AUG 10 1971

Peter A. Morris, Director
Division of Reactor Licensing

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

The information submitted by the subject applicant with respect to the containment and Class I structural design has been reviewed and evaluated by the DRS Structural Engineering Branch. An interim evaluation of the FSAR information submitted to date is attached hereto. Tentative conclusions, for which confirmation is still required, are enclosed in parentheses; the material in brackets provides a summary of actions to be taken to resolve issues still open. Since no responses have been received to date on our list of questions of June 2, 1971, only summaries of open areas are presented rather than addressing each outstanding item.

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INDIAN POINT NUCLEAR GENERATING UNIT #3

DOCKET NO. 50-286

STRUCTURAL ENGINEERING BRANCH INTERIM FSAR REVIEW

CONCRETE CONTAINMENT

The containment structure of Indian Point Unit No. 3 is similar to the containment structure of Unit 2. It is a reinforced concrete vertical right cylinder with a flat base and hemispherical dome, an internal diameter of 135 feet, a height from base to dome springline of 148 feet, 4' - 6" thick cylinder walls and 3' - 6" thick dome. The base mat is 9 feet thick, supported on rock. The containment free volume is 2,610,000 cubic feet with a design pressure of 47 psig. At 1.0, 1.25, and 1.5 times the design pressure, the respective uninsulated liner temperatures will be 247°F, 283°F, and 306°F. The maximum operating temperature is 120°F.

The containment liner is carbon steel plate conforming to ASTM Designation A442-65, Grade 60. It is 1/4-inch thick at the bottom, 1/2-inch thick in the first three courses (except 3/4-inch thick at penetrations), and 3/8-inch for the remaining portion of the cylindrical walls. The dome liner is 1/2-inch thick. The liner nil ductility transition temperature will be 30°F lower than the minimum operating temperature of the liner material. The anchorage system for attaching the liner to the concrete consists of welded studs. They are spaced in a rectangular array 28 inch vertical by 24 inch horizontal at the 1/2-inch diameter plate, and 14 inch vertical by 24 inch horizontal at the 3/8-inch plate. The dome liner has structural tees spaced at approximately 5 feet in each direction with

studs in the center of each panel. Liner insulation is provided at the lower 18-20 feet of the containment. The system has been reviewed for liner integrity and stability under various postulated accidents, fabrication tolerances and inaccuracies, and allowable erection tolerances. /The applicant is being asked to state that the system has been adequately developed to ensure that potential liner buckling, with its attendant rupture hazard, can be controlled even if one of the anchors is missing or has failed./ (We find that the liner and liner anchorage designs are acceptable.)

The containment mat was reviewed and accepted under the exemption request granted the applicant. The two areas which were discussed in greatest depth with the applicant at the construction permit stage involved the elasticity assumptions of the rock surface on which the mat will rest, and the shear reinforcing for the mat and cylinder walls. Both areas were clarified to our satisfaction.

The structural analysis for the reinforced concrete containment is similar to that of Indian Point Unit No. 2. The reinforcing in the structure will have an elastic response to all loads with limited maximum strains to ensure the integrity of the liner.

Diagonal reinforcing was utilized in addition to the horizontal and vertical cylinder reinforcing to handle tangential shears generated by earthquake or tornado.

The applicant's design criteria for penetrations, including the personnel lock and equipment hatch openings, are satisfactory.

/Still to be answered are questions in our June 2, 1971, memo regarding application of the ACI 318-63 Code to containment design, and design of large openings./

CLASS I STRUCTURES OTHER THAN CONTAINMENT

The principal structures, including all the Class I structures, are founded on jointed limestone. The limestone is noncavernous in nature. No sig-ficant foundation problems were encountered during construction, and the foundations are of conventional design. (We have concluded that the foundations as designed and constructed are acceptable.)

The applicant has considered in the design of the containment effects of tornado loads, and tornado generated missiles. Tornado wind loading was taken as a 300 mph tangential wind traveling with a translational velocity of 60 mph. Also considered as a separate and combined loading condition is a 3 psi pressure drop external to the structure. The wind loading and pressure drop parameters are consistent with the generally accepted criteria used for nuclear power plants. The resulting stresses in the containment structure are not a controlling factor in the containment design.

In addition, the Containment structure will withstand the following tornado generated missiles. Only 1 missile was considered to act at any time simultaneously with the 360 mph wind load.

1. 4" x 12" x 12' wood plank at 300 mph

2. 4000# auto at 50 mph less than 25'-0" above the ground

Specific structural effects as the result of missile impact are 1) missile penetration and 2) structural response to dynamic impact. In addition to the overall structural effects such as overturning moment and base shear, the local structural effects are considered in the design for tornado wind and generated missile loads. For missile loads limited local plasticity, structural dynamic response ductility and redistribution of stresses in redundant structures due to plastic action is permitted.

/Still under discussion with the applicant are questions on the combination of tornado loads on the containment structure, seismic torsional effects on Class I structures, and the effects of a corrosive atmosphere on concrete and steel structures./

MATERIALS AND CONSTRUCTION

Construction methods and quality assurance and quality control measures are described in the FSAR and, in general, are similar to those proposed for other recently reviewed facilities.

The reinforcing steel will conform to ASTM Designation A432-65 with a guaranteed minimum yield point of 60,000 psi. The 14S and 18S reinforcing bars will be spliced only by Cadweld splices. A certification of physical properties and chemical content of each heat of reinforcing steel delivered to the job site has been used to join reinforcing bars are sample tested to assure that they will develop at least 125% of the minimum yield point stress of the bar. The test program requires cutting out, at random,

approximately 2% of the completed splices and testing to determine their breaking strength thus confirming the strength of both the bars and the splices.

/Still outstanding are answers to questions relating to the application of construction codes, splicing and welding, liner erection tolerances, and concrete and splice testing./

TESTING AND SURVEILLANCE

Strength and leakage tests will be performed after construction is completed. A 115% overpressure strength test at 54 psig will be conducted and leakage tests will be made at pressure up to 47 psig. Test channels are provided at all liner seams for long-term surveillance. No permanent instrumentation is being installed on the containment for strength testing, although examinations will be made for cracking and distortion during the pressure tests. Periodic leakage rate tests will be performed on the containment and its penetrations.

The containment penetration and weld channel pressurization system provides for continuous pressurization of zones enclosing containment penetrations and channels over the welds in the containment liner. The system continuously maintains a supply of clean dry air that is in excess of the containment design pressure. Pressurized zones include each piping penetration, each electrical penetration, double gasketed spaces on the personnel and equipment hatches, and the liner seam weld channels.

(We have concluded that the provisions for testing and surveillance of the containment are acceptable.) Appropriate test and surveillance requirements will be included in the technical specifications.

/Still to be answered by the applicant are questions about accessibility of the upper containment structure for inspection, test measurements and acceptance criteria, and periodic structural surveillance and testing of the containment structure and liner./