SAFETY EVALUATION REPORT BY THE
OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 4
TO FACILITY OPERATING LICENSE DPR-77
TENNESSEE VALLEY AUTHORITY

In a letter dated December 31, 1980, TVA (the licensee) proposed a change in the Sequoyah Technical Specifications concerning minimum allowable ice condenser ice weight. The following is our evaluation of the proposed change.

In Section 6.2.1 of the Sequoyah Safety Evaluation Report (SER), under the heading "Containment Long-Term Pressure Response," we described the long-term response of the Sequoyah primary containment to a postulated LOCA. The controlling reactor coolant system pipe break accident (design basis LOCA) was identified as the double-ended rupture of the reactor coolant system pump suction cold leg. The peak calculated containment pressure for this accident was reported to be 11.8 pounds per square inch gauge, which is less than the containment design pressure of 12.0 pounds per square inch gauge. Section 6.2.1 of the SER also described the other aspects of the long-term LOCA analysis and our review of it, and we concluded that the analysis was acceptable.

In its letter of December 31, 1980, the licensee submitted a revised long-term containment analysis for the design basis LOCA in support of the proposed reduction in the Technical Specification limit for the minimum allowable ice condenser ice weight. The significant changes in the revised analysis, when compared with the original analysis, include: 1) the initial ice inventory is reduced; and 2) changes were made in the mass and energy release model and the containment heat sink model. The mass and energy calculations used in the original analysis were those described in Westinghouse topical reports WCAP-8312-A (non-proprietary version) and WCAP-8264-P-A (proprietary version), "Westinghouse Mass and Energy Release Date for Containment Design." As we stated in the Sequoyah SER, we have

reviewed these topical reports and have found them acceptable for use in licensing applications. The mass and energy model used in the revised containment analysis also relied on the methods of WCAP-8312-A and WCAP-8264-P-A, except that the decay heat calculations rely on a model based on the most recent version of ANS Standard ANS-5.1; and subcooling of Emergency Core Cooling water from the heat exchangers of the Residual Heat Removal system is assumed. The staff has reviewed this decay heat model and concludes that it provides conservatively high values of decay heat and is thus conservative and acceptable for this application. We also find the assumption of subcooling of the Emergency Core Cooling water coming from the Residual Heat Removal heat exchangers, although less conservative than the original assumption of no subcooling, to be an acceptable change. We, therefore, find that the mass and energy calculations used in the revised analysis are acceptable. This is consistent with the revised analysis accepted by the staff for the McGuire plant concerning a similar reduction in ice weight.

The licensee has also changed the containment heat sink model by using higher heat transfer coefficients for heat transfer from the containment atmosphere to the passive structures and components (heat sinks) in the upper containment compartment. However, the heat transfer coefficients used are lower (i.e., more conservative) than those recommended in the staff's Standard Review Plan. Therefore, the containment heat sink model, as revised, is acceptable.

There are two major conservatisms that remain in the revised containment analysis. The first is the assumption of a flow split of one; that is, all the decay heat is assumed to produce steam, which is released to the containment, instead of assuming that some of the decay heat was merely producing hot water. The effect of

this conservatism, compared to a realistic case, is to approximately double the rate of steam release to the containment in the latter part of the transient. The second conservative assumption consists of ignoring the effect of the passive heat sinks in the dead-ended compartments of the containment. A third, more minor conservatism is that, because of the new decay heat model, the Residual Heat Removal spray system could be turned on sooner than it is in the revised analysis. The effect of removing these conservatisms from the containment analysis would be to lower the peak containment pressure even more than has been done in the revised LOCA analysis described above.

As discussed in the Sequoyah SER, the original analysis determined that the containment peak presure of 11.8 pounds per square inch gauge would occur at about two hours after onset of the accident. The revised analysis shows that the containment peak pressure of 10.5 pounds per square inch gauge occurs at about 60 minutes after onset of the accident. The calculated peak containment pressure of 10.5 pounds per square inch gauge is less than the containment design pressure of 12.0 pounds per square inch gauge and a reduction of 1.3 pounds per square inch gauge below the peak pressure calculated in the original analysis; therefore, we find the applicant's revised long term containment response analysis for a LOCA to be acceptable.

