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

May 18, 1973

Honorable Dixy Lee Ray
Chairman
U. S. Atomic Energy Commission
Washington, D. C. 20545

Subject: REPORT ON FAST FLUX TEST FACILITY

Dear Dr. Ray:

During its 157th meeting, May 10-12, 1973, the Advisory Committee on Reactor Safeguards completed a review of the Commission's plans to construct the Fast Flux Test Facility (FFTF). The Committee reported previously on this subject on July 13, 1971, and January 13, 1972. The project was also considered during the 151st and 152nd meetings, November 9-11 and December 7-9, 1972, and at Subcommittee meetings in Denver, Colorado, on September 28 and 29, 1972, in Washington, D. C., on November 8, 1972, and in Des Plaines, Illinois, on January 4, 1973. Two members visited the site on September 30, 1972. During its review, the Committee had the benefit of discussions with representatives and consultants of the Commission's Division of Reactor Development and Technology (DRD&T), the Hanford Engineering Development Laboratory of the Westinghouse Hanford Company, the Advanced Reactors Division of the Westinghouse Electric Corporation, the Bechtel Corporation, and the AEC Regulatory Staff. The Committee also had the benefit of the documents listed below.

The Committee recognizes that design and construction of the facility have been undertaken with emphasis on quality assurance, and that similar emphasis is intended during operation. An extensive R&D program for verifying the adequacy of the primary coolant system, reactor internals, and reactor control features accompanies the Quality Assurance Program.

In earlier reports, the Committee discussed its review of the FFTF site, factors connected with initial construction, and concerns relating to postulated, very low probability accidents. In this letter, attention is again drawn to some points in the latter area, and comments are made on the research and development programs and analytical studies associated with the safety analysis of the facility.

The proposed design basis for the FFTF is to provide capability for containment of a postulated core disruptive accident of 150 MW-sec work energy. This capability includes: maintenance of the reactor cavity as a barrier to escape of radioactivity to the building; retention of radioactivity in the building with restricted leakage to the environment; and, effective removal of decay heat from the damaged core. In addition, DRD&T is committed to retaining flexibility in the design such that (1) the plant as currently designed or as it must be modified will be able to sustain accidents larger than 150 MW-sec, and (2) appropriate space and access will be available for installation of an ex-vessel core retention system, should the need for such provisions be demonstrated.

In the course of studying hypothetical accident energy releases, DRD&T and its contractors have examined a spectrum of initiating mechanisms and accident progression phenomena. Two postulated situations were selected for detailed analysis. Both of these are very low probability events that involve assumed failure of the reactor scram systems. One event is initiated by a loss of pumping capability (flow coast-down accident); the other by an uncontrolled insertion of reactivity at a specified rate (overpower accident). Results of detailed theoretical investigations of these incidents and the related experimental work conducted since submittal of the PSAR have been evaluated by the contractor as tending to confirm the conservatism of the design basis proposed in the PSAR.

The ACRS believes that these studies have been valuable and should be continued along with associated experimental work. However, development of considerable further information is desirable and the following recommendations are made. For at least the two types of accidents mentioned above, additional studies should be made which include parallel analyses performed in one case with best estimate assumptions and in the other case with conservative assumptions at each step of the accident calculation. A range of initiating conditions should be examined and, where appropriate, event sequences should be extended in time until a stable condition is reached, so as to assure that possible subsequent events cannot lead to significantly greater energy releases. Additional and continuing emphasis should be placed on the search for and investigation of possible autocatalytic effects that might occur in the abnormal states encountered in these studies. It is important that types of accidents additional to the two described, as well as different possible mechanisms and accident sequences, be analyzed with similar scope, thoroughness, and conservatism. Studies of the probability of accidents of differing severity should be initiated. These could be useful even if the probability of a given energy release were determined only on a relative basis for a specified accident sequence.

In view of the above comments, the Committee at this time is not persuaded that the search for accident event sequences that might be significant in regard to the health and safety of the public has been completed, and that provision for capability of containment of an accident of greater than 150 MW-sec work energy should not be required. However, because the above future studies can be expected to provide important additional information prior to start of operation of FFTF and because of the existing commitment to retain flexibility for the accommodation of larger energy releases, the Committee believes it reasonable to defer a final decision in this regard.

