n M. Newmark
ns, Ill.

se

POST OFFICE	REG. NO:
U	

(Must Be Unclassified)

shing comments on review of
or Three Mile Island Unit 1,
ing question for addtl review

DATE OF DOCUMENT	DATE RECEIVED	NO.:
7-8-70	7-13-70	[illegible]

LTR.	MEMO:	REPORT:	OTHER:
X			

ORIG.:	CC:	OTHER:
1	7	

ACTION NECESSARY ☐	CONCURRENCE ☐	DATE ANSWERED
NO ACTION NECESSARY ☐	COMMENT ☐	BY:

FILE CODE: 50-289 -

REFERRED TO	DATE	RECEIVED BY	DATE
A. Dromerick W/ 3 cys for action	7-13-70		
DISTRIBUTION:			
Reg file cy OGC- Room P-506-A			
H. Price & Staff Morris/Schroeder			
Boyd DeYoung		Do Not Remove	
P. Howe Case/Maccary			
Karas/Long (3) extra cys			
		[illegible]	FEL

U.S. ATOMIC ENERGY COMMISSION MAIL CONTROL FORM FORM AEC-326S (8-60)

1589 232

7911010638 A

NATHAN M. NEWMARK
CONSULTING ENGINEERING SERVICES

1114 CIVIL ENGINEERING BUILDING
URBANA, ILLINOIS 61801

8 July 1970

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

Re: Contract No. AT(49-5)-2667
Three Mile Island Nuclear Station -- Unit 1
Metropolitan Edison Company and Jersey Central
Power and Light Company
AEC Docket No. 50-289

Dear Mr. Case:

Dr. W. J. Hall and I have reviewed the Final Safety Analysis Report for the Three Mile Island Nuclear Station Unit 1. On the basis of our review, we call attention below to certain items concerning which additional information is needed to enable us to complete our evaluation. It is possible that we may have additional questions following our inspection of the facility later this year. Our questions and comments follow:

1. The material presented in Section 2 of the FSAR suggests that all the critical Class I structures are founded on bedrock, since bedrock is quite near the surface. The applicant is requested to provide for each of the principal structures at the site a tabulation of the type of foundation employed for the structure, the elevation of the foundation, the foundation medium, and other pertinent information.

2. Overstressing or excessive deformation may arise from differential translational or rotational motion of major structures and connecting elements, or at points where piping or tunnels enter buildings. The applicant is requested to indicate the special provisions that were employed for protection of critical elements running between buildings, such as piping or tunnels.

3. The mechanical design of reactor internals is described briefly in Section 3.1.2.4.1. Therein, reference is made to topical report BAW-10008, Part 1, "Reactor Internals Stress and Deflection Due to Loss-of-Coolant Accident and Maximum Hypothetical Earthquake". Also, reference is made to the allowable stress limits and to Section 4.1.2, Reactor Coolant System. Section 4.1.2 refers in turn to ASME codes. The text indicates that time history, model superposition and response spectra approaches were employed for analyses.

1589 233
2164

The procedures employed in the dynamic analysis of Class I structures and equipment are described at various places in the FSAR, as for example on page 5-51 for the Reactor Building Shell, on page 5-76 for the Piping, and in a separate topical report entitled "Dynamic Analysis of Vital Piping Systems Subjected to Seismic Motion" (which it is understood will be made part of the FSAR). The presentations of the methods of dynamic analysis are general and in some cases are not clear. For example, on pages 5-75 and 5-76, there are described two methods of analysis which theoretically were used for the piping, including (a) what might be termed the response spectrum approach, and (b) a lumped mass modal analysis technique. It is not clear which method was used for which piping, or alternatively whether both methods were used in all cases. The design procedure described in the topical report is more definitive but also leaves some questions unanswered as to the precise techniques employed.

