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COMMENTARY

ON

FINAL SAFETY ANALYSIS REPORT

FOR

THREE MILE ISLAND NUCLEAR STATION -- UNIT 1

METROPOLITAN-EDISON COMPANY AND JERSEY CENTRAL POWER AND LIGHT COMPANY

AEC Docket No. 50-289

by

W. J. Hall and N. M. Newmark

1. Seismic Design Criteria

Earthquake Hazard --

The seismic design for the plant was carried out for a Design Basis Earthquake characterized by 0.12g maximum horizontal ground acceleration to the extent of insuring containment and safe shutdown; also, the design was made for an Operating Basis Earthquake characterized by a maximum horizontal ground acceleration of 0.06g. As noted in our report on the PSAR (Ref. 4), we concur in these design levels for use in the seismic design of this plant.

Buried Piping --

The description of the approach followed by the applicant for buried piping is given on pages 5-76a and 5-76b. Further information will be included in Amendment 20 wherein it will be indicated that a typical detail for the egress or ingress of a pipe into a building is through a spool piece and retainer ring

embedded in concrete. So far as relative motions are concerned, the applicant advises that these are calculated and the stresses in all piping where relative motions may be a problem are kept at 8000 psi or less. Subgrade reactions are considered in arriving at the evaluation of relative motions and piping forces. Also, the length of the pipe run versus possible seismic ground wave length is considered, but in the Three-Mile Island plant the applicant advises that there are no "long" pipe runs. For example, between the make-up water plant and the pumphouse, the piping follows an irregular path that provides considerable flexibility and ductility. On the basis of the information we have been supplied, we believe this design can be considered satisfactory for the seismic risk involved.

Reactor Internals --

The analysis used in the design of the reactor internals, as described on page 3-46 of the FSAR, is that given in Babcock and Wilcox topical report BAW-10008, Part I, Revision 1 (Ref. 3). The approach followed therein for the analysis of the reactor internals is acceptable to us. It was made for higher levels of base ground acceleration than those for the current plant design. The second topical report, BAW 10008, Part II, Revision 1 refers to the fuel assemblies stress deflection analyses for loss of coolant accident and seismic excitation (Ref. 3(b)) and in this case the analysis was made for values of earthquake excitation that were lower than those indicated as the design criteria for the plant. We understand that the applicant has reported in Aprendix 4C that a review of the fuel assembly stress deflection analysis has been made for the appropriate seismic level. Subject to a review of this Appendix when it becomes available to us, we believe the procedures are adequate.

Building Analysis --

The seismic design approach adopted for the buildings is summarized on pages 5-18 and thereafter in the FSAR. It is indicated that the vertical and

horizontal seismic components at any point in the shell were added by summing the absolute values of the response (that is, stress, shear, moment, or deflections) of each contributing mode due to the vertical motion to the corresponding absolute values of the response of each contributing mode to the horizontal motion. We believe the approach is satisfactory. In general, the approach adopted for the seismic analysis of the shell follows classical methods and the materials presented in the FSAR appear to be acceptable.

Design Stresses --

The applicant states in Section 5.2.3 that the design of the prestressed reactor building was made so as to have a low strain elastic response for all design loads. The stresses presented in Table 5-3 for various load combinations appear acceptable. The stresses for loading conditions 31 and 32, which are for the Design Basis Earthquake, do not control the design, according to information to be presented in Amendment 20. The stresses indicated appear reasonable.

Responses Resulting from Vertical Motions --

The statements in the FSAR indicate that appropriate amplification was taken into account in the design of the structures and piping. The applicant advises that Amendment 20 will document the fact that the piping mounted on walls of main supporting elements to the structure, or on floors close to such walls, was designed for vertical amplification corresponding to the input motions. This approach is satisfactory. He further advises that when the piping support is on a floor, if upon examination of the support, which includes the floor and the pipe support system, the frequency is less than Hertz, a dynamic analysis will be carried out to reflect the amplification arising from the support; if the frequency is greater than 30 Hertz, the support arrangement is considered as rigid. This approach is satisfactory.

Further explanation will be presented in Amendment 20 concerning the design of equipment. The applicant indicates that for equipment without a significant mass, the equipment is modeled with the piping when the piping is analyzed. For equipment with a significant mass, the analysis is made with a pseudo floor response spectrum applicable to the piping system at the nozzle point of the equipment. In this way, feedback between the mounted equipment and the piping is taken into account. The applicant also advises that if the equipment is flexibly supported, this fact is taken into account in arriving at the forces on the equipment as well as the input forces into the piping, and in the feedback analysis. On the basis of the information we have been supplied orally, this approach appears satisfactory.

Piping Analyses --

The general description of the method of dynamic analysis followed for piping systems is given on pages 5-76a and 5-76b. Further amplification is given in the topical report by Gilbert and Associates (Ref. 2), which indicates that the method of Biggs and Roesset was employed for the analyses. The floor response spectra that were used in the piping analyses will be presented in Amendment 20, and from our preliminary examination of them they appear to be adequate. It would be desirable to examine typical stress values at critical points in certain of the major piping systems for both the DBE and OBE loading combinations, with comparisons with allowable stress values for these conditions.

2. Class I Items of Equipment in Class II Structures

The applicant advises that there are no Class I equipment items located within Class II structures.

3. Critical Items of Control and Instrumentation

The applicant indicates on page 7-2a that the adequacy of critical controls and instrumentation will be documented in report BAW 10003, "Qualification

Testing of Protection System Instrumentation". This report is not yet available.

4. Aircraft Impact Design

The applicant addresses this question in Appendix 5a. The revised loadings used to determine stresses and deflections in this Appendix, in Amendment 19, appear reasonably conservative for Cases A and B (which correspond to impact of isolated objects such as engine pods) and Case D (which corresponds to impact radially or normally of a 200,000 lb. aircraft) all at 200 knots velocity. The heavier aircraft impact of Case C was not considered as a design basis, and was not reviewed by us.

The stresses and deflections were computed by methods which are appropriately conservative, both for the reactor building and for the flat roof and wall surfaces of other buildings designed to resist aircraft impact. In our opinion, based on our examination of the applicant's presentation and supplemented by considerations of response into the inelastic range, we believe that the stresses and deflections resulting from aircraft impact of aircraft weighing less than 200,000 lb. gross, impacting at velocities of less than 200 knots, will not cause impairment of the safe shutdown capability of the facility.

REFERENCES

1. "Final Safety Analysis Report -- Vol. I through IV, including Amendments 14, 17 and 19", Metropolitan-Edison Company and Jersey Central Power and Light Company, AEC Docket No. 50-289, 1970 and 1971.

2. "Dynamic Analyses of Vital Piping Systems Subjected to Seismic Motion", Gilbert and Associates, Inc., Topical Report No. 1729, May 20, 1970.

3. (a) "Reactor Internal Stress and Deflection due to Loss-of-Coolant Accident and Maximum Hypothetical Earthquake", Babcock and Wilcox Report BAW-10008, Part I, Revision 1, June 1970.

   (b) "Fuel Assembly Stress and Deflection Analysis for Loss-of-Coolant Accident in Seismic Excitation", Babcock and Wilcox Report BAW-10008, Part II, Revision 1, June 1970 (Proprietary).

4. "Adequacy of the Structural Criteria for Three-Mile Island Nuclear Station Unit 1", Metropolitan-Edison Company (AEC Docket 50-289), Report to AEC Regulatory Staff by N. M. Newmark and W. J. Hall, December 1967.