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

December 15, 1972

Honorable James R. Schlesinger
Chairman
U. S. Atomic Energy Commission
Washington, D. C. 20545

SUBJECT: REPORT ON POWER BURST FACILITY (PBF) TEST PROGRAM

Dear Dr. Schlesinger:

In response to a request from the Director, Division of Reactor Development and Technology (DRDT), the Advisory Committee on Reactor Safeguards has reviewed the PBF Test Program Plan dated March, 1972. The Committee last reported on the proposed PBF Test Program in its letter to Mr. Hollingsworth of November 12, 1969. In this review, the Committee had the benefit of a Subcommittee meeting held at Argonne, Illinois on August 3, 1972 and of discussions with representatives of DRDT, the Aerojet Nuclear Company, the nuclear industry and the Regulatory Staff. The Committee's comments with regard to the proposed PBF Test Program follow:

1) As in November, 1969, the ACRS believes the PBF is potentially a very valuable facility for reactor safety research. Every effort should be made to expedite an aggressive, carefully planned experimental program accompanied by a strong analytical support effort and the necessary, related out-of-reactor studies.

2) The March, 1972, program plan reflects a desirable major change in emphasis which is in general accord with the ACRS recommendations of November, 1969, which were partly reiterated in its report to you on water reactor safety research of February 10, 1972. Highest priority has been placed on potential events involving a serious power-flow mismatch which might lead to departure from nucleate boiling (DNB), fuel element melting and failure, the generation of pressure pulses, or fuel element failure propagation. Priority has also been placed on studying fuel element structural integrity and coolability under postulated loss-of-coolant accident conditions more severe than those which have been studied experimentally out-of-reactor. The Committee concurs in these general priorities.

Some water reactor safety matters which may be amenable to study in PBF have not been specifically identified in the experimental program given in the March, 1972 plan. These include the following: study of

the behavior of previously irradiated fuel in anticipated transients, wherein it is intended that a loss of cladding integrity be unlikely; and study of the behavior of fuel, coolant and structural materials under simulated decay-heat conditions to examine phenomena related to the feasibility of retention of molten fuel. The importance of research and development on these matters has been the basis for recommendations by the ACRS in several previous reports.

3) Detailed plans of the first experiments to be run in PBF, including their specific objectives and the mode of accomplishing these objectives, are not yet available. Although the PBF represents a unique facility which will enable tests related to fuel element behavior to be made in-reactor, it will require very considerable pre-planning and analysis of each test to enable the achievement of meaningful and interpretable results. Radial power variations through the test cluster, differences in hydraulic and heat transfer conditions from actual power reactors, and differences in axial power gradient and the design and form of the fuel elements, represent a few of the considerations which will require care in the planning of the actual tests.

A considerable analytical effort in support of the experimental program has been initiated by Aerojet Nuclear Company. However, this analytical effort requires augmentation, and should have the benefit of active participation by other groups in the planning of tests, particularly the water reactor vendors and the Regulatory Staff.

For the future, the Committee recommends timely participation by the Regulatory Staff in the planning and interpretation of each experiment. The Committee also recommends that the nuclear industry accept and pursue vigorously a commensurate share of the efforts required to study these fuel-related safety matters.

4) Partly because of the complexity of in-reactor experiments and partly to provide better understanding of the phenomena involved, the ACRS recommends that an appropriate out-of-reactor experimental program be pursued both in advance of and concurrently with the in-reactor PBF test series. Fuel-coolant interaction represents a potentially vital phenomenon in many of the planned tests; a vigorous program should be initiated promptly to study this effect directly for water power reactors under conditions applicable to both power-flow-mismatch and loss-of-coolant accidents. Also, extensive detailed analyses should be pursued to determine those events in which previous irradiation history, as well as fuel element and sub-assembly design, can be important to the course of the in-reactor experiment.

5) The ACRS recommends that the detailed description and the results of each experiment should be reported as early as possible, and with a wide distribution, so that full advantage can be made of all technical resources in their interpretation and possible beneficial feedback to future tests.

Sincerely yours,

C. P. Siess

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Chairman