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Doc. File 50-352

MAR 23 1971

Peter A. Morris, Director
Division of Reactor Licensing

LIMERICK GENERATING STATION, UNITS 1 AND 2, DOCKET NOS. 50-352/353

The PSAR 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 evaluation of the information submitted to date, including Supplement No. 3, is enclosed. 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.

Original signed by
E. G. Case

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U.S. GOVERNMENT PRINTING OFFICE 1970—407-757

LIMERICK GENERATING STATION, UNITS 1 AND 2
Docket Nos. 50-352/353

STRUCTURAL EVALUATION

CLASS I STRUCTURES

For Class I concrete structures, the factored load approach is taken for design. For Class I steel structures working stresses are used for normal operating loading combinations, while under a combination of normal loads, design accident, and extreme environmental conditions increased stress limits of 0.9Py for bending, 0.85Py for axial tension and 0.5Py for shear are used. These design approaches are acceptable.

The interaction of Class II items with Class I items has adequately defined functional criteria.

The reactor vessel support is a typical steel skirt-to steel ring girder-to concrete pedestal detail. The design of the support is similar to previously reviewed supports and is acceptable.

FOUNDATION AND ENVIRONMENTAL CONSIDERATIONS

The plant will be supported on bedrock of siltstone interbedded and lensed with shale and sandstone strata. The foundation conditions are considered to be acceptable.

All Class I Seismic structures, systems and equipment necessary for safe

shutdown, primary containment and essential heat removal will be protected from the effects of a tornado. This design basis tornado, with 300 mph rotational velocity, 60 mph translational velocity, and a pressure drop of 3 psi is acceptable. Tornadic missiles assumed are similar to those previously accepted.

The applicant has indicated that three peak recording accelerometers will be installed on selected systems and/or components as needed, while two strong motion recording seismographs will be placed such that one will record basement motion and the other building response higher up. It is our intention to require full compliance with the safety guide on seismic instrumentation, as initiated on Newbold Island. Further evaluation is required on this subject.]

CONTAINMENT DESCRIPTION, DESIGN CRITERIA AND LOADS

The primary containment is similar to the Shoreham structure and consists of a truncated conical drywell of reinforced concrete with a steel pressure head, and a cylindrical reinforced concrete suppression chamber under the drywell. A 1/4-inch liner plate of steel conforming to ASTM A-285, Grade A, Firebox Quality will be used on the interior surfaces of the drywell and pressure suppression chamber. (The applicant is revising the PSAR to show a liner on the floor of the drywell. The change has only been described verbally by the applicant, and a formal review will be conducted of this revision when the amendment is filed.)

The vent system connecting the drywell to the pressure suppression chamber

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consists of 24-inch diameter downcomers. Vacuum breakers limit the differential pressure between suppression chamber and drywell to 3 psi.

The primary containment structure is physically separated from the surrounding reactor building, except for a common base mat. Both drywell and suppression chamber will be designed for a pressure loading of 48 psig, and the drywell floor will be designed to withstand 48 psig in the drywell with 21 psig in the suppression chamber. Vacuum breakers from the secondary containment to the drywell will limit external pressure loading to 2 psig, while design is for 3 psig. Design temperature for the drywell is 296°F, for the suppression chamber 175°F at blowdown, and 205°F post blowdown.

The primary containment loading criteria have been reviewed and are incorporated into the design criteria in acceptable manner.

The secondary containment is a typical BWR structure - concrete up to the refueling floor, and then steel framing with insulated siding above. Its loading and design criteria are similar to previously approved BWR secondary containments of this type and are acceptable.

CONTAINMENT DESIGN ANALYSIS

To carry tangential shears due to earthquake, tangential, diagonal reinforcing will be placed in the shell of the primary containment.

The two basic codes used in the design are the ACI 318-63 code and the

ASME Boiler and Pressure Vessel Code, Section III, Subsection B. The basic analytical method used for axisymmetric loads is the finite element method. Nonaxisymmetric loads are analyzed using a computer program developed by E. L. Wilson and S. Ghosh.* Principal stresses and strains are developed from the program, and then converted to rebar stresses using ACI 505. The ASME code is used to establish a basis for designing the liner, wherever applicable, and also to design the drywell steel head.

The primary containment design analysis is acceptable. The secondary containment will be designed by the same methods and to the same criteria as other Class I structures mentioned earlier in this report.

*Ghosh, S. and Wilson, E., Dynamic Stress Analysis of Axisymmetric Structures Under Arbitrary Loading, University of California, Berkeley, Earthquake Engineering Research Center, Report EERC 69-10, September 1969

TESTING AND SURVEILLANCE

During construction, rebar user tests will be performed on full section bars. Arc welding of rebar is not permitted, but if it becomes necessary to arc weld, it will be done in accordance with AWS D12.1 requirements. Cadweld splice sampling for tensile tests is acceptable.

Liner seams inaccessible after construction will be provided with a leak chase system. A minimum of 4% will be radiographed, or a minimum of 10% will be tested by magnetic particle inspection where radiography is not possible. Initial structural integrity tests of the primary containment will be conducted at 115% of the following design conditions:

a. A design pressure condition of 48 psig in both the drywell and suppression chamber.

b. A design pressure condition of 48 psig in the drywell and 21 psig in the suppression chamber.

A full design pressure test of the primary containment can be performed at any time during plant life when not actually in operation.

[Allowable leakage rates through the drywell floor slab are currently under investigation by the applicant, and will be submitted at a later date.]

The reactor building (secondary containment) leakage rate will be tested

by isolating the building and operating the Standby Gas Treatment System, to check a maximum in-leakage rate of 50% of the building free volume per day.

(The criteria for testing of the primary and secondary containments, as well as associated penetrations, are acceptable except that the discussion is still incomplete with regard to the drywell floor slab.) Surveillance criteria will be furnished at the time of the FSAR review.