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

December 10, 1975

Honorable William A. Anders
Chairman
U. S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: INTERIM REPORT ON FLOATING NUCLEAR PLANT

Dear Mr. Anders:

During its 188th Meeting, December 4-6, 1975, the Advisory Committee on Reactor Safeguards completed a partial review of the application of Offshore Power Systems for a license to manufacture eight standardized Floating Nuclear Plant units in a shipyard-like facility located on Blount Island in Jacksonville, Florida. The Committee had previously reported to the Commission on its review of the concept of a Platform Mounted Nuclear Power Plant in its report of November 15, 1972. In addition, the Committee has had discussions of the Floating Nuclear Plant (FNP) concept in connection with the Atlantic Generating Station site review on which the Committee reported on October 18, 1973. The manufacturing facility site was visited on October 29, 1975 and the project was considered at a Subcommittee Meeting on October 29 and 30, 1975, in Jacksonville, Florida. The project was also considered during the 187th Meeting of the Committee in Washington, D. C., November 6-8, 1975. During its review, the Committee had the benefit of discussions with the Nuclear Regulatory Commission (NRC) Staff, the U. S. Coast Guard, and representatives and consultants of Offshore Power Systems. The Committee also had the benefit of the documents listed.

The FNP will make use of the Westinghouse RESAR-3 Consolidated Version four-loop pressurized water nuclear reactor having a core power output of 3411 MW(t). This reactor design is similar to that utilized at the Catawba Nuclear Station Units 1 and 2, reported on by the Committee in its report of November 13, 1973. The scope of the FNP design includes the Nuclear Steam Supply System (NSSS) and the Balance of Plant (BOP). The complete system, which is to be mounted on a large floating platform, represents a standard unit which is being designed for use at sites which fall within an envelope of parameters or specifications. The plant design includes specific requirements for major components, piping systems, and other information necessary to ensure that both the NSSS and BOP are designed to protect the system from site-related hazards. Application of the FNP concept will require an evaluation of each site to confirm its acceptability within the given envelope.

With respect to the site envelope, the Committee recommends that further consideration be given to methods for the assessment of probabilities for given accident events, such as those involving ships. Rather than treat each potential accident situation as a separate class of event, it may be more appropriate in some cases to evaluate the significance of a given class of event on the basis of the total probability of all events within that class.

The NRC Staff has identified several issues which remain to be resolved. One pertains to the acceptability of criteria for containment shell buckling, including the behavior of the shell during construction. To be included in the assessment of this issue are the effects of deformation of the containment foundation. Another issue concerns the effects and consequences on the FNP of the explosion nearby of a petroleum tanker. These matters should be resolved in a manner satisfactory to the NRC Staff. The Committee wishes to be kept informed.

Evaluation of the Emergency Core Cooling System (ECCS) design in accordance with Appendix K of 10 CFR Part 50 is also an outstanding issue which has been identified by the NRC Staff. In this regard, the Committee has special interests relating to detailed assessments of the upper head injection system, the resolution of potential problems with the ice condenser pressure suppression system, and the margins available in the ECCS. The Committee wishes to review the design and analysis of both of these systems prior to the NRC issuance of a license to manufacture the FNP units.

In the course of its review, the Committee noted other areas wherein it wishes to be kept informed. These include any problems associated with turbine-generator alignment; hull-coupled vibrations (particularly as these relate to the potential of turbine failure and the generation of missiles); analysis of stresses on key components associated with platform towing operations; and the location and range of instruments for determining the nature and course of any accidents.

Since the FNP is a novel design requiring unusual structural reliability there is a need to develop plans for verification of structural design and to define the requirements for strain and deformation measurements, visual inspection during operational testing, and nondestructive inspection of critical FNP structures subsequent to operational loading. The Committee wishes to be kept informed.

Consideration should be given in design to the possible provisions for redundant mooring systems.

The Committee recommends that the NRC Staff and the Applicant review further the design features that are intended to prevent the occurrence of fires and to minimize the consequences to safety-related equipment should a fire occur. This evaluation should include a review of systems for detecting and protecting against fires, both within and outside the plant. This matter should be resolved to the satisfaction of the NRC Staff. The Committee wishes to be kept informed.

Also to be evaluated are the consequences of, and any safeguards necessary to cope with, a major accident which could lead to the dispersal of a significant quantity of radioactive materials into the water surrounding the FNP. The Committee understands that this item is being evaluated by the NRC Staff and the Applicant. The Committee will reserve judgment on this item, which is both site and plant related, until it has had an opportunity to review and evaluate the relevant information.

The Committee suggests that analyses be made of any possible increases in the protection of public health and safety which may be obtained by an increase in containment design pressure.

The Applicant has suggested the use of a coating and a cathodic system to protect the platform against corrosion. The proposed cathodic system appears to be suitable for the underwater portion of the platform; however, additional attention should be given to means for protecting the critical wave and splash zone areas where repair or renewal may not be practical under the anticipated operating conditions of the FNP.

Because operating and maintenance personnel may be on board the floating platform for extended periods of time, and because shielding may be limited due to weight restrictions and limitations on available space, it is possible that doses and dose rates to personnel on the FNP may be greater than for land-based units. As a result, the Committee believes that special consideration should be given to conformance with the "as low as reasonably achievable" criterion.

The Committee believes that the Applicant and the NRC Staff should continue to review the FNP design for features that could reduce the possibility and consequences of sabotage.

