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November 7, 1977

Mr. Edson G. Case, Acting Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. A. Schwencer, Chief
Operating Reactor Branch #1

Reference: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287

Dear Sir:

Your letter dated September 13, 1977 requested additional information concerning the details of the seismic design of the overhead emergency power path through the 230 KV switchyard at the Oconee Nuclear Station. The attached is provided in response to your request. Please note that responses to questions 12 and 13 will be provided by December 15, 1977.

Very truly yours,

William O. Parker, Jr.

MST:ge

Attachment

OCONEE NUCLEAR STATION

Seismic Capability of the Emergency Power Path
Request for Additional Information

Question 9

In your response to R1b it is indicated that passive earth pressure has been relied upon to resist sliding and overturning effects. For shallow foundation embedment in backfill material, it is unconservative to rely upon the passive earth resistance. For those cases of deep embedment, factors of safety against sliding should be calculated in such a way that slip circle failure due to shear stress is prevented. One of the acceptable methods of calculating the factor of safety against overturning is given in BC-TOP-4A. It should be noted that the original intent of this request was to determine to what extent the effect of the foundation interaction with the surrounding soil modifies the freefield seismic motion. Provide a discussion indicating in each case how soil-structure interaction was accounted for. Also provide a statement indicating that the factors of safety against sliding and overturning for each foundation meet the acceptance criteria stated in Section 3.8.5.II.5 of the Standard Review Plan.

Response

The response to previous Question Q1b references Table I, Notes A and B. Refer to attached revised Notes A and B for more details on how foundations were analyzed.

Additionally, refer to FSAR Supplement 12, July 26, 1972, response to Question 1, which states that soil structure interaction is insignificant.

All bases (except the 230kV power circuit breaker base) meet the acceptance criteria of Standard Review Plan 3.8.5.II.5a, b, and c. Final evaluation of the PCB base is pending the results of dynamic testing of the breaker. For additional information regarding PCB testing, refer to response to Question Q17.

Question 10

In your response to R1e indicate that the effects of one horizontal and one vertical earthquake components are combined on the basis of the absolute sum method.

Response

The response to previous Question Q1e references Table I, Note E. Refer to attached revised Note E.

Question 11

In your response to R1f, the reference to 5A.3 of the Appendix 5A to the FSAR is not satisfactory. Indicate your intent to qualify each foundations to meet the load combinations and acceptance criteria per Section 5A.2.2 of the Appendix 5A to the FSAR.

Response

The structures listed in Table I of the response to previous Question Q1 are by definition Class II structures (reference FSAR Appendix 5A.1.2). Therefore, the reference to FSAR Appendix 5A.3 is correct. The structures including foundations listed in Table I have been checked for the following load combinations:

a) Dead load plus live load plus wind load (95 mph wind) using 1.33 times the allowable stresses per AISC Specifications as the acceptance criteria.

b) Dead load plus live load plus maximum hypothetical earthquake load (0.15g ground motion acceleration with 2% damping) using 0.9 F_y or 1.5 times the allowable stresses per AISC Specifications as the acceptance criteria.

The bases were designed for the most severe reactions resulting from the above loading conditions using stresses per ACI 318 as the acceptance criteria.

Question 14

In your response to R3a it is stated that seismic loads were generated as prescribed on page 5A-3 of the FSAR. The referenced page simply provides the ground response spectra. However, in order to obtain the seismic loading of the Relay House a dynamic analysis of its mathematical model should be performed. Therefore, provide the specific information requested in R3a and provide a stress summary of the critical sections.

Response

Refer to the attached revised response to previous Question Q3a.

Question 15

In your response to R3b it is stated that a seismic force of 0.36g has been assumed to be applied to equipment supported on the foundation and the structural steel framed building. Floor response spectra for points of attachment provide the maximum responses for a range of natural frequencies. When the equipment has more than one degree of freedom, the effective acceleration is usually greater than the response from the predominant mode. Demonstrate the conservatism of the 0.36g static coefficient through a comparison of response obtained from a dynamic analysis of the multimode equipment subjected to floor response spectra.

