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

February 11, 1976

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

Subject: REPORT ON SWESSAR-P1, STONE AND WEBSTER ENGINEERING CORPORATION BALANCE-OF-PLANT DESIGN

Dear Mr. Anders:

At its 190th meeting on February 5-7, 1976, the Advisory Committee on Reactor Safeguards reviewed the application of the Stone and Webster Engineering Corporation for a Preliminary Design Approval of its SWESSAR-P1, a standardized nuclear balance-of-plant (BOP) design. SWESSAR-P1 had previously been reviewed at Subcommittee meetings held in Chicago, Illinois, on August 1, 1975, and in Washington, DC, on January 22, 1976. During its review, the Committee had the benefit of discussions with representatives of the Stone and Webster Engineering Corporation and the Nuclear Regulatory Commission (NRC) Staff. The Committee also had the benefit of the documents listed.

The SWESSAR-P1 BOP design would interface with single unit pressurized-water-reactor nuclear islands of standardized design such as RESAR-41 and CESSAR-80. This review is limited to RESAR-41. The interface requirements with other standardized nuclear island designs have not yet been established.

The SWESSAR-P1 containment is a conventional reinforced-concrete-steel-lined building with a flat base, a cylindrical shell, and a hemispherical dome. It is surrounded by an annulus building extending about one-half the height of the containment building. The containment and the annulus buildings are supported on a common base mat. The annulus building contains portions of the engineered safety features and some auxiliaries. The turbine generator is housed in a separate turbine building with its axis oriented radially with respect to the containment structure. Separate buildings are provided to house the diesel generators, the control facilities, and the radioactive waste disposal equipment.

A set of design parameters has been established for SWESSAR-P1 which enable it to be applied to a range of sites without site-specific-design treatment of many features. The design was reviewed for a power level of 3800 MWt and would accept seismic loadings equivalent to 0.30g horizontal ground acceleration for the safe shutdown earthquake (SSE) and 0.15g horizontal ground acceleration for the operating basis earthquake (OBE). SWESSAR-P1 would be usable under meteorologic conditions prevailing in 22% of the more than 40 sites reviewed in this context by the NRC Staff. An optional extension of the annulus building to enclose the entire containment structure would permit SWESSAR-P1 to accommodate meteorological conditions at most sites thus far licensed. Other site conditions such as tornado design requirements, missile resistance, flood design limits, and postulated pipe rupture effects inside and outside containment are comparable to those now being required in licensed nuclear power plants. The remaining related design features such as offsite power, ultimate heat sink, and condenser cooling water supply and return, would be individually selected to suit the site on which SWESSAR-P1 is used.

The arrangement of SWESSAR-P1 provides extensive physical separation of critical safety-related equipment to protect against common mode failures associated with fires or other operational contingencies. However, complete design details for SWESSAR-P1 have not been developed and the concept has not yet been applied to a complete nuclear power plant design. Consequently, further review of the physical separation arrangement should be made prior to the Final Design Approval or when SWESSAR-P1 is proposed for a nuclear power plant for which a construction permit is being sought. The Committee wishes to be kept informed.

A matter of major concern in the NRC Staff's review has been the safety-related interfaces between the SWESSAR-P1 BOP design and the RESAR-41 NSSS design, on one hand, and the custom-designed site-related structures and components, on the other hand. The responsibilities and requirements related to the SWESSAR-RESAR interfaces have been defined in detail in the Safety Analysis Reports for these two standardized designs. The Committee believes that these interface requirements are satisfactory for a Preliminary Design Approval, but expects the NRC Staff and the Applicant to continue to examine them further in connection with the proposal to use these designs for an actual plant when it is reviewed for a construction permit. The interfaces between SWESSAR-P1 and the site-related features are defined in the SWESSAR-P1 Safety Analysis Report, but have not yet been subjected to the test of a complete design for a nuclear power plant. The NRC Staff should review these interfaces in greater depth when a construction permit application is received.

The Committee recommends that, during the design, procurement, construction, and startup, timely and appropriate interdisciplinary system analyses be performed to assure complete functional compatibility across each interface for the entire spectrum of anticipated operations and postulated design basis accident conditions.