The Committee recommends that further attention be given to the possibility of extended loss of off-site power due to natural events or other causes, and the potential impact of this possibility on the requirements for emergency AC power.

Generic problems relating to large water reactors are discussed in the Committee's report dated March 12, 1975. The Committee believes that procedures should be developed to incorporate approved resolution of these items into the FNP.

The Advisory Committee on Reactor Safeguards believes, that subject to the foregoing and to other applicable matters discussed in its reports of November 15, 1972 and October 18, 1973, the Floating Nuclear Plant units can be constructed with reasonable assurance that they can be operated without undue risk to the health and safety of the public. The Committee will complete its review of this application when the necessary additional information has been developed.

Sincerely yours,

W Kerr

W. Kerr
Chairman

References

1. Floating Nuclear Plant (FNP) Plant Design Report (PDR) Volumes 1-8

2. Amendments 1 through 17 to the PDR

3. Safety Evaluation Report by the Division of Reactor Licensing (DRL), dated September 30, 1975

4. Memorandum of Understanding Between the U. S. Coast Guard (USCG) and the U. S. Atomic Energy Commission for Regulation of Floating Nuclear Power Plants, dated January 4, 1974

5. Letter, dated September 5, 1975, Offshore Power Systems (OPS) to DRL, transmitting Westinghouse Report entitled "Valve Reliability, Turbine Inlet Valves," dated August 1975

6. Letter, dated September 2, 1975, USCG to DRL, providing comments on Offshore Power Systems Response to Staff Position Concerning Charpy V-Notch Testing of Weldments

7. Letter, dated August 25, 1975, OPS to DRL, providing additional turbine missile information

8. Letter, dated August 11, 1975, providing information on Emergency Core Cooling System Performance

9. Letter, dated August 8, 1975, OPS to DRL, transmitting Revision 1 to the Platform Hull Drydocking Equivalency document

10. Letter, dated June 3, 1975, OPS to DRL, providing information on turbine missile penetration of steel barriers

11. Letter, dated May 21, 1975, OPS to DRL, regarding external fire protection system

12. Letter, dated April 3, 1975, USCG to DRL, providing plan regarding details of exterior fire protection

13. Letter, dated March 10, 1975, USCG to DRL, providing comments on Platform Hull Corrosion Control Plan

14. Letter, dated January 30, 1975, OPS to DRL, regarding Damaged Platform Stability

References - Continued

15. Letter, dated January 23, 1975, OPS to DRL, transmitting report on Control Rod Drive Mechanism Analysis performed by Westinghouse

16. Letter, dated January 15, 1975, OPS to DRL, transmitting reports requested by USCG

17. Letter, dated January 3, 1975, USCG to DRL, providing comments on fracture toughness testing of hull steel for floating nuclear plants

18. Letter, dated December 17, 1974, OPS to DRL, transmitting errata sheet for report on external fire protection

19. Letter, dated December 5, 1974, OPS to DRL, regarding procedures for structural plans

20. Letter, dated November 22, 1974, OPS to DRL, transmitting revision to Equivalency Demonstration document

21. Letter, dated November 17, 1974, OPS to DRL, transmitting four reports referenced in the PDR

22. Letter, dated November 13, 1974, OPS to DRL, transmitting nonproprietary report on Emergency Trip Systems and Ultrasonic Inspection

23. Letter, dated November 12, 1974, OPS to DRL, transmitting document entitled "Floating Nuclear Plant Platform Hull Corrosion Control Plan

24. Letter, dated November 12, 1974, OPS to DRL, transmitting Westinghouse Electric Corporation reports

25. Letter, dated October 16, 1974, USCG to DRL, enclosing August 29, 1974 letter from OPS and USCG's October 11, 1974 letter to OPS

26. Letter, dated October 8, 1974, OPS to DRL, transmitting report entitled "Wind and Wave Persistence and Forecast Lead Times for Four Offshore Locations"

27. Letter, dated September 26, 1974, OPS to DRL, transmitting position on Anticipated Transients Without Scram

28. Letter, dated September 6, 1974, OPS to DRL, transmitting Westinghouse report entitled "A Comparison of Westinghouse Overspeed Protection to the Requirements of IEEE 279"

29. Letter, dated August 29, 1974, OPS to DRL, transmitting three Westinghouse reports

30. Letter, dated August 12, 1974, OPS to DRL, providing clarifying information regarding the calculation of transmission line reliability

31. Letter, dated August 8, 1974, OPS to DRL, transmitting MIDAS code report

32. Letter, dated August 7, 1974, OPS to DRL, transmitting revision to Emergency Power Equivalency document

33. Letter, dated August 2, 1974, OPS to DRL, transmitting Westinghouse Electric Corporation report on Analysis of the Probability of the Generation and Strike of Missiles From A Nuclear Turbine

34. Letter, dated July 2, 1974, OPS to DRL, transmitting document entitled "Platform Inclinations Due to Damage to Any One Side"

35. Letter, dated July 2, 1974, OPS to DRL, transmitting revision to Emergency Power Equivalency document

36. Letters, dated March 29 and February 25, 1974, USCG to DRL, regarding selection of hull material for Floating Nuclear Plants

37. Letter, dated January 7, 1974, OPS to DRL, transmitting information on Anticipated Transients Without Scram

38. Letter, dated October 26, 1973, OPS to DRL, providing interim information regarding Nuclear Plant Arrangement and Ice Condenser Design