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

September 11, 1961

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

Subject: NUCLEAR REACTOR SYSTEM MECHANICAL DESIGN

Dear Dr. Seaborg:

Since the primary loop of any nuclear reactor system is the principal and sometimes the first containment of radioactive fission products produced in the nuclear reaction, adequate mechanical design of these systems is important to the integrity of the plant and to the health and safety of the public.

Design of vessels, piping, and other components for these systems must be of a quality far superior to that ordinarily acceptable for commercial or defense installations. The generally recognized standards for commercial installations have been the Pressure Vessel Code of the American Society of Mechanical Engineers, and the Pressure Piping Code of the American Standards Association. These have been incorporated in many state codes and laws, and modified for marine and naval service. These codes are attempting to meet the changing needs for superior quality by the issue of revisions or addenda. Both organizations have in preparation complete new code sections for nuclear installations. These new codes will take some years for completion and adoption.

The Navy has prepared "NR-S-1 Tentative Structural Design Basis for Components of Reactor Coolant and Associated Systems" which is new and in some respects may appear to be a more lenient code than the two mentioned above. The apparent lenience is balanced by the more complete and rigid inspection of materials, fabrication, and testing by the Navy.

It is important to recognize that the codes specify minimum requirements and that additional specifications will necessarily be added by the purchaser or the manufacturer of the vessel or apparatus.

Experienced and reputable manufacturers fabricating nuclear vessels go beyond the minimum required by the codes or by the purchasers' specifications in inspection of materials and control of fabrication. If apparatus is purchased on a competitive price basis alone, the successful bidder may be inexperienced and so not supply the needed extra unspecified quality, or a competent bidder may be forced to sacrifice quality to be competitive. Bids should not be accepted for nuclear vessels without assurance that the bidders can adequately fabricate and inspect, and are of demonstrated competence in the construction of similar nuclear or nonnuclear equipment.

In addition to the usual design and inspection problems in pressure vessel manufacture, considerations must be given to deterioration of materials under irradiation. The most clearly recognized problem is the rise in nil ductility temperature in some metals. This might result in failure of reactor vessels and in case of such failure reactor containments are likely to be violated. In event that reactor internal parts are made of such materials, they might remain under stress when cold resulting in possible internal structural failures. This general problem is currently under study by a number of specialized groups, and the available data and their application to operating and new reactor vessels is being considered by the Division of Licensing and Regulation.

It is the recommendation of the ACRS that:

(1) Except in special units, all nuclear vessels and piping be designed, built, and inspected in accordance with one of the recognized codes and that no deviation be permitted except as provided by the code used;

(2) In selection of vendors for supplying equipment for use in nuclear installations, recognition be given to the need for care beyond code requirements in selection of materials, control of fabrication, and testing;

(3) In the Hazards Summary Report, (a) the code used be specified, and (b) assurance be given that adequate concomitant material selection, manufacturing procedure, and testing will be used;

(4) Every effort be made to expedite the laboratory and field study of radiation damage of metals as related to nil ductility temperature;

(5) The Division of Licensing and Regulation continue to pursue vigorously the determination of the status of present reactor vessels, the necessary steps to avoid failure from brittle fracture, and definition of the basis for preventive design of future installations.

Sincerely yours,

/s/ T. J. Thompson

T. J. Thompson
Chairman