ADVISO~~Y COMMITTEE ON REACTOR S~~EGUARDS
UNITED STATES ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

August 10, 1971

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

Subject: REPORT ON LIMERICK GENERATING STATION UNITS 1 AND 2

Dear Dr. Seaborg:

At its 136th meeting, August 5-7, 1971, the Advisory Committee on Reactor Safeguards completed its review of the application from the Philadelphia Electric Company for a permit to construct the two-unit Limerick Generating Station. The project was considered at Subcommittee meetings on November 10, 1970 at the plant site, and on March 31 and July 29, 1971, in Washington, D. C. During its review the Committee had the benefit of discussions with representatives and consultants of the applicant, the General Electric Company, and the AEC Regulatory Staff. The Committee also had the benefit of the documents listed below.

The Limerick Station will be located in Pennsylvania on a 587-acre site on the Schuylkill River about midway between Philadelphia and Reading. The nearest population center is Pottstown (1960 population - 26,000; year 2000 predicted population - 55,000) with its nearest boundary 1.7 miles to the northwest. The low population zone radius is 1.3 miles. The estimated population in 1968 was 500 persons within one mile and 5,200 persons within two miles. The minimum exclusion distance is about 2,500 feet, which extends to the west bank of the Schuylkill River and includes a small uninhabited island owned by the State of Pennsylvania. The City of Philadelphia is 20.7 miles to the southeast with a 1970 census population of about 2,000,000.

Each unit of the Limerick Station includes identical boiling water reactors to be operated at a power level of 3293 MWt. The core designs, power densities, and other features of the nuclear steam supply systems are essentially identical to the Browns Ferry units of the Tennessee Valley Authority and Peach Bottom Units 2 and 3 currently under construction by the Philadelphia Electric Company. Waste heat is rejected to the atmosphere by two natural draft cooling towers. The normal cooling water requirement of 74 cfs, including 54 cfs for consumptive use, is supplied from the Schuylkill River. To provide another source during drought periods arrangements are being made to obtain water from the Delaware River.

The containment is of the over-under pressure suppression type similar to that of the Shoreham Nuclear Power Station. The drywell is a reinforced concrete, steel-lined truncated cone; the wetwell is a cylinder of similar construction. The drywell and wetwell are separated by a 3-1/2 foot thick reinforced concrete floor penetrated by 85 vent pipes. A low-leakage, Class I reactor building surrounds both units which share a single compartment above the level of the refueling floor and occupy separate compartments below this level. The building is designed to relieve through blow-out panels at an internal pressure of 7 inches of water, an arrangement which the applicant has stated serves to protect engineered safety equipment from excessive steam exposure while still maintaining offsite doses from postulated process steamline failures far below 10 CFR Part 100 guidelines.

The reactor building in-leakage at a differential pressure of 1/4 inch of water will be limited to 50% of the building volume per day. On isolation of the building a recirculation-filtration system starts automatically, continuously processing about 60,000 cfm through HEPA and charcoal filters. A small fraction of the discharge of this system is exhausted to the outside environment through the standby gas treatment system which includes deep-bed, charcoal filters.

The entire length of the main steam lines, up to and including the turbine stop valves, will be designed to Class I seismic standards. The main steam lines from the downstream isolation valve to the turbine stop valve will be designed and fabricated in substantial accordance with the requirements for AEC quality assurance Classification Group B. In addition, the Committee believes it appropriate to design and install all connected piping down to 2-1/2 inches in diameter to Class I seismic standards out to and including the first valve. The applicant has stated that he will install a third steam line isolation valve downstream of the two fast-acting valves or develop an equivalent water-seal system acceptable to the Regulatory Staff.

The biological shield is to be constructed of magnetite concrete placed between steel plates. The shield will be reinforced near openings to insure integrity for postulated ruptures in the vicinity of nozzles. The Committee believes that the entire biological shield should be designed to have reasonable ability to withstand internal pressure and jet forces.

The emergency core cooling system (ECCS) has been changed in several ways. The high pressure coolant injection (HPCI) system has been modified to inject water directly into the core through the spray sparger rather than into the downcomer region by the feedwater sparger. In addition, the applicant has stated that the turbine driven HPCI pump will also be modified to the extent feasible to increase the volume of water delivered to the core. The low pressure coolant injection (LPCI) system has been changed to inject water inside the core shroud through four vessel penetrations. Each of two pairs of LPCI pumps feed a header serving two nozzles. The applicant has stated that these changes provide increased reliability of these systems and reductions in the peak clad temperatures attained in the unlikely event of a loss-of-coolant accident.

The radioactive waste disposal systems include several features beyond those normally provided in boiling water reactor plants. The liquid waste system permits the recycling of equipment and floor drain wastes and the evaporation of chemical and laundry wastes before discharge to the environment. The gaseous waste system provides for the recombining of hydrogen and oxygen, condensing the vapor, hold-up for decay of short-lived isotopes, and cryogenic separation of the noble gases. Krypton and xenon may be stored for periods sufficiently long that krypton-85 becomes the only significant remaining radioisotope. Provisions will be made to utilize non-radioactive steam in the turbine gland seals and to process containment purge gases when deinerting. The Committee believes that these waste management systems are capable of limiting releases of radioactivity to the environment to levels that are as low as practicable.

The applicant has studied design features to make tolerable the consequences of failure to scram during anticipated transients, and has concluded that automatic tripping of the recirculation pumps and injection of boron could provide a suitable backup to the control rod system for this type of event. The Committee believes that this recirculation pump trip represents a substantial improvement and should be provided for the Limerick reactors. However, further evaluation of the sufficiency of this approach and the specific means of implementing the proposed pump trip should be made. This matter should be resolved in a manner satisfactory to the Regulatory Staff and the ACRS during construction of the reactor.

The applicant has stated that a system will be provided to control the concentration of hydrogen in the primary containment that might follow in the unlikely event of a loss-of-coolant accident. The proposed system is not capable of coping with hydrogen generation rates in accordance with current AEC criteria unless the primary containment is inerted. Therefore, the Committee believes that the containment should be inerted and that the hydrogen control system should be designed to maintain the hydrogen concentration within acceptable limits using the assumptions listed in AEC Safety Guide 7, "Control of Combustible Gas Concentrations in Containment Following a Loss of Coolant Accident."

The applicant has selected a value of 0.12 g for the acceleration representing the maximum ground motion at the site and on which Class I seismic design is to be based. The Committee recommends a minimum acceleration of 0.15 g be used for the design basis earthquake for this site.

Other problems related to large water reactors have been identified by the Regulatory Staff and the ACRS and cited in previous ACRS reports. The Committee believes that resolution of these items should apply equally to the Limerick Station.

The Committee believes that the items mentioned above can be resolved during construction and that, if due consideration is given to these items, the Limerick Generating 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.

Sincerely yours,

Spencer H Bush

Spencer H. Bush
Chairman

References

1. Philadelphia Electric Company Preliminary Safety Analysis Report (Volumes 1 through 5), for Limerick Generating Station Units 1 and 2

2. Amendments 1, 2, 3, 4, 6, 7, 9 & 10 to the License Application of Philadelphia Electric Company for the Limerick Generating Station Units 1 and 2