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

April 16, 1976

Honorable Marcus A. Rowden
Acting Chairman
U. S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: REPORT ON WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECTS NO. 3 AND NO. 5

Dear Mr. Rowden:

During its 192nd meeting, April 8-10, 1976, the Advisory Committee on Reactor Safeguards completed a review of the application of the Washington Public Power Supply System (WPPSS) for permission to construct the WPPSS Nuclear Project No. 3 and WPPSS Nuclear Project No. 5 (WNP-3 and WNP-5). The site was visited on August 4, 1975, and Subcommittee meetings were held that same day in Elma, Washington, and on February 24, 1976, in Richland, Washington. The project was also considered during the 191st meeting of the Committee in Washington, D. C., March 4-6, 1976. During its review, the Committee had the benefit of discussions with representatives of WPPSS and its consultants, Combustion Engineering, Inc., Ebasco Services, Inc., and the Nuclear Regulatory Commission (NRC) Staff. The Committee also had the benefit of the documents listed.

The WNP-3 and WNP-5 site is located in Grays Harbor County, Washington, approximately thirteen miles east of Aberdeen-Hoquiam-Cosmopolis, Washington, the nearest population center (1970 population 28,549). The minimum exclusion distance is 1310 meters and the low population zone (LPZ) radius is three miles. The total 1970 resident population within the LPZ was 260.

The WNP-3 and WNP-5 application is submitted in accordance with the Commission's standardization policy as described in Appendix O to Part 50, "Licensing of Production and Utilization Facilities," and Section 2.110 of Part 2, "Rules of Practice," of Title 10 of the Code of Federal Regulations. For this application the reference system is the Combustion Engineering Standardized Nuclear Steam Supply System known as its Standard Reference System-80. This design has been reviewed by the ACRS and discussed in its report of September 17, 1975, "Combustion Engineering Standard Safety Analysis Report - CESSAR-80."

The ultimate heat sink for each reactor will consist of a system of dry cooling towers and components that reject excess heat to the atmosphere. Because of its design the ultimate heat sink does not require a makeup water supply.

The Applicant described his investigations of the geologic and seismic characteristics of the site and the surrounding region. While the geology of the surrounding area is complex, and there is definite tectonic activity, there are no known geologic or seismic problems that cannot be solved by design. The proposed safe shutdown earthquake is 0.32g horizontal acceleration at the foundations. The operating basis earthquake is 0.16g.

Each WNP reactor will employ a containment system including a free standing steel vessel surrounded by a reinforced concrete shield building. The inner steel vessel is designed for an internal pressure of 44 psig. The annulus, between the two structures, is maintained at subatmospheric pressure to permit the collection of leakage from the steel vessel, in the unlikely event of a LOCA, and permit its processing before release to the environment.

The Committee recommended in its report of September 10, 1973, on acceptance criteria for ECCS, that significantly improved ECCS capability should be provided for reactors for which construction permit requests were filed after January 7, 1972. The WNP-3 and WNP-5 design is in this category. These projects will use the 16 X 16 fuel assemblies similar to those to be used in Arkansas Nuclear One Unit 2 and St. Lucie Plant Unit 2. Although calculated peak clad temperatures, in the event of a postulated LOCA, may be less for 16 X 16 than for the 14 X 14 array, the Committee believes that the Applicant should continue studies that are responsive to the Committee's September 10, 1973, report. If studies, conducted with the best available techniques, establish that significant further ECCS improvements can be achieved, consideration should be given to incorporating them into WNP-3 and WNP-5.

A generic question has arisen concerning loads on the vessel support structure for certain postulated loss-of-coolant accidents in pressurized water reactors. This matter should be resolved for WNP-3 and WNP-5 in a manner satisfactory to the NRC Staff.

The Committee believes that the Applicant and the NRC Staff should continue to review the WNP-3 and WNP-5 design for features that could reduce the possibility and consequences of sabotage.

