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

January 17, 1973

Honorable James R. Schlesinger
Chairman
U. S. Atomic Energy Commission
Washington, D. C. 20545

Subject: REPORT ON SHEARON HARRIS NUCLEAR POWER PLANT, UNITS 1, 2, 3, AND 4

Dear Dr. Schlesinger:

At its 153rd meeting, January 11-13, 1973, the Advisory Committee on Reactor Safeguards completed its review of the application of the Carolina Power and Light Company for a permit to construct the Shearon Harris Nuclear Power Plant, Units 1, 2, 3, and 4. The project was considered at Subcommittee meetings held at the plant site on October 19, 1972, and in Washington, D. C. on January 10, 1973. During its review, the Committee had the benefit of discussions with representatives and consultants of Carolina Power and Light Company, the Westinghouse Electric Corporation, Ebasco Services Incorporated, and the AEC Regulatory Staff, and of the documents listed. The Committee reported to the Commission on March 8, 1972, its acceptance of the applicant's proposal for a single review of the application to construct four reactors at the Shearon Harris Nuclear Power Plant site.

In its report of March 8, 1972, the Committee noted that, in response to its concern, the applicant emphasized that his 1979 and 1980 units (representing Units 3 and 4) "will represent the same quality of safety incorporated in other units which beco · operational during that time period." The Committee believes that the Regulatory Staff should follow closely the development of design details and the construction of the Shearon Harris plant so that appropriate improvements in safety-related systems can be incorporated in a timely manner.

The Shearon Harris Nuclear Power Plant is to be located in a sparsely populated region in Wake County, North Carolina, about 16 miles southwest of Raleigh (population 124,000). The exclusion radius is to be 7000 feet (2133 meters) and the low population zone radius has been selected to be three miles. The applicant stated that an underground liquefied petroleum gas pipeline which now traverses the proposed exclusion area will be relocated to be outside the exclusion area.

Each of the four units for this plant will employ a 3-loop Westinghouse pressurized water reactor, to be operated at power levels up to 2775 MW(t). The nuclear steam supply system, including the reactor, is essentially identical to the 3-loop Westinghouse system to be provided for the Summer Nuclear Station, Unit 1 which has slightly higher reactor power, coolant flow rate, and coolant temperature than previous 3-loop Westinghouse systems and on which the Committee has reported recently. The Committee believes that appropriate additional evidence regarding core behavior will be obtained from reactors of similar design prior to operation of the plant.

The plant will be constructed adjacent to a main reservoir of approximately 10,000 acres with a normal average depth of approximately 27 feet which will be created by constructing a Seismic Category I earthen dam on Buckhorn Creek about 2½ miles north-northeast of its confluence with the Cape Fear River. The main reservoir will serve as the principal source of plant cooling water. The Cape Fear River will be used as a supplemental source, when necessary. An auxiliary reservoir is to be formed by constructing a Seismic Category I dam across an arm of the main reservoir adjacent to the plant site. The auxiliary reservoir will serve as an emergency source of service water. Design details of these dams and related spillways are under development and should be reviewed by the Regulatory Staff prior to construction.

The applicant plans to design the Shearon Harris Nuclear Power Plant to withstand a bedrock acceleration of 0.15 g for the safe shutdown earthquake (SSE) and an acceleration of 0.075 g for the operating basis earthquake (OBE). The Committee finds these accelerations acceptable for this plant.

In order to satisfy requirements with regard to efficacy of the emergency core cooling systems for these reactors, the applicant proposes to limit the maximum permissible linear power by reducing peaking factors. The applicant described an experimental and analytical program intended to provide improved understanding of phenomena entering into the loss-of-coolant accident, which can provide the basis for developing improvements in ECCS design. He also described flexibility in design which can be used to improve ECCS effectiveness. The Committee believes it important that improvements in ECCS effectiveness be included in the Shearon Harris Plant, and recommends that the final design of the ECCS be reviewed by the Regulatory Staff and the ACRS prior to fabrication and installation of major components.

