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

December 31, 1962

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

Subject: REVIEW OF REACTOR SAFETY RESEARCH PROGRAM

Dear Dr. Seaborg:

The Advisory Committee on Reactor Safeguards has completed the following stages of a review of the program in reactor safety research that is supported by the Division of Reactor Development:

1. A complete summary of the program by Dr. J. A. Lieberman and his branch chiefs. (Summary Report, Nuclear Safety Research & Development Program, Division of Reactor Development, June 1962, by I. E. Jackson, Jr.)

2. Review of the Spert and Step programs at the National Reactor Testing Station presented by the Phillips Petroleum Company's research group and others.

In addition, a number of reports on the Spert program have been made available to the Committee. Recently, information on tests of fission-product release and transport has been received but this has not yet been studied by the Committee.

The Committee commented on the safety aspects of the Spert I destructive tests in our letter to you dated August 30, 1962. In a letter to the General Manager, dated December 31, 1962, copy attached, the ACRS has presented further opinions on the conduct of the program including individual tests at the NRTS. The attached letter provides the initial response to a request from the Director, Division of Reactor Development, for Committee comments on the entire reactor safety research program.

Sincerely yours,

/s/ F. A. Gifford, Jr.

F. A. Gifford, Jr.
Chairman

Att. Ltr to Gen. Mgr., dtd 12/31/62

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
UNITED STATES ATOMIC ENERGY COMMISSION
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December 31, 1962

A. R. Luedecke
General Manager
U. S. Atomic Energy Commission
Washington, D. C.

Subject: REVIEW OF REACTOR SAFETY RESEARCH PROGRAM

Dear General Luedecke:

The Advisory Committee on Reactor Safeguards has completed the following stages of a review of the program in reactor safety research that is supported by the Division of Reactor Development:

1. A complete summary of the program by Dr. J. A. Lieberman and his branch chiefs. (Summary Report, Nuclear Safety Research & Development Program, Division of Reactor Development, June 1962, by I. E. Jackson, Jr.)

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In addition, a number of reports on the Spert program have been made available to the Committee. Recently, information on tests of fission-product release and transport has been received but this has not yet been studied by the Committee.

The Committee commented on the safety aspects of the Spert I destructive tests in our letter to Chairman Seaborg dated August 30, 1962. The present letter presents further opinions on the conduct of individual tests at the NRTS, and provides the initial response to a request from the Director, Division of Reactor Development, for Committee comments on the entire reactor safety research program.

General Remarks on the Spert Program

The Committee believes that the present series of Spert destructive tests, which are carried out with small fission-fragment inventories, cannot constitute a serious hazard to the health and safety of the public. Such experiments provide information very useful to the understanding of reactor accidents, and any delay of such experiments increases the probability that safety evaluations of other reactor projects may be erroneous due to lack of the new information. It is therefore recommended that review of such experiments by the ACRS, and possibly by other safety groups within the AEC, be eliminated if the operator of the experiment files with the AEC a document showing that the radiation limits specified in 10 CFR Part 20 will not be exceeded for the general public, even in case of dispersion to the atmosphere of the whole fission fragment inventory of the reactor at any time throughout the test. This simple procedure should be modified at the request of the AEC, the ACRS, or the contractor, if unusual circumstances so warrant.

The Committee also suggests that a planned program of press releases be instituted to educate the general public that releases of fission products from tests of the Spert type will not constitute an undue hazard to anyone either on or off the site. The publicity should emphasize the point that such releases are an integral part of a reactor-safety research program whose objective is to protect the health and safety of the public.

Specific Recommendations on the Spert Program

The Spert group has built up experience and skill. There are many results which give a good basis for planning future tests of this type and this part of the whole program should grow. The analytical part of the work is making progress, but it would profit from further strengthening. For example, more adequate computer facilities should be provided.

The Committee recommends that destructive tests be performed as soon as possible on low-enrichment oxide cores, since such cores are used in the majority of power reactors. The tests on highly enriched metal cores have to be relatively widely spaced to allow adequate analysis between tests. Since oxide fuel for about two cores is available at the Spert facility, consideration might be given to performing destructive tests on oxide cores while the analysis of a metal-core test is underway.

The Committee suggests that the following areas be studied:

1. The influence of slow acting, small, positive temperature and void coefficients (in particular positive coefficients extending over a limited range of temperature and voids) on destructive or other severe transients. Such limited positive coefficients may prove to be without much influence on these transients; and, if this is the case, they may be used to reduce the reactivity change from cold to hot-operating. Such reduction would improve the reactivity lifetime and economics of the reactor, or it could be used to reduce the excess reactivity that has to be controlled.

2. The possible existence of mechanisms by which catastrophic local disturbances in a large reactor can propagate. Perhaps large reactors could be built in such a manner that destruction of more than a small part of the reactor is demonstrably impossible.

The Committee wishes to encourage a program consisting of destructive testing of fuel assemblies, and employing a re-usable reactor as source of the neutron burst in order to supplement the whole core destructive tests. Such a program for the testing of small fuel assemblies is in progress at the KEWB facility. The Fast Burst Facility, proposed by Phillips Petroleum Company, would allow testing of somewhat larger assemblies. The fuel assembly destructive testing program would have the following advantages:

a. It would save the cost of loss of material and cleanup involved in tests of whole-reactor destructions.

b. It could provide answers more rapidly than can be obtained in the case of whole-reactor destructive tests.

c. If tests were performed with "dirty" fuel, only a small amount of radioactivity would be dispersed.

d. It would extend the range of available reactor periods into the important region of fast transients by more than an order of magnitude beyond that available at the transient facilities which are now in operation and could accommodate large samples.

The recent Spert I destructive test seems to indicate that the destructive effect is separate from the reactivity-feedback effects, and it is essentially this feedback which requires whole-reactor tests.

The Step Program

The Step program is in the formative stage. It is our understanding that the loss of coolant accident will figure prominently in these tests. The Committee recommends that the investigation of this potential accident be carried out in two steps:

(a) Coolant loss from the reactor, at a controlled rate and correlation of this rate of loss with quantitative information on the behavior of the core;

(b) Study of the nature of piping failures and their effects on the rate of coolant; this study should take full advantage of and should not duplicate work done outside the Step group.

Inasmuch as accident analyses usually assume that the pressure vessel containing the reactor will not fail, and since brittle failure of this vessel may lead to catastrophies far in excess of the "maximum credible accident", the Committee recommends that additional support be given to the groups now investigating brittle failure starting at defects in pressure vessels. Of particular interest would be tests using pressurization by gases rather than liquids and the effect of environment on crack propagation. Continued attention should be given to radiation damage on pressure vessels and the study of the effects of the significant variables on radiation damage specimens.

The results of the Reactor Safety Research Program are important in the work of the ACRS. Quantitative data of general applicability are required to permit precise evaluation of reactor safety and for design and operation of economic nuclear power systems. The reviews to date have been extremely valuable to us.

Sincerely yours,

/s/ F. A. Gifford, Jr.

F. A. Gifford, Jr.
Chairman