ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

October 18, 1973

Honorable Dixy Lee Ray
Chairman
U. S. Atomic Energy Commission
Washington, D. C. 20545

Subject: REPORT ON THE ATLANTIC GENERATING STATION

Dear Dr. Ray:

At its 162nd meeting, October 11-13, 1973, the Advisory Committee on Reactor Safeguards completed a pre-application site review of the Atlantic Generating Station which Public Service Electric and Gas Company of New Jersey (PSE&G) proposes to construct offshore from the coast of the State of New Jersey. The Station is to employ two 3425 MW(t) standardized floating platform-mounted nuclear power plants purchased from Offshore Power Systems (OPS). The proposed site was considered at the 160th meeting of the Committee, August 9-11, 1973, the 161st meeting of the Committee, September 6-8, 1973, and at Subcommittee meetings held May 23, 1973, June 20, 1973, and August 29, 1973, in Washington, D. C. During these meetings the Committee had the benefit of discussions with representatives and consultants of Public Service Electric and Gas Company, Offshore Power Systems, and the AEC Regulatory Staff, and of the documents listed below. The Committee had previously reported to the Commission on its review of the concept for a platform-mounted nuclear power plant in its report of November 15, 1972.

In its request for a pre-application site review and during its discussions with the Committee, PSE&G expressed the hope that the review would enable it to prepare a preliminary safety analysis report which would be adequate and complete for formal review. To the extent practical with the preliminayr information available, the Committee has tried to be responsive to this request in the comments presented below. These comments focus on the site-related structures unique to this plant as described in the PSE&G Preliminary Site Description Report and supplement the comments of the November 15, 1972 Committee report. The structures discussed include the breakwater, the platform mooring system, the electrical power lines from the plants to the breakwater and to the shore, and the cooling water systems.

The Committee did not review the floating nuclear power plants to be included in the Atlantic Generating Station. These plants will be reviewed separately prior to final construction permit review of the site, in accordance with the Commission's proposed rule of April 25, 1973, regarding the licensing of nuclear power plants of standardized design. As a result, the Committee's comments regarding the interaction of the floating plants and the site structures are tentative and incomplete.

The Atlantic Generating Station is to be located in the Atlantic Ocean about 2.8 miles from the entrance to Little Egg Inlet, approximately 11 miles northeast of Atlantic City, New Jersey, which has a population of about 48,000 and is the nearest population center with a population greater than 25,000. Three other towns, with a total population of slightly over 10,000 are within ten miles of the site.

The platform mounted nuclear power plants for this station are to be fabricated and assembled in a specially constructed shipyard facility where each will be individually floated, outfitted, and tested without fuel. Each unit will be separately towed to the site and moored within a breakwater where fuel loading and final preoperational tests will be completed. PSE&G estimates that about a year will elapse between delivery of the first and second units.

A proposed design envelope specifying the site characteristics which must be met to assure compatibility of the site and the plant was described by OPS during this review. The Committee did not review this envelope in detail, but it appears that at least two matters require further attention. First, it must be established that all necessary aspects of the envelope have been identified, and second, that the specific parameters chosen for each aspect will acceptably protect the plant. In addition, it will be necessary to demonstrate that the site conforms to the design envelope and to justify the bases on which the conformance is achieved. Specific attention must be given to the interaction of the platforms, the mooring system, and site-related phenomena, such as wave and wind action, and to the bases for the design conditions selected.

The following items illustrate the type of information that will be required to permit evaluation of the acceptability of this site and the structures and components to be built under a site construction permit.

1. Breakwater

    a) The stability of the foundation soils under loads imposed by the breakwater during the lifetime of the plant must be

adequately demonstrated. In addition, the program for monitoring soil settlement during construction and the criteria for evaluating such settlement will have to be identified.

b) Because of variability in the subsurface soils, adequate tests of soil samples must be performed to demonstrate that liquefaction is not a problem. Also, because of the divergent conclusions which can be obtained from different methods and criteria for evaluating the liquefaction potential of loose sands, a comparison will have to be made of the conservatism of the selected method with those of other approaches.

c) The Applicant also will have to provide sufficient data to show that no pinched-off sand layers open to the seaside extend under the breakwater and terminate in the basin such that differential pore pressures could develop from varying water levels during severe storms and lead to reduction of shear resistance, resulting in lateral spreading or failure of the breakwater.

d) The adequacy of the breakwater design must be demonstrated to be equivalent to that of a Category I structure in respect to simultaneous loadings imposed by wind, waves, and seismic forces. The extent to which the breakwater can sustain damage without loss of function under such conditions should also be explored.

e) The results of the breakwater model tests currently being carried out will be valuable in evaluating the action of waves on the breakwater. Plans exist to make tests with and without modeling of the shoal which presently exists on the seaward side of the breakwater. Consideration should also be given to testing the effects of irregular waves on the breakwater, the mooring system, and other structures. In addition, studies should include the effects of storm-driven sea currents and long-period waves on the breakwater.

f) The Committee also recommends that the possible advantages to safety of a closed breakwater (possibly employing locks) be analyzed and receive careful consideration. Of particular interest would be the effectiveness of a closed breakwater in mitigating the possible consequences of a very low probability uncontained fuel-melting accident, as well as possible advantages in the protection against fire or wave action. The Committee recognizes that modifications or complications in the handling of fuel may be involved.