Following the Browns Ferry fire the NRC Executive Director for Operations set up a special review group to determine what could be learned from this incident. This group has made recommendations that apply to future reactors, to reactors that are already operating, and to the NRC regulatory process. The review group points out that its recommendations are not specific to any single plant and that its recommendations are based on knowledge at the time of this investigation. The ACRS wishes to be kept informed of the specific application of the review group's recommendations, as they apply to WNP-3 and WNP-5, for the development of additional information on fire prevention, fire fighting, quality assurance, and the improvement of NRC policies, procedures, and criteria.

Other generic problems relating to large water reactors are discussed in the Committee's report dated April 16, 1976. These problems should be dealt with appropriately by the NRC Staff and the Applicant.

The Advisory Committee on Reactor Safeguards believes that the items mentioned above can be resolved during construction and that, if due consideration is given to the foregoing and to items mentioned in its CESSAR-80 report of September 17, 1975, the Washington Public Power Supply System Nuclear Projects No. 3 and No. 5 can be constructed with reasonable assurance that they can be operated without undue risk to the health and safety of the public.

Additional comments by Members Max W. Carbon, David Okrent, Milton S. Plesset, Stephen Lawroski, and Myer Bender are presented below.

Sincerely yours,

Dade W. Moeller

Dade W. Moeller
Chairman

Additional Comments by Members Max W. Carbon, David Okrent, Milton S. Plesset, and Stephen Lawroski

The site for WPPSS Nuclear Projects No. 3 and No. 5 lies in a seismically active region that has been subject to large earthquakes in historic time and includes active major faults. While we do not disagree with the proposed seismic design basis, we believe it would be desirable to have the geologic and siesmic aspects of such sites, and perhaps most sites, also reviewed by the U. S. Geological Survey to provide the benefit of an additional independent evaluation.

Additional Comments by Members David Okrent and Milton S. Plesset

The recurrence interval of an earthquake of the order of the safe shutdown earthquake may be about 1,000 years for this site. For such a recurrence interval the probability of not achieving safe shutdown, given the SSE, must be very small if the NRC Staff goal of less than 10^{-7} per year, of a serious accident from any single cause, is to be achieved. Since seismic design adequacy is not subject to direct experimental confirmation, we believe that other measures, including independent design review, low-amplitude shaking measurements of the completed structure, as-built construction validation, and detection of possible inservice degradation, should be evaluated and the necessary steps taken to provide the high degree of detailed specific assurance required with regard to seismic capability of all safety-related features.

Additional Comments by Member Myer Bender

With increasing frequency, questions have arisen concerning the appropriate degree of conservatism to be included in the seismic design criteria for nuclear power plants. The needs of public safety would be best served if the design practices currently in vogue were altered to permit inelastic response so as to enhance the energy absorption characteristics of nuclear structures under severe seismic loadings. For the more severe seismic conditions inelastic design principles should be applied to foundations, concrete containments, floors, and support structures in order to assure a high degree of damping and thus minimize the forces transmitted to critical safety features and to the primary coolant circuitry. This would eliminate the need for many of the complex supplemental structural features of questionable reliability which are now used to meet extreme seismic design conditions. This design approach would allow nuclear structures to satisfy even the most pessimistic loading requirements of the most extreme seismic prophet. If it is not used there is doubtful value, and possibly some loss in public safety margin, from the use of ultraconservative seismic design requirements because the reliability of the structural restraints cannot be assessed from relevant structural experience or post-construction vibrational testing.

References:

1. Washington Public Power Supply Systems (WPPSS) Nuclear Projects No. 3 and No. 5 Preliminary Safety Analysis Report (PSAR) Volumes 1-18
2. Amendments 1-30 to the PSAR

References Continued

3. Division of Reactor Licensing (DRL) Safety Evaluation Report, dated February 1976
4. Letter, dated December 31, 1976, WPPSS to DRL, concerning reactor pressure vessel support design, shutdown cooling system, and containment purging
5. Letter, dated January 12, 1976, WPPSS to DRL, concerning atmospheric dump valve sizing