The revised analysis is based on 2.10×10^6 pounds of ice initially in the ice condenser, instead of 2.45×10^6 pounds which was assumed in the original analysis. Therefore, we conclude that the lower ice weight may be used as the basis for the Technical Specification limit for the minimum allowable ice condenser ice weight.

We have reviewed and discussed with TVA and Westinghouse the impact of a reduced ice weight on the effectiveness of the interim distributed ignition system for hydrogen control. Specifically, we considered the results of TVA's CLASIX analysis of the containment pressure and temperature response to hydrogen burning in the containment atmosphere under postulated degraded core accident conditions. We have concluded that the CLASIX analysis will not be materially affected by the proposed reduction in ice weight.

In Supplement 4 to the Sequoyah SER, we reported that the TVA base case analysis, using very conservative ice melt assumptions, resulted in an ice mass of approximately 300,000 pounds remaining in the ice condenser after the last hydrogen burn. TVA has submitted a more realistic analysis which results in approximately 800,000 pounds of ice remaining in the ice condenser after the last hydrogen burn. After reducing the ice weight by 400,000 pounds (per the proposed change to the Technical Specifications), approximately 400,000 pounds of ice are calculated to remain in the ice bed. An alternate CLASIX analysis, in which the initial ice mass was arbitrarily reduced by 1,170,000 pounds, resulted in a calculated peak containment pressure of about 26 psig, which was still substantially below the pressure capacity of the containment of 36 psig (lower bound estimate). As long as the ice bed remains as an effective heat sink there would be no significant change in the expected containment atmosphere temperature response and containment pressure response of the Sequoyah containment. Therefore, it does not alter our conclusions regarding the efficacy of the Interim Distributed Ignition System to ensure containment integrity and equipment survivability under degraded core accident conditions.

Since this licensee-requested change to the Technical Specifications for ice mass is a result of substantial losses in ice mass due to sublimation and since the revised containment LOCA analysis is now based on less ice mass, when compared to the original analysis, we require and TVA has furnished a commitment to provide the following information by June 30, 1981:

a. A description of the TVA program for maintaining the ice mass as high as reasonably achievable;

b. A projection of ice mass as a function of time;

c. A simplified heat balance to illustrate margin, including calculation for hydrogen; and

d. A feasibility study on alternatives to minimize the rate of ice loss so that the available (plant-life averaged) heat sink associated with ice inventory can be maximized.

Accordingly, since a) the mass and energy release calculations and the containment heat sink model are the only aspects of the revised analysis which differ from the original analysis (other than the change in ice weight which has been accounted for); b) the revised analysis is a conservative analysis containing substantial margins; c) the reduced ice mass does not alter our prior conclusions regarding the efficacy of the Interim Distributed Ignition System to ensure containment integrity and equipment survivability under degraded core accident conditions; and d) we will continue our review of this matter upon receipt of the additional information that the licensee commits to furnish, we conclude that the revised LOCA analysis is acceptable, and that the Technical Specification for ice mass may be changed to require a minimum of 2,333,100 pounds of ice (total), i.e., 1200 pounds per basket, in the ice condenser.

Environmental Consideration

We have determined that this action does not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that this action is insignificant from the standpoint of environmental impact and, pursuant to 10 CFR 51.5(d)(4), that an environmental impact statement or negative declaration and environmental impact appraissal need not be prepared.

Conclusion

We have conluded, based on the consideration discussed above, that: (1) because the action does not involve a significant increase in the probability or consequences of accidents previously considered and does not involve a significant decrease in a safety margin, the action does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commissioner's regulations and will not be inimical to the common defense and security or to the health and safety of the public.

Dated:

MAR 6 1981