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. NATHAN M. NEWMARK
CONSULTING ENGINEERING SERVICES

1114 CIVIL ENGINEERING BUILDING
URBANA, ILLINOIS 61801

13 July 1967

Dr. Peter A. Morris, Director
Division of Reactor Licensing
U. S. Atomic Energy Commission
Washington, D.C. 20545

Re: Three Mile Island Nuclear Station Unit 1
Metropolitan Edison Company
Docket No. 50-289

Dear Dr. Morris:

Dr. W. J. Hall and I have reviewed the Preliminary Safety Analysis Report (Volumes 1, 2 and 3) for the Three Mile Island Nuclear Station Unit 1, and our comments and questions follow.

The Three Mile Island Unit 1 is to be a pressurized water reactor, fabricated by the Babcock and Wilcox Company, of 2551 MWt capacity and 871 MWe capacity. The containment structure is to be a prestressed post-tensioned building similar to Turkey Point, Palisades, Point Beach, and Oconee. The structure is to be about 130 ft. inside diameter, 187 ft. high, with cylindrical wall thickness of 3 1/2 ft. and dome thickness of about 3 ft. The base slab is to be about 9 ft. in thickness. We note that in this particular plant the steam generators are partially shielded from the containment structure by concrete walls in contrast to some of the other plants of this type.

Our questions and comments follow.

1. The figures in Sections 1 and 5 indicate that the reactor building floor is to be at about elevation 281 ft. The site summary on page 2-1 indicates that the containment structure foundation rests on normal sedimentary rock, namely the Gettysburg shale located at the site. A review of the geology summary beginning on page 2-14 and that presented in Appendices 2A and 2D leave some question as to exactly where the structure will be founded, for it is difficult to locate the structure from the information provided therein on the cross sections shown. It would be helpful to have a clear delineation of the location of the plant on one of the plans in order that a better evaluation of the local site geology can be made.

With regard to faulting, there is no indication that there are faults in the immediate zone. However, the plots in Appendix 2D suggest that some faulting may be in existence, and we await evaluation by the Geological Survey on this point.

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2. The seismicity and response spectra are briefly summarized in Appendix 2A and in the main body of the report on page 2-14 and page 5-4. The first part of Appendix 2A indicates a value of 0.04g, whereas the report by Dr. R. V. Whitman recommends a value of 0.06g and an earthquake of twice this size for the maximum earthquake. The reasoning for the selection of the size of the earthquake is not definite.

With regard to the spectra, we do not agree that the Golden Gate spectra should be chosen for use at this particular plant. There are other more applicable spectra, such as Helena or Taft, which are on rather firm basement material. The cut-off in response at the lower frequency range for the anomalous Golden Gate spectra can be most significant with regard to the design of the structures. We believe that this "cut-off" should not be permitted unless there is a special justification for it. This justification has not been given. The anomalies of the Golden Gate earthquake may be partially explained by shock transmission across certain discontinuities, which may account for the cut-off in the low frequency region. We see no evidence presented that similar conditions apply at this site; nor do we agree that they should be permitted to control the seismic design of so important a structure as a nuclear reactor.

As for the basic earthquake value itself, we shall await the evaluation by the U. S. Coast and Geodetic Survey.

3. With regard to the tendons, we note on page 5-9 that there will be cathodic protection and that the tendons will be surrounded with neat cement grout to prevent entry of air and water. Further information on the grouting techniques to be employed and the inspection techniques that will be employed over the life of the plant are desired.

We have reviewed the instrumentation description in Appendix 5F and find very little there concerning long-term surveillance during the operation of the plant.

4. With regard to the dynamic analysis, we note that the response spectrum approach is to be employed, and a table of damping values is given in Appendix 5A. These damping values look acceptable. We assume that these damping values will be used for both the design and maximum earthquake. If not, this point should be clarified by the applicant.

5. In Appendix 5B we note that A-431 and A-432 reinforcing steel may be employed in the structure. In the event these steels are employed, it is our recommendation that no welding (tack or otherwise) be allowed with these steels in order to prevent the opportunity for brittle fracture.

6. In Appendix 5B the design stress criteria are given. These appear similar to previous presentations and appear acceptable. Of interest, though, is the fact that mention is made of the tornado loads in Section 1.2 but no subsequent mention is made as to how the tornado loadings will be handled in the design. Elaboration on this point is desirable.

On page 5-3 it is noted that the tangential wind velocity associated with the tornado will be 300 mph and that there is an external vacuum of 3 psig. These criteria appear appropriate to the site. We trust that these will be employed in the design in accordance with Appendix 5B.

7. The York Haven Dam, located downstream, which we assume is crucial to the operation of the pond for the plant, is described briefly on pages 2-12 and 2-13. From the discussion presented it appears that certain parts of the York Haven Dam, particularly a new gated spillway section, will be designed and constructed. With regard to the design conditions that must be satisfied, it is not clear whether the entire dam will meet the criteria noted or whether just the new section will meet the criteria. In any event, we should like to have details of the earthquake analysis for the entire dam system, and should like further information on provisions for ponding of water required for safe shut-down, in the event that leakage of the dam occurs.

We note that flooding and hydraulic buoyancy effects will be taken into account in the design of the containment structure, and we assume that this holds as well for any of the auziliary service facilities that are required.

8. The discussion of the handling of the shear in Appendix 5C requires clarification. It is noted on page 5C-4 that "Membrane tension of $3\sqrt{f'_c}$ will be allowed in checking the load capacity strength of the structure. When principal flexural tension exceeds $6\sqrt{f'_c}$ due to thermal gradients through the wall, non-prestressed reinforcing shall be added to resist the thermal stresses based on cracked section theory similar to that contained in ACI 505-54." It is our recommendation that net principal tension not be permitted on a section which is required to carry shear; however we are willing to permit a net principal tensile stress of $3\sqrt{f'_c}$ excluding bending or flexural stress due to thermal loads, for the maximum credible earthquake.

9. We find little information on the piping design under seismic loading, and should like to have further information on the criteria that will be employed for the critical piping systems. The section on structural design bases in Appendix 5A appears to include the piping systems; however, the subsequent Appendices 5B and 5C do not appear to be directed to the piping; as a result, further discussion of the piping design is desired.

10. We see no mention of a stack for this plant and assume that a main stack is not part of the design of this plant. We should like confirmation of this fact.

11. We find little or no information on the design of the cranes that might be employed and should like information concerning how the design of these will be carried out with regard to seismic loading.

Respectfully submitted,

N. M. Newmark

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bjw
cc: W. J. Hall

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