Response

The response to previous Question Q3b defined the seismic forces acting on the Relay House foundation. The response to previous Question Q7 defined the methods employed in the dynamic analysis of the Relay House electrical equipment. Refer to the response to previous Question Q7, Note BB.

Question 16

In your response to R4, note that the Section 5A.2 of the FSAR simply states that where the analysis is difficult the highest acceleration from the response spectrum curve is to be used. For 2% damping this value is approximately 0.36g. Provide justifications for ignoring contributions from higher modes (see your own discussion in Note CC in response to R7).

Response

The justification for using the static type analysis is based on the rigidity of the transformer foundation and the major components of the transformer. The natural frequency of a typical transformer foundation in the overhead emergency power path is approximately 27 hertz. The natural frequencies for major components of transformers similar to those in the overhead emergency power path are greater than 30 hertz. Therefore, the transformer will act along with its foundation.

Question 17

In your response to R6 it should be noted that the power circuit breakers must be verified by at least prototype testing for demonstration of operability in the seismic environment.

Response

A 230kV power circuit breaker will be seismically tested to verify its operability during and following a seismic event. The NRC Staff will be advised of the test results.

Question 18

Periodic inspection and testing of electrical power systems are required by the General Design Criterion number 18 of the Appendix A to 10 CFR Part 50 and by the Regulatory Guide 1.118 entitled "Periodic Testing of Electrical Power and Protection Systems". Provide the details of a program of inservice inspection and testing that would be incorporated in your technical specifications.

Response

The response to original question 8 outlined those surveillance items which are performed on the Oconee overhead emergency power path. These inspections are considered to be typical of those routinely performed on the Duke system and are relatively detailed in nature. It is not considered that Technical Specifications are necessary for the performance of these items.

REVISED NOTES AND RESPONSES

Note A: Bases were checked for a general bearing capacity failure based on the theory proposed by J B Hansen and as presented in "Foundation Analysis and Design" by Joseph E Bowles, McGraw-Hill, 1968.

Note B: Bases were designed by rigid pole theory as described in "A Review of Soil-Pole Behavior," by M T Davisson and S Prakash, Proceedings of the Highway Research Board, Record 39, Section III, pages 25-48, 1969. The pole is held in place by passive pressure and shear resistance. The analysis takes into account the prevention of slip circle type failure.

Note E: A three dimensional earthquake was not used. Seismic forces were applied simultaneously in one horizontal direction and one vertical direction as described in Supplement #1 to PSAR, Question 8.4.2. The effects of one horizontaland one vertical earthquake components are combined on the basis of the absolute sum method.

3a: Describe the dynamic model of the 230kV Switchyard Relay House:

The structural steel superstructure for the Relay House is a rectangular structure consisting of a roof system supported by columns forming a rigid frame in the direction of its least dimension and is braced with diagonal bracing in the other direction. The steel structure is erected on a slab on grade.

The original calculations addressed normal live and dead loads and a wind loading based on a 95 mph wind. Seismic loading was not considered.

Calculations were performed in August, 1976, which verified that the structure is adequate for seismic loading. A modal analysis was not performed on the Relay House. The seismic analysis was based on the following:

The Relay House is assumed to be a single degree of freedom system consisting of a single story steel frame, wherein the roof is considered to be the predominent mass. For a single degree of freedom system it is conservative to use the peak of the appropriate response curve and apply this acceleration to the mass and check the structure for the resulting forces. The response spectra curve for ground motion of 0.15g with 2% damping was used to generate the seismic loads. This curve was used because the Relay House foundation is a slab on grade and is assumed to act the same as the ground during a seismic event. The resulting peak of the appropriate response curve is 0.36g. All calculated stresses are below the allowables specified in FSAR Section 5.7.