ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
UNITED STATES ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

May 15, 1974

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

Subject: REPORT ON GRAND GULF NUCLEAR STATION, UNITS 1 AND 2

Dear Dr. Ray:

At its 169th meeting, on May 9-11, 1974, the Advisory Committee on Reactor Safeguards completed its review of the application of the Mississippi Power and Light Company for a permit to construct the Grand Gulf Nuclear Station, Units 1 and 2. The Committee also considered this application during its 166th meeting on February 7-9, 1974, and its 167th meeting on March 7-9, 1974. Subcommittee meetings were held on this project in Los Angeles, California, on October 25, 1973, at Jackson, Mississippi, on December 21-22, 1973, at San Jose, California, on January 17-18, 1974, and in Washington, D. C., on March 6, 1974, and May 3-4, 1974. The site for the proposed station was visited by Committee members on December 21, 1973. In its review, the Committee had the benefit of discussions with representatives of the applicant, his consultants and contractors, and representatives of the Regulatory Staff and its consultants, and of the documents listed.

The Grand Gulf Nuclear Station will employ the BWR/6 nuclear system on which the Committee reported on September 21, 1972, and the Mark III containment concept on which the Committee reported on January 17, 1973.

The site of the Grand Gulf Nuclear Station is located in Claiborne County, Mississippi, on the east bank of the Mississippi River. The nearest population center with more than 25,000 persons is Vicksburg, Mississippi, 25 miles north-northeast of the site.

The history of seismic activity in the tectonic province including the Grand Gulf site is dominated by the three Modified Mercalli Intensity XII earthquakes which occurred near New Madrid, Missouri, in 1811-1812. The applicant's studies support a conclusion that the New Madrid earthquake zone is confined to a region extending northward from near Memphis, Tennessee, and the Regulatory Staff and its consultants concur that possible future major earthquakes in this tectonic province should be so confined. On this basis a safe shutdown earthquake ground acceleration of 0.15g in the Catahoula formation at the site, and 0.2g for those Category I structures founded in formations above the Catahoula formation, has been selected. The Committee finds this seismic design basis to be acceptable. However, the Committee recommends that, in the design of the plant, the applicant give careful attention to the possible effects of long duration, low frequency ground shaking.

The General Electric Company is pursuing an analytical and experimental program intended to provide more detailed knowledge of the behavior of the Mark III containment system and to confirm the design bases of the Grand Gulf Station. Among the phenomena for which further information will be obtained are vent-clearing, vent-interaction, pool stratification, and dynamic loads on suppression-pool and other containment structures. A well-defined and well-executed experimental program is of great importance to the validation of the Mark III concept and should be pursued diligently and expeditiously. Should any results indicate a significant deviation from current predictions of the designer, the Committee wishes to be informed.

The Regulatory Staff is continuing its review of the criteria for, and the preliminary design of, guard pipes around process lines traversing the region between the drywell and the containment. In view of the importance of the guard pipe function, special care, including use of conservative design stresses and achievement of an independent design check, should be taken. Because these pipes constitute a part of containment, it also is important that appropriate precautions be taken to assure the integrity of any penetrations incorporated, such as inspection hand holes. These matters should be resolved in a manner satisfactory to the Regulatory Staff.

The applicant reported a marked reduction in the use of non-metallic insulation within the drywell which might, if displaced, plug screens or otherwise lead to a short or long term degradation of the efficacy of the heat removal systems required in the unlikely event of a loss-of-coolant accident. This matter should be resolved in a manner satisfactory to the Regulatory Staff.

The applicant reported plans to utilize means to monitor for loose parts in the reactor pressure vessel during operation.

The applicant reported calculated peak cladding temperatures of 1515°F using interim acceptance criteria evaluation models, including densification. He also reported that he anticipated about 100°F or less increase in calculated peak cladding temperatures when the evaluation model for the recently adopted ECCS Acceptance Criteria is implemented. The Committee believes that such improvements are appropriate for reactors whose construction permits are requested after January 7, 1972, as noted in the Committee's report of September 10, 1973 on Acceptance Criteria for Emergency Core Cooling Systems for Light-Water-Cooled Nuclear Power Reactors.

To meet Regulatory Guide 1.7 the applicant has proposed a combustible gas control system in which a high-capacity recirculation system is available to mix the gases in the drywell and surrounding containment building beginning ten minutes after a postulated loss-of-coolant accident, should the hydrogen generation be as large as assumed in this guide. The proposed combustible gas-control system includes recombiners, is redundant, and is designed to meet engineered safety system requirements. However, the mixing system is relatively complicated and would require careful attention to reliability considerations.

