment pressure and temperature resulting from a postulated loss of coolant accident or steamline break by removing heat from the containment atmosphere. The Containment Cooling System consists of two (redundant) piping loops each having two air coolers. Each loop is capable of providing 50% of the accident heat removal function. During normal plant operation, the Containment Cooling System performs its normal function of maintaining a cool containment temperature by circulating

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TABLE 3.3-5 (Continued)

ENGINEERED SAFETY FEATURES RESPONSE TIMES

INITIATING SIGNAL AND FUNCTION	RESPONSE TIME IN SECONDS
4. Containment Pressure --High-High	
a. Containment Spray	≤ 42.1*/27.1**
5. Steam Generator Pressure-Low	
a. Main Steam Isolation	≤ 3.9
b. Feedwater Isolation	≤ 36.4*/21.4**
6. Refueling Water Tank-Low	
a. Containment Sump Valve Open	≤ 145.0
7. Steam Generator Level-Low	
a. Emergency Feedwater - Train A	≤ 97.4
b. Emergency Feedwater - Train B	≤ 112.4*/97.4**
8. Steam Generator ΔP-High Coincident With Steam Generator Level-Low	
a. Emergency Feedwater - Train A	≤ 97.4
b. Emergency Feedwater - Train B	≤ 112.4*/97.4**

TABLE NOTATION

*Diesel generator starting and sequence loading delays included.

**Diesel generator starting delays not included, sequence loading delays included. Offsite power available.

***Diesel generator starting and sequence loading delays, and time delay for water hammer concerns included.

chilled water from the plant Chilled Water System through the air coolers. Under accident conditions, the Chilled Water System is assumed to be lost and service water is supplied to the service water coils of the fan coolers. The instrumentation also switches over certain dampers to realign the containment air flow to bypass equipment not classed as Seismic Category 1 and to provide increased air flow. The service water supplied to the fan coolers during accident conditions is supplied from Lake Dardanelle or from the Emergency Cooling Pond if Lake Dardanelle water supply is not available.

2.2 MODIFICATION TO PREVENT WATER HAMMER

ANO-2 has experienced water hammer events in its cooling water systems. Lake Dardanelle is located at a relatively low elevation with respect to piping and equipment. In the event of loss of power to the cooling water pumps, the piping at the higher elevations will void due to Toricelli's Law (i.e., atmospheric pressure can only support a column of water ≈33 feet high.) The higher elevation piping thus becomes filled with water vapor. Upon restoration of emergency power the service water pump discharge pressure is restored. This can cause an excessively rapid refill of the piping as the void collapses which results in a water hammer. To eliminate this water hammer problem and its potential damaging effects on equipment, the licensee will perform a modification that will limit the rate of system reflood when the pumps restart. The modification involves the provision of 1-inch diameter bypass lines containing solenoid valves to be installed around the service water inlet isolation valves, and the provision of timing sequence controls for the solenoid valves and isolation valves. These controls provide a slow refill of the voided piping thereby precluding water hammer. This results in an additional delay of initiation of the containment cooling safety function in the event of a LOCA or Steamline Break (SLB). The control logic only implements this additional delay if offsite power is lost, since, if offsite power is not lost, the water hammer problem does not arise.

The 1-inch diameter lines that were added to bypass the service water inlet valves penetrate containment and were designed to meet containment isolation criteria. Remote manual valves are incorporated into the bypass line design to serve as containment isolation valves. These valves have been added to the list of containment isolation valves that is maintained by the licensee.

2.4 SAFETY EFFECT OF ADDITIONAL DELAY PERIOD

The primary containment is designed for specific pressure and temperature conditions using ASME Code criteria. In addition, safety-related electrical equipment in containment is qualified for bounding accident pressure and temperature profiles. Containment cooling systems must be capable of ensuring that postulated accidents would not result in more severe conditions than those for which the containment is designed and equipment is qualified. Since a delay in initiation of containment cooling systems may result in more severe post-accident containment pressure and temperature conditions, the licensee performed analyses to verify that the additional delay resulting from the modifications would be acceptable.

For ANO-2, of the analyzed design basis events involving Loss of Offsite Power, that event which produces the greatest peak accident pressure, is a Double-Ended Reactor Coolant Pump Suction Line Slot Break (DESLSB). For the offsite power available events, the SLB is more limiting. However, when offsite power is lost, the SLB effects are greatly reduced due to the fact that the loss of power to the Reactor Coolant Pumps results in less primary coolant system heat energy being added to the break flow. The DESLSB is thus the limiting event of concern with respect to the additional time delay.

The licensee analyzed the effects on DESLSB post accident containment pressure and temperature due to the additional delay. The new DESLSB analysis predicts a peak accident pressure is 52.5 psig and a peak temperature is 286°F. The peak pressure is a "secondary" peak (a characteristic of cold-side breaks), occurring well after the "blowdown" peak has occurred and after spray has been initiated. The peak pressure and temperature values are less than those used in the design and qualification of the containment and equipment and are less severe than those associated with the more limiting (for offsite power available) SLB case.

In order to offset the slight increase in the containment cooler response time, containment conditions for the first 200 seconds following the DESLSB were assessed assuming that service water would be supplied to the containment fan coolers at a temperature of 105°F instead of the 120°F that was originally assumed. Since the emergency cooling pond (ECP) is not allowed to exceed 100°F per existing Technical Specification requirements, the licensee felt that the use of 105°F would be conservative. However, recognizing that there would be some delay before the stagnant (potentially hotter) service water in containment could be displaced by water drawn from the ECP, the NRC staff found that further justification was necessary. In a conference call on October 18, 1995, the licensee provided the following additional explanation to justify using service water at 105°F for the first 200 seconds following event initiation:

- Service water flow is initiated at 36.8 seconds into the event, and the service water valves are fully open at 51 seconds. However, since the service water isolation valves are butterfly valves, full service water flow is achieved at about 42 seconds into the event.

- Under full flow conditions, it takes about 30 seconds to fully flush the service water piping to the containment fan coolers. Therefore, the piping is fully flushed sometime between 67 seconds and 73 seconds into the event.

- The accident analysis credits the containment fan coolers for removing heat at 63 seconds into the event. While 10 seconds (at most) may still be needed at this point to fully flush the stagnant water from the service water lines, the cooling fans in the containment fan coolers start operating at about 43 seconds into the event and are actually removing heat from the containment atmosphere for 20 seconds before the start of cooling is assumed by the accident analysis. The licensee felt that this additional heat removal (beyond what is assumed by the accident analysis) would more than compensate for the 10 second delay.

2.5 STAFF ACCEPTANCE CRITERIA

With certain exceptions such as for isolation valves, there is no specific staff guidance or acceptance criteria for minimum values for ESF response times in terms of allowable seconds of delay. For containment cooling initiation, the staff criterion is that delay times be consistent with and accounted for in the analyses of design basis events. In the above case, the licensee has adequately justified the use of 105°F as the service water temperature in the analysis for the first 200 seconds following DESLSB initiation, and the licensee has demonstrated through analysis that changing the containment cooling response time from ≤43.1 seconds to ≤51 seconds will not result in containment conditions more severe than those for which the containment and its equipment are designed and/or qualified. The proposed TS changes are therefore acceptable.

3.0 TECHNICAL CONCLUSION

Based on its review of the information provided in the application, the staff has determined that the proposed amendment is acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Arkansas State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding (60 FR 37090). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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Date: October 26, 1995