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Mr. Edson G. Case
Assistant Director
Division of Reactor Licensing
U. S. Atomic Energy Commission
Washington, D.C. 20545

Re: Contract No. AT(49-5)-2667, Dockets No. 50-269 and No. 50-270
Oconee Nuclear Station Units 1 and 2
Duke Power Company

Dear Mr. Case:

The following questions are based on the review by Dr. W. J. Hall and myself of the material presented in the Preliminary Safety Analysis Report, Volumes I and II, for the Oconee Nuclear Station Units 1 and 2, submitted by the Duke Power Company.

The facility consists of two reactor units of 839 MWe net output each. The nuclear steam supply system consists of pressurized water reactor units similar to systems now operating. The reactor containment building is a fully continuous reinforced concrete structure in the shape of a cylinder with a shallow domed roof and a flat foundation slab. The cylindrical portion is prestressed by a post-tensioning system consisting of horizontal and vertical tendons. The dome has a three-way post-tensioning system. The foundation slab is conventionally reinforced with high-strength reinforcing steel. The entire structure is lined with 1/4 in. welded steel plate to provide vapor tightness.

Our questions follow.

1. The report indicates that the maximum vertical and horizontal ground acceleration to be expected at the site is on the order of 5 percent of gravity. No mention is made of a maximum earthquake criterion for design for safe shutdown. On page 2-9 it is noted that the structure will be founded on gneiss rock. The earthquake levels for both design earthquake and maximum earthquake require clarification, and we await the evaluation of these items by the U.S. Coast & Geodetic Survey.

2. The recommended response spectra are shown in Plate II-4 of Appendix 2B. The basis for the shapes of the recommended ground motion spectra and the recommended response spectra is not explained therein, and needs clarification. Also, the plots are not compatible in terms of scaling with respect to displacement, velocity, acceleration, and frequency. It appears that the velocity and frequency have been scaled without consideration of the scaling of the displacement and acceleration.

3. The discussion on page 2-? of the proposed Keowee and Jocassee dams briefly describes the design procedure to be employed, including the effects of seismic loadings. Further elaboration on these procedures is desirable, especially when consideration is taken of the maximum as well as the design earthquake loadings that are finally selected. It is not clear from the discussion presented whether the failure of one or both of these dams would seriously jeopardize the safety of the plant as constructed, and the ability for safe shutdown.

4. On page 5-3 note is made of the wind loadings to be employed in the design, including a 225 mph tornado. The wind velocity associated with this tornado is less than those used previously in similar designs, and justification for using this lower value is desired.

5. With regard to seismic design considerations, the discussion on page 5-5 indicates that "structural design principles will be followed in the design for seismic loads, including a dynamic analysis where indicated by the characteristics of portions of the structure." The meaning of this statement is not particularly clear, and a description of the procedures to be followed in making the dynamic analysis is desired.

6. We find no discussion therein as to the damping values to be employed in the dynamic analysis.

7. With regard to the piping, on page 5-6 a general discussion of piping design is given. No comments are made there concerning the design of the piping for the seismic loadings. Amplification of the procedures to be incorporated for handling the design in the case of seismic loadings combined with other applicable loadings is desired. It would be particularly instructive to learn more of the procedures to be followed in providing for anchorage of the piping systems so that the containment function of the structure will not be impaired.

8. With regard to the large penetrations, for example the equipment access opening, the procedure outlined for handling the design seems appropriate. However, on page 5-7 under item 5.1.2.6.2g, discussion is given of the strength of the reinforcement that is provided to replace the strength removed by the opening. The discussion concerns the concept of maintaining the compatibility between the general vessel shell and the area around the opening. In connection with evaluation of the compatibility of deformations, and from a review of the instrumentation plan in Fig. 5-7, it would be helpful to have further elaboration on the instrumentation around the opening and some discussion of the measurements to be taken, and the possible interpretation of these measurements. It is noted that a number of two-element strain gages are to be used in the instrumentation. Such gages reveal significant measurements generally only when the principal directions of strain are known. It is not clear how these directions would be known in all cases to enable these gages to be used with any degree of confidence.

9. On page 5A-3 the statement is made: "The horizontal and vertical components of ground motion are applied simultaneously unless a calculation of acceleration response is made for the two components and

it proves they are not additive in time." It would be instructive to know of any situation where such a calculation could be made with confidence, and it is suggested that in all cases the components be considered as occurring in such a way that the stresses are directly additive.

10. On page 5C-3 under Section 3.4c, reference is made to the increase in allowable shear stress to $1.5\sqrt{f'_c}$ and further reference to the fact that the membrane principal tension will be controlled by limiting the allowable shear to this value. Further discussion of this point seems necessary, for the shear values cited as coming from ACI Code Chapter 12 refer to shear values as a measure of diagonal tension performance in concrete beams. The same situation does not necessarily hold in this shell structure, and in fact calculation of the principal tensions would involve tensions and shears of appropriate magnitude and direction, which in turn can be combined to calculate the principal tension and orientation of such principal tension. Thus the statement concerning the control of shear in this case does not seem to be compatible with the concept of handling the principal tension in the design.

11. On page 5C-4 discussion is given of the procedure to be followed at yield loads. It is noted that membrane tension of as much as $3\sqrt{f'_c}$ and combined flexural tension (membrane plus flexural) of $6\sqrt{f'_c}$ are to be allowed in checking the yield strength of the structure. It would seem desirable to limit net membrane tension of the section to a very small value, and in any event to not more than $3\sqrt{f'_c}$ except possibly in the case where self-limiting thermal effects are involved.

Of equal importance here is the design procedure to be followed in the case of the maximum earthquake loading, which is not delineated in the report, and for which some evaluation of loading resistance and deformation need be given.

Respectfully submitted,

N. M. Newmark

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cc: Dr. W. J. Hall