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

March 9, 1971

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

Subject: REPORT ON QUAD-CITIES STATION, UNITS 1 AND 2

Dear Dr. Seaborg:

At its 131st meeting, on March 4-6, 1971, the Advisory Committee on Reactor Safeguards reviewed the application by Commonwealth Edison Company and Iowa-Illinois Gas and Electric Company for authorization to operate the Quad-Cities Station Nuclear Units No. 1 and No. 2 at power levels up to 2511 MW(t); the Committee's review for construction was based on a design power of 2255 MW(t). The application was also considered at a Subcommittee meeting held at the site near Cordova, Illinois on March 1, 1971. During its review the Committee had the benefit of discussions with representatives of the applicants, the General Electric Company, Sargent and Lundy, Inc., United Engineers and Constructors, Inc., the AEC Regulatory Staff, and their consultants. The Committee also had the benefit of the documents listed below. The Committee reported to you on the construction of these units in its letter of December 14, 1966.

Units 1 and 2 of the Quad-Cities Station located near Cordova, Illinois next to the Mississippi River are identical BWRs, substantially similar in design to Dresden Units No. 2 and No. 3. The Dresden units were reviewed for operating licenses at a similar power level; these reviews were reported to you in the Committee's letters of September 10, 1969 and July 17, 1970.

The applicant has estimated that the water level would reach plant grade at the Quad-Cities site in the event of a Mississippi River flood having a discharge of about 585,000 cfs, which exceeds the flood of historic record but is about half the Probable Maximum Flood. In the event of a predicted flood level above plant grade, the applicant proposes to shut down the reactor

and to flood necessary portions of the plant in order to maintain structural integrity and enable shutdown heat removal. The Regulatory Staff should assure itself as to the adequacy of the emergency plans prepared to deal with this unlikely event.

The Committee recommends that provisions be made to remove radioactivity from moderate conductivity liquid wastes and that low conductivity liquid wastes be processed for recycle to the reactor cooling system. The Committee also recommends that maximum use be made of all liquid waste treatment systems so that releases to the river are limited to very low levels with regard to both the concentration in the discharge canal and the total amount of radioactivity.

The Quad-Cities units will employ a mixture of gadolinium and uranium oxides in certain fuel rods for reactivity control during the first fuel cycle as a substitute for boron-steel curtains. Analyses by the applicant indicate that the mechanical and thermal characteristics of these rods are acceptable; a surveillance program is planned in order to follow the performance of these rods.

Further studies should be made of the possible effects of a dropped fuel cask on the integrity of the spent fuel pool. Means of reducing damage should be examined and measures taken, if necessary, to provide the needed degree of integrity. This matter should be resolved on a reasonable time scale in a manner satisfactory to the Regulatory Staff.

The Committee recommends that a confirmatory vibration test program be undertaken as part of the start-up and power ascension test program. This matter should be resolved with the Regulatory Staff. It is also recommended that consideration be given to the use, on a developmental basis, of neutron noise measurements, accelerometers, or other devices to provide information concerning the occurrence of excessive vibrations, structural damage, or loose parts. The Committee wishes to support and encourage continuing efforts by the applicant to develop improved methods of inservice pressure vessel inspection.

Conservative pressure-temperature relationships should be established to cover reactor start-up and shut-down. This matter should be resolved in a manner satisfactory to the Regulatory Staff.

The containment is penetrated by a large number of small diameter instrument lines. The Committee recommends that special attention be given to assuring the continued integrity of these lines and to a program

of periodic examination and testing of the valves in these lines. The applicant should study means to reduce the rate of leakage from instrument lines, in the event of failure, to provide greater assurance that the leakage would not damage the secondary containment or bypass the building filters. The adequacy of measures taken with regard to such instrument lines should be confirmed by the Regulatory Staff.

The applicant has indicated that the biological shield surroundng the reactor vessel can withstand the internal pressure that could be developed by a failure in the region of a nozzle safe-end; in addition, analyses of the effects of possible jet forces of such leaks should be provided to assure that such forces would not lead to failure of the shield with unacceptable consequences.

Provisions have been made to avoid possible damage to the containment if a recirculation line were to fail. The Committee believes that additional analyses should be made by the applicant to show that the unlikely failure of other lines inside the containment would not lead to unacceptable consequences due to pipe whipping. These analyses should be reviewed by the Regulatory Staff.

Performance of the emergency core cooling system has been reevaluated for the effects of possible variations in heat transfer coefficients and other parameters with regard to fuel clad temperatures. Additional studies are underway by the applicant and his contractors to provide further assurance that postulated loss-of-coolant accidents, as analysed with conservative assumptions, will not lead to peak clad temperatures which exceed limits acceptable to the Regulatory Staff. The Committee believes that these studies should be expedited and the matter resolved in a manner satisfactory to the Regulatory Staff prior to routine operation at full power. 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 of design features to make tolerable the consequences of failure to scram during anticipated transients. The Committee believes it 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. The Committee wishes to be kept informed of the resolution of this matter.

The Committee has commented in previous reports on the development of systems to control the buildup of hydrogen in the containment that might follow in the unlikely event of a loss-of-coolant accident. The applicant proposes to use a purging technique after a suitable time delay subsequent to the accident. The Committee believes that purging capability should be retained, but that the primary protection in this regard may need to utilize a method of hydrogen control other than purging. The applicant should submit, on a reasonable time scale, a proposed design for hydrogen control for review by the Regulatory Staff. The Committee wishes to be kept informed of the resolution of this matter.

The Committee believes the containment should be inerted during operation of the reactor. The Committee recognizes that inerting makes inspection and repair of the primary system more difficult, and believes it acceptable to de-inert during operation just prior to a shutdown and to re-inert during startup and operation following a shutdown. It is recommended that the need for inerting be reviewed periodically as operating experience and further knowledge from current development work are obtained, and as other means of coping with the hazards from accident-generated hydrogen are found.

The Advisory Committee on Reactor Safeguards believes that, if due regard is given to the items mentioned above, and subject to satisfactory completion of construction and pre-operational testing, there is reasonable assurance that the Quad-Cities Station Units 1 and 2 can be operated at power levels up to 2511 MW(t) without undue risk to the health and safety of the public.

Sincerely yours,

/s/ Spencer H. Bush

Spencer H. Bush
Chairman

References Attached

References (Quad-Cities Station)

1. Commonwealth Edison Company letter, dated August 30, 1968 with Safety Analysis Report, Vols. I, II, and III, for Quad-Cities Station

2. Commonwealth Edison Company letter, dated June 16, 1970 with Revised Safety Analysis Report, Vols. I, II, and III, for Quad-Cities Station

3. Amendments 8 through 20 to Safety Analysis Report for Quad-Cities Station

4. Quad-Cities Station Environmental Report, dated November 16, 1970, Commonwealth Edison Company