2. Mooring System

a) The adequacy of the proposed mooring system as a Category I system, including interactions of the foundation soils, mooring caissons, mooring struts, and platforms, will have to be demonstrated for a wide range of conditions. The site envelope specifies only limiting accelerations associated with pitch, roll, and heave of the platforms. The Committee believes that horizontal accelerations in surge and sway as well as angular acceleration in yaw should be explored. In addition, the effects of both long period and short period waves, as well as irregular waves, should be evaluated to ensure that the natural period of the mooring system is outside the range of wave periods to be expected from normal and storm wave activity, or that the moorings are appropriately designed to handle them. The effects of long period tsunami waves on mooring system stresses and platform motion should be considered.

b) Since earthquakes may cause sloshing of water inside the mooring basin and lead to motions of the moored platforms, the effect of earthquake-induced water motion in the basin should be investigated.

c) The adequacy of the mooring system foundations must be demonstrated by analyses and laboratory tests, including the effects of the different soil characteristics under the several mooring caissons.

d) Adequate measures to assure continued integrity of the mooring system material throughout the life of the plant must be clearly defined.

e) The materials chosen for mating surfaces of the morring system universal joints should be capable of withstanding the marine environment without depending upon cathodic protection.

f) Documentation of the values of parameters used in fatigue analyses of the mooring system will be needed. The Committee believes that further attention to the selection of fatigue limits is required for this application because of the presence of corrosive sea water. Where cathodic protection is relied upon to avoid corrosion fatigue effects, attention will have to be given to means for controlling and monitoring the cathodic protection system.

g) Consideration should be given to providing an additional diverse mooring system or means for limiting platform motion in the unlikely event that the installed mooring system were to fail.

3. Accident Analyses

a) Further analyses of site-related accidents will be needed to permit evaluation of this site. Of particular interest are the probabilities and potential consequences of accidents involving the collision of ships with the breakwater, particularly ships carrying flammable or other hazardous cargo, such as LNG, and accidents involving aircraft crashes.

Two fundamental questions have arisen regarding the probabilities involved in these accidents. The first relates to the need for further justification of what is an acceptably low probability. The second concerns the methodology used for estimating the probabilities. With regard to the first question, the Committee believes that because of the plant's location offshore, the acceptable probability for an aircraft crash into the site may need to be lower than that used for land applications. As one aspect of the second question, the Committee believes that more attention must be given to establishing the data bases and the degree of independence of the various factors entering into the probability estimation of ship collision with the breakwater. Both of these questions need more detailed treatment by the Applicant.

b) Further evaluation is needed of the potential consequences of various degrees of failure of the breakwater and/or the mooring system.

c) Methods of assessing the course and effects of routine and accidental radioactive releases from the station should be presented.

d) Further work is needed on the dispersal characteristics of fission products and plutonium which might be released in the highly unlikely event of an uncontained fuel melting accident at this site.

e) The capability for coping with fires must be adequately demonstrated.

f) The conservatism in the design of the breakwater and the mooring system to withstand the design basis hurricane and hurricane-induced forces should be documented.

g) Studies should be made of the advantages and disadvantages of various additional measures to reduce ship breakwater collision probabilities, including active warning systems and a separate ship arrester external to the breakwater.

4. Integrity of Electric Power Cables

Information is needed on the bases for design and protection of the electrical cables which supply onshore power to the plant. For example, the Applicant should discuss the extent to which the cables can withstand plant motions and wind loads at the site and scouring action of the waves where the lines enter the water.

5. Cooling Water Systems

The adequacy of safety-related cooling water systems will have to be demonstrated for normal and accident conditions.

6. Other General Considerations

Further information is also needed on the following site-related matters.

a) Details of proposed security plans during normal operation, during installation of Unit II, and following postulated accidents.

b) Information regarding needed onshore support facilities.

c) Plans for eventual decommissioning of the station.

If the foregoing information is provided together with other information normally submitted for a construction permit, the Committee believes that it will be able to evaluate the acceptability of this site, after review of the floating platform nuclear power plants proposed for this Station.

In the pre-application site review, the Committee found no reasons to indicate that this site is unacceptable for the location of the proposed Station if due attention is given to the foregoing items and the adequacy of the design is confirmed by additional studies, analyses, and tests.

Mr. Harold Etherington did not participate in the review of this project.

Sincerely yours,

s/s H. G. Mangelsdorf

H. G. Mangelsdorf
Chairman

References

1. Atlantic Generating Station Preliminary Site Description Report - December 1973

2. Offshore Power Systems Plant Design Report - May 1973 (Site Related Portions)

3. Amendment No. 1 to Offshore Power Systems application dated August 14, 1973

4. Atlantic Generating Station Description Booklet - October 1973

5. Public Service Electric and Gas Company letter dated May 31, 1973 transmitting the following:

   a) Site Envelope Comparison - Atlantic Generating Station Site Values compared to Offshore Power Systems Site Envelope

   b) Meteorological - Oceanographic Conditions Affecting Design and Operation of Nuclear Power Generating Facilities Offshore New Jersey: Final Report dated September 27, 1971 by A. H. Glenn and Associates

   c) Hinged Strut Mooring System Description, May 7, 1973 (Revised May 25, 1973) by F. R. Harris, Inc.

   d) A Study of the Probability of an Aircraft Hitting the Atlantic Generating Station, dated March 26, 1973 by Pickard Lowe and Associates

6. Staff Report - Pre-application Site Review, Public Service Electric and Gas Company of New Jersey, Atlantic Generating Station, dated June 8, 1973