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

May 20, 1965

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

Subject: REPORT ON SOUTHWEST EXPERIMENTAL FAST OXIDE REACTOR (SEFOR)

Dear Dr. Seaborg:

At its sixty-second meeting, March 11-13, 1965, and at its sixty-third meeting, May 13-15, 1965, the Advisory Committee on Reactor Safeguards considered the application of the General Electric Company for a construction permit for the Southwest Experimental Fast Oxide Reactor (SEFOR). The Committee had the benefit of discussions with representatives of the applicant, the AEC Staff and its consultants, and of the documents listed. A preliminary review of the project was held at the Committee's 48th meeting. Members of the Committee visited the site of the proposed reactor on February 19, 1965, and Subcommittee meetings were held on January 14, 1965, and March 4, 1965.

SEFOR will have mixed plutonium oxide - uranium oxide fuel and sodium coolant, and is to be operated at a maximum steady state power level of 20 MW(t). The core volume will be roughly 500 liters; the fuel will contain about 16% plutonium; and approximately 11% by volume of BeO will be added to the core to lower the average neutron energy and provide a Doppler coefficient similar to that of much larger fast reactors.

The principal purpose of operating SEFOR with this core is to study the nuclear characteristics of such a system, particularly the Doppler effect. The planned experimental program includes critical experiments and oscillator measurements at steady power. The intent to perform super-prompt-critical transient tests, after the reactor characteristics are well understood, has been mentioned by the applicant, but a review of transient testing was not requested and has not been made by the Committee.

The proposed reactor site is a 620 acre tract of land owned by the Southwest Atomic Energy Associates and located in Cove Creek Township, Washington County, Arkansas. The site is approximately 16 miles south-southwest of Fayetteville and 29 miles north-northeast of Fort Smith.

As yet no meteorological data exist for the site, but preliminary estimates of atmospheric dispersion have been made, based on the records of surrounding stations. The applicant proposes to make wind velocity and direction measurements on-site in order to obtain meaningful diffusion factors that can be applied to potential release conditions.

The proposed site is in an area of only minor seismic activity, and the SEFOR plant will be designed accordingly. The SEFOR site is located in a region having a relatively high incidence of tornadoes, and the outer containment building and the air blast heat exchangers will be designed to withstand loads resulting from winds up to 300 mph.

The reactor building will provide two containment barriers, an outer cylindrical steel containment vessel, and an inner, reinforced concrete, steel-lined containment. The inner containment will normally contain an oxygen-depleted atmosphere.

A design criterion for the inner containment is that it withstand the energy release and missiles associated with credible reactivity accidents. A few structural details remain to be discussed between the applicant and the Regulatory Staff.

Provisions will be made to prevent re-criticality in the unlikely event of large scale melting and any subsequent motion of the fuel out through the bottom of the reactor vessel.

The primary cooling system of the reactor is comprised of a main and an auxiliary loop. In the event of a major break in a main primary pipe, the sodium level in the reactor vessel would fall rapidly and uncover the main vessel nozzles. The applicant has stated that model experiments will be performed to assure no significant gas entrainment in the sodium of the auxiliary system under these circumstances.

Reactor control will be accomplished by vertical movement of ten reflector segments that are outside the reactor vessel. Design of the control rod system and the fuel element is not complete, and the Committee would like to be informed of the design details when these are available. The General Electric Company has stated that details of the reactor instrumentation will be supplied for review prior to actual fabrication and installation of such equipment.

The shutdown margin is calculated to be 7.4 dollars of reactivity with all control rods inserted. If control rod worth, as measured in ZPR-III critical experiments, is found to be much less than that calculated, General Electric proposes to utilize a considerable reduced shutdown

margin, as low as 2 dollars. The Committee does not now agree to the suitability of the smaller shutdown margin and wishes to review this matter, should measured control rod worths prove to be quite low.

The reactor is calculated to have a Doppler coefficient (T dk/dt) of -0.008, and to have a small maximum positive reactivity contribution if centrally preferential sodium voiding occurs. If the reactivity coefficients measured in ZPR-III prove to be considerably different from those calculated, the Committee would like to review the situation.

The Advisory Committee on Reactor Safeguards believes that the items mentioned above can be suitably resolved during construction, and that the proposed reactor can be constructed at the site selected with reasonable assurance that it may be operated without undue risk to the health and safety of the public.

Sincerely yours,

/s/
W. D. Manly
Chairman

References Attached.

References (SEFOR)

1. Preliminary Safeguards Summary Report, Part I, Southwest Experimental Fast Oxide Reactor, undated, received November 5, 1964.
2. Preliminary Survey of the Site of the SEFOR Project, Washington County, Arkansas, prepared by the University of Arkansas, Fayetteville, dated December 16, 1963.
3. Preliminary Safeguards Summary Report, Supplement No. 1, Southwest Experimental Fast Oxide Reactor, undated, received February 24, 1965.
4. Page 3-62, Answer, undated, received February 24, 1965.
5. Supplement No. 2 to License Application for Southwest Experimental Fast Oxide Reactor (SEFOR), dated March 9, 1965.
6. Preliminary Safeguards Summary Report, Supplement No. 3, Southwest Experimental Fast Oxide Reactor, transmitted by Supplement No. 3 to License Application, dated March 29, 1965.
7. Supplement No. 4 to License Application for Southwest Experimental Fast Oxide Reactor, dated April 16, 1965.
8. Report to AEC Regulatory Staff by David B. Hall of the Los Alamos Scientific Laboratory Concerning Evaluation of the Energy Release Due to Large Reactivity Excursions in the Proposed Southwest Experimental Fast Oxide Reactor (SEFOR), dated April 1965.
9. Report to AEC Regulatory Staff, Adequacy of the Structural Criteria for the Proposed Southwest Experimental Fast Oxide Reactor (SEFOR) by N. M. Newmark and W. J. Hall, dated April 1965.
10. Letter dated April 26, 1965 from Coast and Geodetic Survey to AEC Director of Regulation with attached "Report on the Seismicity of the Washington County, Arkansas Area".
11. Geological Survey, "Review of the Hydrology and Geology of the Site for the Southwest Experimental Fast Oxide Reactor (SEFOR) near Fayetteville, Arkansas", dated April 1965.