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Peter A. Morris, Director, Division of Reactor Licensing

INDIAN POINT NUCLEAR GENERATING UNIT #3, DOCKET NO. 50-286

Adequate responses to the enclosed request for additional information are required before we can complete our review of the subject application. These requests, prepared by the DRS Structural Engineering Branch, concern the containment and Class I structural design material presented in Sections 5 and Appendix 5A of the FSAR.

Original signed by
E. G. Case

Edson G. Case, Director
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Request for Additional
Information for Indian Point
Unit #3

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DATE ▶	5/28/71	6/1/71	6/1/71	6/~/71		

INDIAN POINT NUCLEAR GENERATING UNIT #3

(DOCKET #50-286)

REQUEST FOR ADDITIONAL INFORMATION

I. CLASS I STRUCTURES

1. During an OBE and a DBE, torsional loads will be applied to non-symmetrical and to symmetrical structures (refer to paper by N.M. Newmark "Torsion in Symmetrical Buildings" Fourth World Conference on Earthquake Engineering Santiage Chile 1969). Indicate whether torsional effects have been considered for all Class I structures including the containment and its interior structure. Indicate the structural elements which carry these loads and demonstrate that the corresponding stresses meet the criteria for allowable design stresses. Describe the reinforcing provided to carry the seismic loads and demonstrate that it provides a sufficient degree of ductility for the concrete structures.

2. Due to the release of various deleterious elements including sulfur to the atmosphere by the super-heater, discuss the increased probability of corrosion of reinforce concrete and

steel structures over the long-term period and indicate whether any provisions have been made to prevent or minimize corrosion in these structures.

II. CONTAINMENT STRUCTURAL DESIGN

1. The ACI Committee 334 in "Concrete Shell Structures Practice and Commentary" indicates in Section 202(d) and 202(e) that (1) equilibrium checks of internal stresses and external loads are to be made, (2) an ultimate strength analysis may be used only as a check on the adequacy of the design, and (3) the ultimate strength analysis is not to be used as a sole criterion for design. In its commentary in Part 4 the Committee again states that the analysis must be made at design and at ultimate loads. Indicate whether these recommendations have been complied with in the design of the Indian Point 3 containment.

2. The ACI 318-63 Code is essentially a code for framed structures where stresses are mostly uni-axial, whereas, in the containment, the stress distribution is mostly tri-axial. Experimental evidence exists (refer to "Strength of Plain Concrete Under Biaxial Stress" by I. Rosenthal and J. Glucklich, Journal of the ACI, November 1970; pp. 903-914) that, when one or two of the three principal stresses are tensile stresses, the ultimate compressive strength of concrete decreases by a large amount.

Therefore, the different design stress limits established by the Code such as:

$0.45f'_c$; $0.60f'_c$; $0.85f'_c$; $3.5\sqrt{f'_c}$; $2\sqrt{f'_c}$; $1.1\sqrt{f'_c}$; etc.,

may not be applicable, unless some reduction of these values were considered. Demonstrate that the containment structure as designed and built, has sufficient safety margins, despite the fact that an adjustment of the design stress limits has not been considered.

3. The large openings for the equipment hatch and for the personnel lock have been designed using finite element methods of analysis. For evaluation of the structure, additional information is required:

   a. Indicate the manner by which jet loads, missile impact and the tornado loads have been considered in the design.

   b. Indicate whether the finite element analysis used considered the curvature of the wall. Describe the method used to include this factor in the design, especially the torsional effect. Indicate the procedure used to design for the six stresses: axial, two shears, two bending and one torsional shear. Explain the assumptions made for the transmission of these stresses through cracked concrete and justify the stirrup and shear reinforcing arrangement used at the opening.

c. Provide a summary of equilibrium checks of internal stresses and external loads that have been made for the large openings.

4. Indicate whether the tornado design of the containment considered the bending in the meridian and hoop direction. Explain the method used to evaluate the bending in these two directions and justify its omission if such was the case. Explain the manner used to combine the effect of the tornado generated wind velocity with the negative pressure of 3 psig assumed to act simultaneously.

5. Provide an analysis of the protection provided against tornado missiles in the design and construction of Unit #3 Class I structures, including the containment. Provide and justify the list of the types of tornado missiles considered.

III. CONSTRUCTION

In order to permit an evaluation of the structures as built:

1. Indicate where and to what extent ACI 301 standard practice for construction has not been followed and justify your basis for alternative practices.

2. Indicate the specific extent to which ASME Section III Code rules have been applied in liner fabrication and erection.

3. To evaluate the extent of quality assurance, provide a listing of any documents (for example, U.S. Army Corps of Engineers, Bureau of Reclamation, etc.) which have been referenced in for your specifications to contractors to cover items not included in any specific Code. Specify any other supplementary mandatory specifications which have been applied.

4. Indicate the extent to which splice stagger has been achieved in the containment and other Class I structures.

5. Indicate the extent to which the splicing of reinforcing steel has been made by welding and indicate the general locations of

such welds. Indicate where reinforcing steel has been welded to structural steel. Specify the quality control procedures for strength welds of reinforcing bars to structural steel elements such as plates, rings, sleeves, and for occasional strength weld splicing of heavy reinforcing bars. If any tack welding of reinforcing steel was permitted, specify whether any limitations were imposed to avoid such welding in critical areas.

6. Since ASME Section III - Nuclear Pressure Vessel Code rules do not define liner erection tolerances in sufficient detail to ensure a satisfactory erection of the liner (e.g., they do not cover local curvature deviations), provide a comprehensive set of erection tolerance standards used for the liner, and indicate the extent of deviations experienced during constructions, and explain the procedures by which any erection deviations have been corrected.

7. Provide a description of the actual erection procedure of the bottom liner. Indicate the practice followed to assure a good bearing of the liner on the concrete beneath the liner.

Indicate the procedure used for fitting the bottom liner plates to the embedded anchors and other structural elements.

8. Describe the extent of concrete compression and slump testing which has been used in all Class I structures. Include the statistical results of the program, the standards for rejection, and pour removal, and a summary of such occurences. Indicate at what location (at mixer or at point of placement) concrete compression and slump test samples have been actually taken during construction.

9. Indicate the results of the Cadweld splice test procedure and justify your criteria for acceptance of the number of rejections experienced during construction.

IV. TESTING AND SURVEILLANCE

1. Describe the permanent structural provisions made for access to the upper external parts of the containment structure to facilitate periodic inspection and testing, during the service life of the facility.

2. The acceptance pressure-testing should provide a check on design and construction of the containment. In this context, describe in detail and justify the number and arrangement of measurements taken during testing, and demonstrate that the information thus collected will be sufficient to fulfill the test purpose. Indicate the acceptance criteria on test acceptability.

3. Indicated whether periodic structural integrity tests are planned in conjunction with containment leakage rate testing, following the initial proof test. Discuss the expected results of these structural integrity tests and the testing procedure which will be implemented. These periodic tests may serve the purpose of checking on possible gradual deterioration of the structure. Provide the frequencies at which containment

structural integrity tests will or could be conducted during plant life, either separately or in conjunction with periodic containment leakage rate tests.

4. Present the program for inspection of the containment structure concrete and liner, during the service life time of the plant.