ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
UNITED STATES ATOMIC ENERGY COMMISSION
WASHINGTON 25, D.C.

September 17, 1965

Mr. R. E. Hollingsworth
General Manager
U. S. Atomic Energy Commission
Washington, D. C.

Subject: REPORT ON REACTOR SAFETY RESEARCH PROGRAM

Dear Mr. Hollingsworth:

The Advisory Committee on Reactor Safeguards wishes to transmit further comments concerning certain aspects of the Reactor Safety Research Program. Though many of these comments reflect the briefing on parts of the program that the Reactor Safety Research Subcommittee received on August 3, 1965, others are of a more general character. The Committee is transmitting in a separate letter its views on the proposed program for experimental study of reactivity-induced accidents.

One question that arises in many safety analyses and that will be interesting in the LOFT experiment is the temperature-time history of a reactor core that has lost coolant. The analysis of this relation is complex and is hindered by the lack of experimental data obtained with realistic cores. It appears possible and of real value to perform an experiment in a facility such as SPERT-III, in which the coolant is removed after a power run, and the temperature transient of the fuel is measured under conditions which assure that fuel clad temperatures do not closely approach the melting-point. This experiment would help to provide insight into analysis of core heating and melting after a loss of coolant, and the Committee recommends that it be considered.

Relative to LOFT, the Committee wishes to offer several comments:

1) The decision to use zirconium alloy clad for the fuel in the LOFT meltdown seems to be reasonable in view of the current trend toward general use of this cladding material for water reactors. The Committee suggests that a few stainless steel clad elements be included among the predominantly zirconium clad elements, however, so that further insight into the relative behavior of the two fuel clad materials may be obtained from the test.

2) The LOFT program is already making contributions to safety through the methods of calculation and analysis that are being developed. It is to be expected that many of these methods will be useful in safety analysis of reactor plants by supplementing or replacing many of the existing methods, a number of which are proprietary. Careful documentation of the analytical techniques and general results obtained therewith is suggested.

3) The Committee recommends that calculations be made of the sensitivity of the expected consequences of the LOFT tests to the accuracy of the input data used in the analysis.

4) The intensive instrumentation studies being made for LOFT should generate a considerable amount of new information on instrument reliability, sensitivity, speed of response, etc. The Committee suggests that much of this information would be of wide interest and that it should be published.

5) If, as is still planned, the LOFT reactor is not scrammed just before or at the time of the blowdown leading to core melting, the calculated pressure-time history should include the contribution of any associated power excursions that might be considered plausible.

The Committee recommends that a study be undertaken to determine whether existing experimental information, supplemented by data from presently planned experiments, will be adequate for understanding and predicting the course of blowdown during a postulated loss of coolant accident. This should consider both the large-scale flow from the reactor vessel and the flow through the core.

The Committee believes that well-planned tests of transient behavior with an oxide-fueled core in SPERT-III will be valuable in improving the understanding of the dynamic behavior of pressurized water power reactors. The Committee is of the opinion that it is unnecessary to do nondestructive transient tests with both stainless steel clad and zircaloy clad fuel.

It is questionable that useful results would be derived from experiments to determine whether center melting affects the Doppler coefficient significantly, because of the need for high accuracy required in calculating or estimating the values of such parameters as temperature and compensated reactivity.

The Committee wishes to encourage research such as that leading to the newly-developed sonic method of locating defects in reactor vessels by triangulation. The development of this and other methods of inspecting and testing pressure vessels during their service lives is important to reactor safety.

The Committee wishes to emphasize the need for promptly obtaining definitive information concerning the rate of production of iodine compounds from airborne elemental iodine, and the degree of retention of these compounds in air cleaning apparatus.

The Committee also recommends experiments on metal-water reactions in meaningful, reactor-like configurations, if possible, to check some of the assumptions now made in analyses of such accidents.

The Committee wishes to suggest research in several areas in addition to those now approved. These are:

1) The development of greater reliability of certain components of nuclear power plants that have not shown evidence of the complete dependability desired for nuclear use. Examples are: airlock seals, isolation valves in gas and liquid systems, containment penetration seals, instrumentation components and systems, control mechanisms, and emergency power supplies.

2) Theoretical studies of the course and consequences of postulated accidents to very large water reactors including the metal-water reaction and hydrogen recombination phases. The effects of operability of various combinations of engineered safeguards should be considered.

3) The development of sophisticated analytical methods of predicting the course and effects of postulated destructive reactivity transients in large water reactors.

4) The development of methods to store and dissipate fission product gases, especially the noble gases, from confined reactors in the unlikely event of a major accident.

In addition to the areas of reactor safety considered in the foregoing, the problems of shipping highly radioactive fuel without undue hazard to the health and safety of the public will become of increasing importance as the number of reactors increases. Present shipping containers are lead-shielded. Lead has good shielding properties, but it has certain drawbacks, such as the possibility of loss by melting in accidents involving exposure to fire. Investigations made thus far in regard to container design and construction have been restricted in concept and scope. Available basic and design information should be correlated and supplemented by a co-ordinated program of additional analysis and research leading to more suitable shipping containers.

Sincerely yours,

/s/

W. D. Manly
Chairman