The coordination of interdependent instrumentation and controls in the nuclear island and in the balance of plant will require attention at the time when SWESSAR-P1 is used as a portion of a nuclear power plant license application. These matters should be included in the NRC Staff's standard review plans.

The proposed orientation of the turbine-generator with respect to the nuclear island is suitable for a single unit installation. For multiple unit power plants, the location and orientation of the units should be such as to yield acceptably low probabilities of damage by low-trajectory turbine-generator missiles, or suitable missile shielding should be provided.

Although SWESSAR-P1 includes provisions for protection against industrial sabotage, the Committee believes that further steps can be taken beyond those in SWESSAR-P1 and in the custom plant designs about which the ACRS has previously expressed concern. Prior to the use of SWESSAR-P1 as a portion of an application for a nuclear power plant license, the Utility-Applicant should be required to demonstrate that acceptable industrial sabotage provisions will be incorporated into the plant design.

The SWESSAR-P1 design should include provisions which anticipate the maintenance, inspection, and operational needs of the plant throughout its service life, including cleaning and decontamination of the primary coolant system, and eventual decommissioning. In particular, the Committee believes that the NRC Staff and the Applicant should review methods and procedures for removing accumulations of radioactive contamination whereby maintenance and inspection programs can be more effectively and safely carried out.

Generic problems related to large water reactors are discussed in the Committee's report dated March 12, 1975. Those problems relevant to SWESSAR-P1 should be dealt with appropriately by the NRC Staff and the Applicant as solutions are found.

The Advisory Committee on Reactor Safeguards believes that the items mentioned above can be resolved during the standardized plant licensing process and that, if due consideration is given to the foregoing, Preliminary Design Approval for SWESSAR-P1 to be used in conjunction with RESAR-41 can be granted in accord with the spirit and purposes set forth in the Commission's policy statement on standardization of nuclear power plants as described in WASH-1341, "Programmatic Information for the Licensing of Standardized Nuclear Power Plants" and in conformance with the Regulations of Appendix 0 to Part 50 and Section 2.110 of Part 2 of Title 10 of the Code of Federal Regulations.

Sincerely yours,

Dade W. Moeller

Dade W. Moeller
Chairman

References

1. Pressurized Water Reactor Reference Nuclear Power Plant Safety Analysis Report (SWESSAR) and Amendments 1 through 20.

2. Stone and Webster Engineering Corporation letters:
   a. April 8, 1975 - Containment and Subcompartment Analysis
   b. April 18, 1975 - Subcompartment Analysis
   c. April 29, 1975 - Schedules
   d. April 30, 1975 - Steam Pipe Break Analysis
   e. June 4, 1975 - Implementation of WASH-1341
   f. June 5, 1975 - Supplementary Leak Collection and Release System
   g. September 5, 1975 - Reactor Cavity Nodulization Study
   h. September 5, 1975 - Schedules
   i. September 11, 1975 - Electrical System
   j. September 29, 1975 - Boron Recovery System
   k. October 2, 1975 - Interface Data
   l. November 13, 1975 - Supplementary Leak Collection and Release System
   m. November 21, 1975 - Resolution of Outstanding Items
   n. November 26, 1975 - Electrical, Instrumentation and Control Systems
   o. December 9, 1975 - Soil-Structure Interaction

Reference - Continued

3. Report to the Advisory Committee on Reactor Safeguards in the Matter of Stone & Webster Engineering Corporation Standard Safety Analysis Report PWR Reference Nuclear Power Plant SWESSAR-P1 (and its relationship to the RESAR-41 Standard NSSS Design) Docket No. STN 50-495, Published: October 1975, U. S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation.

4. Supplement No. 1 to the Report to the Advisory Committee on Reactor Safeguards in the Matter of Stone & Webster Engineering Corporation Standard Safety Analysis Report PWR Reference Nuclear Power Plant SWESSAR-P1 (and its relationship to the RESAR-41 Standard NSSS Design) Docket No. STN 50-495, January 1976, U. S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation.