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Subject: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Response to NRC Request for Additional Information Regarding ANO's November 3, 1999, Containment Uprate License Amendment Request

Gentlemen:

In a letter dated November 3, 1999 (2CAN119903), Entergy Operations, Inc. submitted a license amendment request for Arkansas Nuclear One, Unit 2 (ANO-2) regarding increasing the design pressure of the containment building from 54 to 59 psig. During a telephone conference call between members of the Nuclear Regulatory Commission (NRC) and ANO staffs on April 17, 2000, three follow-up questions posed by the NRC were discussed. ANO's responses to the three questions are provided in the attachment to this letter.

Should you have any questions or comments, please contact me.

Very truly yours,

Jimmy D. Vandergrift
Director, Nuclear Safety Assurance

JDV/dwb
Attachment

A001

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ANO Responses to NRC Staff Questions Regarding Uprating the ANO-2 Containment Building

NRC Question 1:

The licensee states that all ANO-2 equipment remains qualified for the new accident conditions; however, three equipment types possess less than the required margins suggested by IEEE 323-1974 (15°F temperature and 10% for pressure). Provide justification that the equipment remains EQ qualified even though it possesses less than the suggested margins.

ANO Response:

Using the limiting loss of coolant accident (LOCA) peak conditions of 57.6 psig and 285°F (see response to NRC question 2), only the peak pressure is not met when applying 10% margin. Environmental qualification (EQ) is maintained by type testing with analysis which is an accepted method. Three equipment types have peak pressure test conditions that envelope the required peak pressure conditions but not with the margins suggested by IEEE 323-1974 (10% for pressure).

1) Incore thermocouple cable/connector assembly

This equipment was tested to a peak pressure condition of 59 psig, which bounds the required peak pressure of 57.6 psig. When comparing the required pressure of 63.36 psig (57.6 psig plus 10% margin suggested by IEEE 323-1974), the suggested margin is not met. However, pressure qualification is justified by the fact that the test pressure of 59 psig was maintained for greater than 1200 seconds compared to ANO-2's required 57.6 psig peak transient for approximately 100 seconds (conservative). This provides adequate margin; especially, considering that the margin values are suggested guidance and not a strict requirement.

2) American Insulated Wire (AIW)

AIW tested pressure was to 60 psig, which bounds the required pressure of 57.6 psig but does not meet the suggested 10% pressure margin of 63.36 psig. However, this difference in pressure does not impact the cable qualification. The 60 psig is sufficient to have proven qualification to ANO's required pressure. Further, similar AIW cable has been tested to 86 psig and demonstrated full qualification. Pressure has no degrading mechanism on cable; therefore, not meeting the suggested margin poses no qualification concern for cable.

3) Amphenol electrical penetrations

The penetrations were pressure tested to 63 psig, which bounds the required pressure of 57.6 psig; however, they do not meet the 10% pressure margin of 63.36 psig. This equipment is being modified with new module seals during 2R14 as discussed in Enclosure 5 of ANO's letter dated November 3, 1999 (2CAN119903). The new module seals have been type tested to a peak pressure condition of 69.76 psig.

NRC Question 2:

The EQ profile uses 291°F as the worst-case temperature. However, some postulated accident scenarios result in a peak temperature of 294°F, although for a short time. Provide an explanation of why the equipment is considered to remain EQ qualified at the higher temperature.

ANO Response:

The containment design basis accident analyses have been revised to correct initial input assumptions, that by themselves, would have further increased peak pressures and temperatures. However, other input assumptions were also discovered that served to offset these changes. Additional containment heat sinks have been incorporated and the initial containment pressure has been reduced. As a result, the peak pressures reported in the license amendment request have decreased slightly. The calculated peak containment pressure has decreased from 57.7 to 57.6 psig. The input changes and the revised analysis results will be provided to the NRC in a revision to the November 3, 1999, license amendment request.