The applicant intends to use pre-pressurized fuel and is considering other modifications of the fuel assemblies. The fuel rod problem involving densification and associated movement of the fuel pellets is undergoing intensive investigation. The Regulatory Staff and the ACRS should review the resolution of this matter.

The Committee recommends that the applicant give careful attention to the use and improvement of instrumentation capable of providing continuing quantitative information on the local performance characteristics of high power density cores. Although the applicant does not propose to install a fixed in-core flux monitoring system, he stated that it would be possible to install such a system; the Committee believes this flexibility should be retained.

The Committee finds that the applicant's estimates of the probability of generation of large high-energy missiles, in the unlikely event of a turbine failure, are significantly smaller than those that others have derived from existing world experience. The Committee believes that the applicant has not, as of now, demonstrated that the probability of an intolerable accident arising from turbine missile generation is acceptably low, and recommends that, unless the applicant can demonstrate this probability to be acceptably low, further measures both to reduce the probabilities and the potential consequences of turbine missile generation be studied and implemented. Analytical and experimental work on the penetration of reinforced concrete by missiles of the type of interest is an example of the kinds of data important to evaluation of this problem.

The Committee believes that protection against pipe whip should be provided in accordance with criteria being developed by the AEC Regulatory Staff.

The applicant has proposed criteria for means to mitigate safety-related consequences of a possible main steam line or feedwater line rupture outside the containment building. This matter should be resolved in a manner satisfactory to the Regulatory Staff; the Committee wishes to be kept informed.

The Committee reiterates its previous comments concerning the need to study further means of preventing common mode failures from negating reactor scram action, and the design features to make tolerable the consequences of failure to scram during anticipated transients. The Committee believes it is desirable to expedite these studies and to implement in timely fashion such design modifications as are found to improve significantly the safety of the plant in this regard. This matter should be resolved during construction in a manner satisfactory to the Regulatory Staff and the ACRS.

Emergency onsite a-c power for this plant will be provided by two sets of diesel-driven generators -- one set assigned to Units 1 and 2 and the other set to Units 3 and 4. Each set would consist of three diesel generators, one for each unit and one to be shared such that its power can be directed to either unit. The applicant stated that he proposes to proceed on this basis for Units 1 and 2 but that he will maintain flexibility to make modifications to the design of the onsite emergency a-c system for Units 3 and 4 pending formulation of AEC criteria for sharing of electrical systems of multi-unit plants. The Committee believes that this approach is satisfactory. The details of the onsite power system for all four units should be resolved in a manner satisfactory to the Regulatory Staff.

The applicant reported that the criteria for design of safety-related items in the instrumentation and control system will meet the requirements of IEEE-279 (1971). Details should be resolved in a manner satisfactory to the Regulatory Staff.

The Committee believes it desirable for the applicant and the Regulatory Staff to review further the Shearon Harris Nuclear Power Plant for design features, in accordance with Safety Guide No. 17, that should reduce the possibility of sabotage.

Other problems relating to large water reactors, which have been identified by the Regulatory Staff and the ACRS and cited in previous reports should be dealt with appropriately by the Regulatory Staff and the applicant as suitable approaches are developed.

The Committee believes that the items mentioned above can be resolved during construction and that, if due consideration is given to these items, the Shearon Harris Nuclear Power Plant Units 1, 2, 3, and 4 can be constructed with reasonable assurance that these units can be operated without undue risk to the health and safety of the public.

Sincerely yours,

H. G. Mangelsdorf

H. G. Mangelsdorf
Chairman

References attached

References - Shearon Harris

1. Amendments 3-4, 6-10, 12-13, 15, and 17-20 to the License Application

2. Carolina Power & Light Company (CP&L) letter dated October 26, 1972

3. Safety Evaluation by Directorate of Licensing dated December 22, 1972