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

September 23, 1970

Honorable Glenn T. Seaborg  
Chairman  
U. S. Atomic Energy Commission  
Washington, D. C. 20545

Subject: REPORT ON OCONEE NUCLEAR STATION UNIT NO. 1

Dear Dr. Seaborg:

During its 125th meeting, September 17-19, 1970, the Advisory Committee on Reactor Safeguards completed its review of the application of the Duke Power Company for a license to operate Unit 1 of the Oconee Nuclear Station at power levels up to 2568 MW(t). The Committee met with the applicant during its 124th meeting, August 13-15, 1970 and Subcommittee meetings were held on June 23, 1970, at the site and on July 31, 1970 and September 9, 1970, in Washington, D. C. In the course of the review, the Committee had the benefit of discussions with representatives and consultants of the applicant, the Babcock and Wilcox Company, the Bechtel Corporation, and the AEC Regulatory Staff, and of study of the documents listed.

The Oconee Station is located in a rural area of Oconee County, South Carolina. The nearest population center is Anderson, 21 miles south, with a population of about 41,000. The minimum exclusion distance for the completed three-unit power station will be one mile and the Low Population Zone radius will be six miles containing about 3,400 people. The water supply for the plant is taken from Lake Keowee which was created by the applicant. The lake and associated recreational facilities are expected to attract a transient population to the area.

The application covers Oconee Units 1, 2, and 3, but this report applies only to Unit 1, which will employ the first of the Babcock and Wilcox two-loop, four-pump, pressurized water reactor, nuclear steam supply systems. The three units are designed to be nearly identical, but some facilities and services are shared in various arrangements. The Committee has reviewed the temporary arrangements necessitated by operation of Unit 1 while Units 2 and 3 are still under construction. It is believed that the proposed physical measures and administrative procedures to isolate the operating unit from construction activities are adequate.

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The Committee reported to you on the construction permit application for this power station on July 11, 1967. At that time the proposed operating power was to have been 2452 MW(t); the current proposal for operating at powers as high as 2568 MW(t) is justified by the applicant, primarily on the basis of a flatter power distribution. Prior to operation at the higher power level, reactor operation should be reviewed by the Regulatory Staff.

The prestressed concrete containment building is similar to those for the Palisades and Point Beach plants which have been reviewed recently for operation.

The Committee recommends that the applicant accelerate his studies of means of preventing common failure modes from negating scram action and of design features to make tolerable the consequences of failure to scram when required during anticipated transients. As solutions develop and are evaluated by the Regulatory Staff, appropriate action should be proposed and taken by the applicant on a reasonable time scale. The Committee wishes to be kept informed.

The applicant has proposed using a power-to-flow ratio signal as a diverse means to cause shutdown of the reactor if emergency core cooling action should be initiated. The Committee believes it is necessary that either the equipment associated with this signal be demonstrated to be able to survive the accident environment for an adequate time or a different, diverse trip signal be employed. This matter should be resolved to the satisfaction of the Regulatory Staff.

The Committee suggests that developmental techniques, such as neutron noise analysis and use of accelerometers, be considered as an aid in ascertaining displacements, changes in vibration characteristics, and the presence of loose parts in the primary systems. The Committee notes the desirability of the continuing use of some thermocouples in the core.

The Committee has commented in previous reports on the development of systems to control the buildup of hydrogen in the containment which might follow in the unlikely event of a loss-of-coolant accident. The applicant proposes to make use of a purging technique after a suitable time delay subsequent to the accident. Relatively high off-site doses possibly could result following purging of the containment. The Committee recommends that purging systems be incorporated in the plant but that the primary protection in this regard should utilize a hydrogen control method which keeps the hydrogen concentration within safe limits by means other than purging. The

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hydrogen control system and provisions for containment atmosphere mixing and sampling should have redundancy and instrumentation suitable for an engineered safety feature; these should be made available within the first two years of power operation. The Committee wishes to be kept informed of the resolution of this matter.

The applicant stated that the amount of radioactivity in liquid wastes normally will not be greater than one percent of 10 CFR Part 20 limiting concentrations after dilution with the minimum flow (30 cfs) below the Keowee dam. Larger flows will have proportionately smaller limiting concentrations. The mean annual discharge from the Keowee dam is expected to be 1,100 cu. ft./sec. The off-gas system has holding tank and filtering capability and gas release rates are not expected to exceed a few percent of 10 CFR Part 20 limits.

In order to protect against the postulated consequences of the accidental dropping of a fuel element, the applicant has stated that either, he will install filters in the fuel pool building exhaust system, or the equivalent control and protection will be assured by another method. This matter should be resolved to the satisfaction of the Regulatory Staff within the first year of power operation.

Improved calculational techniques are being applied to the analysis of the efficacy of the emergency core cooling system in the unlikely event of a loss-of-coolant accident. Interim results appear to be acceptable, but further calculations are needed and some phenomena important to the course of the accident require further study. This matter should be resolved in a manner satisfactory to the Regulatory Staff prior to operation at power. The Committee wishes to be kept informed.

The reactor is calculated to have a positive moderator coefficient of reactivity at power which will become negative as boron is removed from the coolant concurrent with build-up of fission products and fuel burnup. The applicant plans to perform tests to verify that divergent azimuthal xenon oscillations cannot occur in this reactor. The Committee recommends that the Regulatory Staff follow the measurements and analyses related to these tests.

A conservative method of defining pressure vessel fracture toughness should be employed that is satisfactory to the Regulatory Staff.

Other problems relating to large water reactors which have been identified by the Regulatory Staff and the ACRS and cited in previous reports to you should be dealt with appropriately by the Staff and applicant in the Oconee Unit 1 power plant as suitable approaches are developed.

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Committee on Reactor Safeguards believes that, if due attention to the items mentioned above, and subject to satisfaction of construction and preoperational testing there is assurance the Oconee Nuclear Plant Unit 1 can be operated at power levels up to 2568 MW(t) without undue risk to the health and safety of the public.

Sincerely yours,

/s/

Joseph M. Hendrie  
Chairman

Comments by Dr. W. R. Stratton are presented below:

High off-site doses which are stated to accompany the proposed purging operation are based on calculations which include a number of assumptions which I believe to be overly conservative. It is my opinion that the situation, should ever arise, would be much less severe and that the proposed purge system would provide adequate protection for the health and safety of the public in this regard and therefore the additional hydrogen control equipment required by this letter is not necessary."

Attachment: List of References

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References:

1. Amendment No. 7 to Duke Power Company Application for Oconee Nuclear Station, Units 1, 2, and 3, consisting of Final Safety Analysis Report, Volumes I and II, received June 4, 1969
2. Amendments Nos. 8 through 21 and Revised Amendment No. 13 to the License Application.

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