In the process of revising the analyses, the peak temperatures in the LOCA analyses were evaluated. The peak temperatures previously reported were the result of superheat conditions predicted by the COPATTA computer code for the brief period just before the start of containment spray. A significant contributing factor to the prediction of superheat is the very conservative treatment by COPATTA, of the condensed steam cooled by the containment heat sinks. As it has been configured in the ANO-2 analyses, all condensate was assumed to be instantaneously deposited in the sump. The relatively cool condensate was assumed to absorb no additional heat from the superheated steam in the containment atmosphere.

As described in Section 1.b of Appendix B to NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," December 1979, a maximum of 8% of the condensate formed on heat sinks may be assumed to remain in the vapor region (i.e., be revaporized) rather than be transferred directly to the sump, during periods of superheat conditions. The COPATTA code supports the use of this assumption. Consequently, the revised containment analyses for LOCA events have included an assumption of 8% revaporization.

With the added assumption of revaporization, the superheat conditions prior to the start of spray were reduced sufficiently such that the peak event temperature shifted to the saturation temperature at the time of the peak pressure. For the limiting LOCA analysis, the peak temperature during superheat conditions was about 282°F. The peak temperature at the time of peak pressure was 285°F. Similar superheat temperature reductions were predicted for each LOCA case analyzed; consequently, the peak temperature for the LOCA events is 285°F instead of the previously reported 291°F temperature. The 285°F value becomes the new peak temperature for equipment qualification.

Comparisons of analysis results with and without the revaporization assumption show that peak pressures are unaffected by the assumption. Peak pressure for the more limiting LOCA analyses occurs after spray has initiated and the containment atmosphere is effectively at saturated conditions. Since the revaporization assumption affects only limited portions of the analyses, and does not affect peak pressure results, the limiting analysis with the revaporization assumption will be used as the LOCA Containment DBA analysis and to establish the equipment qualification profiles.

NRC Question 3: How does the licensee justify post-LOCA pressures in the long term?

ANO Response:

Licensee EQ programs have established a maximum post-accident duration, for qualification purposes, ranging from 30 days to one year or longer. ANO's EQ program established a maximum post-accident duration of 30 days. At ANO, most equipment is conservatively qualified to the 30-day maximum duration. In most cases, equipment specific operating time has not been specified and the maximum is applied.

Much of ANO's EQ equipment is common to the nuclear industry (e.g., Rosemount transmitters, Raychem splice kits, ASCO solenoid valves, NAMCO limit switches, Limitorque motor operated valve actuators, etc.). These equipment types were tested to accident conditions, including temperature and pressure profiles. While some licensees have qualified their EQ equipment for 30 days or more, most EQ equipment has been accident tested for 30 days or less. Therefore, total envelopment of the licensees' required profiles by the tested conditions will not occur much of the time.

ANO's EQ program established a process to evaluate the equipment's tested condition against the plant-required conditions. ANO accident evaluations include a graphical presentation of the accident test temperature and pressure profile versus the accident required temperature and pressure profile for each type of EQ equipment located inside containment. With respect to pressure, the test and required profiles are visually compared. The fundamental concern during the accident period is the long-term effects of elevated temperature conditions. Since thermal degradation is basically an oxidation reaction, the chemical reaction would not be significantly affected by a slight pressure during the long-term accident period (i.e., the temperature profile equivalency evaluation is not affected by this slight, long-term pressure). The challenge to equipment from the accident pressure is maintaining the equipment's integrity (e.g., to prevent pressure from crushing the enclosure or seals/gaskets leaking, thus allowing the external environment into the enclosure). The ability of enclosures to tolerate differential pressures is most challenged during the initial high temperature, high pressure transient conditions. The long-term accident pressure is significantly lower than during the accident transients. Physical failures related to pressure classically do not occur during the long term, post-accident period. Adverse seal/gasket leakage effects, if any, would become evident during the higher-pressure transient period. Many equipment types are not functionally affected by the external environment entering the enclosure (e.g., Limitorque motor operated valve actuators) and as such are not required to be sealed against the pressure.

Therefore, total graphical envelopment by the test pressure profile over the required pressure profile for the entire duration is not a significant concern. The main concern is the highest pressure that the equipment will experience during an accident. Therefore, the testing is evaluated to ensure that the equipment is subjected to at least the required peak pressure conditions.