In order to be sure as to what was actually used by the applicant in carrying out the seismic analysis, it is requested that the applicant provide a table or chart for each major item or group of items of Class I structures and equipment, as well as Class II structures and equipment, to show the following: the method of analysis used (with the corresponding response spectrum, time history, peak seismic coefficient from response spectrum or the like); the damping coefficient used; stress or deformation levels applicable; margins of safety for the combined loading conditions considered; a description of the method by which shears, moments, and stresses and/or deflections and/or accelerations are computed for each mode, as well as for the combined total response; and any special comments or explanations necessary to clarify the presentation in the table, as for example procedures used in finding the response spectrum for items supported at different levels, or the method employed in handling differential displacements for items such as piping connected at different levels in the building or between different buildings. A tabulation of stresses, and sources of stresses, should be provided for certain typical structures and items to aid in the evaluation.

The requested tabulation need be supplied only for the Design Basis Earthquake and the corresponding design conditions applicable for this earthquake; however, it should include both vertical and horizontal excitation and the methods used for combining horizontal and vertical excitation.

Also, the tabulation should include the information on, or provide a basis for evaluating, the methods employed for analyzing critical items of equipment which for the most part are not described in the FSAR.

4. The applicant is requested to indicate the manner in which the vertical excitation was handled in the various design procedures; more specifically, the applicant should indicate whether a constant inertial static loading was employed (and if so, the value) or whether appropriate amplification associated with the vertical motion was

considered and incorporated in the analysis as for the seismic analysis for horizontal excitation.

5. The applicant -hould indicate whether there are any Class II buildings in which Class I items are located and if so, what provisions have been taken to provide for their protection in the event of damage to the Class II buildings.

6. With regard to procurement and evaluation of critical items of control, instrumentation, valves, etc., the applicant is requested to provide information as to the types of criteria that were employed for such items. It would be helpful to have some specific examples to aid in the interpretation of the ability of such items to withstand seismic excitation.

7. A summary of the aircraft impact design is contained in Appendix 5A of the FSAR. Section 2 of the Appendix indicates that a single-degree-of-freedom analysis approach was employed. On the other hand, in the analysis for Case C, impact loading, there is an indication that a modal analysis procedure involving multiple-degree-of-freedom considerations was employed. It is not clear whether the dynamic load factors originally referred to were employed with that analysis technique or whether some other approach was used, for the forcing functions are not defined in the presentation. In order to gain a better appreciation for the analysis carried out and the significance of the results, the applicant is requested to submit the following additional information.

(a) The justification for the adequacy of modeling a multiple-degree-of-freedom system as a single-degree-of-freedom system for concentrated load considerations, as indicated at the beginning of Appendix 5A.

(b) A further explanation of the technical analysis employed for Case C and any correlations between the findings there and those reported in the earlier sections of Appendix 5A.

(c) A discussion of the variation of parameters investigated as a part of the analysis, and the sensitivity of the analysis and evaluation to the variation of parameters.

(d) The applicability of the penetration formulas should be discussed especially with respect to the empirical material coefficients and the variation in these that might be expected to be applicable in this case; and, the interaction of the penetration with the overall flexural response. The applicant should indicate how these were considered to be interrelated.

(e) The impact effects on equipment and components within the structure subjected to shock. Any significant shock effects carried through the structure should be identified, and the provisions employed to alleviate damage and effects of the shock should be described.

8. The stress analysis of the buttresses for the reactor building are presented in Appendix 5B. Althougn the maximum and miminum principal stresses for a number of different loading conditions are presented in Appendix 5B, there is no presentation of the maximum shear stresses or their locations. It would be desirable to have these values available for evaluation. At the same time the reinforcing provided to resist these shearing forces should be indicated.

9. The structural integrity testing of the reactor containment structure is described in Appendix 5B. In reviewing the strain, displacement and other measurement criteria summarized in the text and tables, it is not apparent what measurements will be made in and around the vicinity of the prestressing anchorages to indicate their adequacy. Comment on this point is requested.

It is appreciated that in view of the high stresses already existing in these areas by virtue of the prestressing, the additional stress and strains arising from internal pressure loading may not be highly significant. Nonetheless, it would seem that some monitoring might be appropriate, coupled with visual observations and inspections, to attempt to lend validity to the analysis and understanding of the behavior.

Respectfully submitted,

N. M. Newmark

N. M. Newmark

dp

cc: W. J. Hall

1589 236