The applicant has described an alternative system for the control of combustible gas, based on hydrogen generation resulting from only one percent metal-water reaction as compared to the five-percent figure required by Regulatory Guide 1.7. The Committee believes that the design of this plant, including the reactor core, the ECCS, and the containment system, are such that the assumption of one percent metal-water reaction is sufficiently conservative, and that use of the alternative system is preferable.

The applicant has stated that the station will be designed to deal with main steam line isolation valve leakage in a manner satisfactory to the Regulatory Staff. The Committee wishes to be kept informed of the resolution of this matter.

The Regulatory Staff is continuing to review several matters relating to the reactor instrumentation and control system, including system response to a turbine trip and the possible operation of control rods in groups. The Committee wishes to be kept advised of the resolution of these matters.

Generic problems relating to large water reactors have been identified by the Regulatory Staff and the ACRS and have been discussed in the Committee's report dated February 13, 1974. These problems should be dealt with appropriately by the Regulatory Staff and the applicant.

The ACRS believes that the above items can be resolved during construction and that, if due consideration is given to these items, the Grand Gulf Nuclear Station, Units 1 and 2 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 Dr. S. H. Bush and Dr. D. Okrent are attached.

Sincerely yours,

/s/ W. R. Stratton

W. R. Stratton
Chairman

References Attached.

Additional Comments by S. H. Bush

I believe the use of guard pipes is inappropriate in most, if not all instances, in nuclear designs. Industrial experience with such systems has not been satisfactory. There have been failures due to moisture entrapment, limited in-leakage and differential thermal loads. Such designs make visual inspection and volumetrc inspection difficult. A similar guard pipe design was suggested at the Brunswick construction permit and a suitable inspection program was substituted. While I do not dissent on this specific item, I do believe that approval of this feature for a class of reactors is undesirable. I urge that alternate approaches be considered for future BWR/6 Mark III plants.

Additional Comments by D. Okrent

Although I agree that the proposed safe shutdown earthquake for the Grand Gulf Station appears to be equivalent in level of safety to that utilized for most recent nuclear stations east of the Rockies, I find little basis for judging that the probability of exceeding the safe shutdown earthquake is less than 10^{-7} or event 10^{-6} per year. To say the least, the uncertainty in any such prediction is very large. In view of this situation I believe it would be prudent to provide some additional margin in the seismic design bases at this site and for most other future nuclear plants sited east of the Rockies.

I would also like to note specifically that, in addition to the large margins between calculated peak clad temperatures and acceptance criteria limits for a LOCA and to the diversity and stated reliability of the ECCS, an important consideration in applying the assumption of 1% clad-water reaction as an acceptable design basis for the combustible gas control system is the evaluation of the applicant that the drywell can accept the rapid burning of substantial quantities of hydrogen in the post-blowdown period without adversely affecting any vital safety function.

References

1. Preliminary Safety Analysis Report, Grand Gulf Nuclear Station, Units 1 and 2, Volumes 1 through 11.

2. Amendments 1 through 18 to the PSAR.

3. Directorate of Licensing letter to the Executive Secretary, ACRS, dated January 12, 1974 forwarding Safety Evaluation of the Grand Gulf Nuclear Station, Units 1 and 2 by the USAEC Directorate of Licensing, January 1974.

4. Directorate of Licensing letter to the Executive Secretary, ACRS, dated April 12, 1974 forwarding Supplement No. 1 to the Safety Evaluation by the USAEC Directorate of Licensing, April 12, 1974.

5. Mississippi Power & Light Company letter dated January 2, 1973 regarding fuel densification.

6. Mississippi Power & Light Company letter dated May 10, 1973 regarding maximum allowed thermal power.

7. Mississippi Power & Light Company letter dated October 17, 1973 regarding seismic survey program.

8. Mississippi Power & Light Company letter dated November 30, 1973 regarding miscellaneous additional information.

9. Mississippi Power & Light Company letter dated December 4, 1973 regarding proprietary seismic data.

10. Mississippi Power & Light Company letter dated December 11, 1973 regarding additional proprietary seismic data.

11. Mississippi Power & Light Company letter dated December 12, 1973 regarding additional proprietary seismic data.

12. Mississippi Power & Light Company letter dated December 12, 1973 regarding other proprietary information.

13. Mississippi Power & Light Company letter dated December 18, 1973 requesting an exemption to proceed with construction.

14. Mississippi Power & Light Company letter dated January 9, 1974 regarding additional information.

15. Mississippi Power & Light Company letter dated January 10, 1974 regarding ATWS.

16. Mississippi Power & Light Company letter dated January 29, 1974 regarding request for exemption to proceed with construction.

17. Mississippi Power & Light Company letter dated February 6, 1974 regarding additional information.

18. Mississippi Power & Light Company letter dated April 8, 1974 regarding guard pipes and blowdown from a recirculation line.

19. Mississippi Power & Light Company letter dated April 11, 1974 regarding seismic design.