The Committee reiterates its earlier recommendation (Committee letter dated January 13, 1972) that an intensive program be pursued to develop an ex-vessel, post-accident core retention and cooling system suitable for installation below the reactor. The Committee emphasizes its belief that the required information should be obtained in time to enable installation prior to reactor startup, so there will be no unnecessary delay in startup, should installation be found advisable.

The Committee recommends that the necessary further regulatory review of the design basis work energy release and the requirements with regard to post-accident heat removal be scheduled and accomplished in timely fashion so that additional features, if necessary, can be provided prior to the scheduled reactor startup.

It is noted that the FFTF design does not provide an auxiliary heat removal system for dissipation of decay heat, but relies on the normal heat transport systems for this function. The Committee believes that this approach is acceptable for FFTF in view of the favorable site characteristics and the simplicity and expected high reliability of the air-dump heat rejection systems.

The Committee also wishes to note that some features of the facility, such as details of the core design and instrumentation requirements, have not been fully specified and reviewed. The Committee will examine these areas prior to operation of the reactor.

The Committee believes that the Regulatory Staff should be kept fully informed on current DRD&T contractor research and development results, and that all analytical or computational capabilities developed should be made promptly available to the Staff. It is also important that the Regulatory Staff have the capability for independent analysis of fast reactor safety.

The Advisory Committee on Reactor Safeguards believes that, in view of the favorable site and the special role of FFTF, and if due regard is given to the foregoing, it is acceptable for construction of FFTF to proceed as proposed.

Dr. Spencer H. Bush did not participate in the review of this project.

Additional comments by Dr. W. R. Stratton are presented below.

Sincerely yours,

/s/ H. G. Mangelsdorf

H. G. Mangelsdorf
Chairman

Additional Comments by Dr. W. R. Stratton

I do not believe that an ex-vessel, post-accident core retention structure or device is a necessary feature of this reactor. The evidence that I have seen leads me to conclude that design effort in this regard would not be well invested, but that a continuing research effort on properties of materials and materials interactions under extreme conditions can be justified.

References attached.

References - Fast Flux Test Facility (FFTF)

1. WARD-2171 21, "Preliminary Fast Flux Test Facility Closed Loop In-Reactor Assembly Fuel Failure Analysis," dated December 1, 1971

2. Memo, A. J. Pressesky to Director, DRL, Subject: Answers to DRL Information Request No. 5, FFTF PSAR (Project No. 448), dated January 12, 1972

3. Report from the U. S. Department of the Interior, Geological Survey, Re: Geology aspects of the Fast Flux Test Facility Site, dated February 22, 1972

4. Report from the U. S. Department of Commerce, National Oceanic and Atmospheric Administration, "Report on the Site Seismicity for the Fast Flux Test Facility," dated March 2, 1972

5. Memo, A. J. Pressesky to Director, DRL, Subject: Answers to DRL Question Set No. 5 on FFTF (P-448), dated March 31, 1972

6. ANL/RAS-71-39, "A Preliminary Study of the FFTF Hypothetical Flow Coastdown Accident," dated April 1972

7. Commentary by N. M. Newmark and W. J. Hall, Consulting Engineering Services, Subject: Preliminary Safety Analysis Report Review of the Adequacy of the structural Criteria of the Fast Flux Test Facility, Wadco Corporation, Richland, Washington, dated May 8, 1972

8. HEDL-TME 72-92, "Fast Flux Test Facility Design Safety Assessment," dated July 1972

9. HEDL-TME 72-109, "Effects of Molten Fuel Movement During a Fast Reactor Overpower Transient," dated August 4, 1972

10. Letter, Assistant Director for Nuclear Safety, RDT, to Directorate of Licensing, Re: Transmittal of revised pages to the Fast Flux Test Facility Design Safety Assessment, dated August 14, 1972

11. Safety Evaluation of the Fast Flux Test Facility by the Directorate of Licensing, USAEC, dated October 31, 1972