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

September 10, 1973

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

Subject: REPORT ON ACCEPTANCE CRITERIA FOR EMERGENCY CORE COOLING SYSTEMS FOR LIGHT-WATER-COOLED NUCLEAR POWER REACTORS

Dear Dr. Ray:

In response to your August 30, 1973, letter, the Advisory Committee on Reactor Safeguards at its 161st meeting, held on September 6-8, 1973, submits the following comments with regard to Acceptance Criteria for Emergency Core Cooling Systems (ECCS) for Light-Water-Cooled Nuclear Power Reactors. The Committee previously commented on the Interim Acceptance Criteria for ECCS in its report of January 7, 1972. The Committee has also addressed matters related to the Interim Acceptance Criteria in its reports on various reactor applications during the past two years and in its response to a set of questions addressed to it by the Hearing Board on Docket No. RM-50-1.

The ACRS believes that the Concluding Statement of Position of the Regulatory Staff's Public Rulemaking Hearing on Acceptance Criteria for Emergency Core Cooling Systems for Light-Water-Cooled Nuclear Power Reactors (April 16, 1973) represents an improvement over the Interim Acceptance Criteria. The Committee notes that some sections still require interpretation. The Committee believes that the Position should represent a living document which will be responsive to added inputs of substantive information acquired through both analytical and experimental studies. The Committee believes also that it is essential that the Position provide flexibility for changes on a reasonable time scale.

In general, the Position retains previous restrictive assumptions, and several others have been added. Although there is evidence to support less restrictive evaluations, the Committee believes that a more substantial demonstration in terms of analyses and experimental data is required before relaxation of the restrictions can be effected. In achieving these goals, the development of the needed technical bases would be considerably enhanced if the proprietary aspects could be minimized.

The Committee continues to believe that more work is required on code development, safety research oriented to LOCA-ECCS, and improved ECCS. The Committee wishes to emphasize its opinion that a major portion of current and future research on LOCA-ECCS should be oriented toward the development of significant improvements in ECCS.

The Committee reaffirms its position that, in the future, design changes to improve ECCS capability should be sought and, to the extent practical, employed, irrespective of whether the plant design without such changes appears to meet the provisions of the Interim Acceptance Criteria and the proposed changes in these criteria. In its approach to nuclear safety, the Committee has sought to make allowances for the state-of-the-art knowledge on issues, to encourage further acquisition of background knowledge, to determine whether added safety improvements or margins are achievable, and then to encourage incorporation of practical improvements. It is the Committee's judgment, that for an expanding nuclear industry, the cumulative effects of the added improvements represent prudent goals. In particular, reactors proposed for standardized units should incorporate design improvements.

The Committee views the following as examples of measures which contribute to design improvements: 1) improved reliability of the ECCS and system components, including approaches intended to minimize the potential for common failure modes; 2) reactor core designs and operating modes which reduce the potential for high temperatures, clad swelling or perforation in postulated LOCAs; 3) ECCS whose proper functioning is relatively insensitive to reactor or ECCS design parameters and to proper functioning of other components such as steam generators or reactor containment; 4) ECCS having redundancy, diversity and abundance of flow such that its adequacy is subject to evaluation without undue requirement for complex evaluation techniques; and 5) other measures which further reduce the probabilities and consequences of a LOCA.

For existing ECCS designs, the ACRS encourages the ongoing efforts to develop evaluation methods, which are subjected to rigorous quality assurance measures, which are validated by experiment and theory, and which receive independent confirmation by the Regulatory Staff.

Acceptance Criteria for ECCS are not viewed by the Committee in isolation from other applicable design and evaluation criteria and guides. The Committee seeks to identify and to evaluate all pertinent factors for each case reviewed, as well as to be responsive to new information and experience. As noted in the Committee's December 18, 1972, report, Status of Generic Items Relating to Light-Water Reactors, resolution of some items on a generic basis is still pending. Other items which have been identified, studied or are under study, include pressure vessel integrity, steam generator tube integrity, reactor coolant pump overspeed, independent capability to analyze the ECCS, evaluations of containment pressures, independent analysis of the ice-condenser containment time-pressure history, and structural responses to a LOCA. All such items are taken into account in arriving at Committee positions.

For those plants which are licensed to operate under acceptance criteria such as those of the Regulatory Staff's Position, the Committee recommends continued study of means to improve ECCS reliability and performance by such design and operational measures as appear practical and significant. When such studies indicate that a significant safety improvement can be achieved, it should be considered for backfitting on a timely basis in accordance with the Commission's backfitting policy.

The evaluation of ECCS capabilities must, of course, include the possible effects arising from fuel densification. Several restrictive assumptions have been introduced by the Regulatory Staff in their densification evaluation models that, when combined with the Interim Acceptance Criteria, result in more severe limitations being placed on maximum linear heat generation rates for PWRs and maximum average planar (bundle) linear heat generation rates for BWRs. These restrictions result in the requirements for more intensive incore monitoring. In some cases, such restrictions have also led to lower initial power ratings for reactors having operating licenses. In this new phase of bringing into operation reactors having both higher power and higher power density, the Committee agrees that some initial limits on power may be appropriate in achieving the following objectives:

a) prudent approach for gaining operating experience
b) more thorough demonstration of fuel behavior
c) more detailed measurements of maximum linear heat generation rates and peaking factors for PWRs, and maximum average planar (bundle) linear heat generation rates for BWRs
d) resolution of more generic items, and
e) implementation of the proposed new requirements for the acceptance criteria, including evaluation of analytical and experimental data relating to model and code developments.

The initial restriction on power ratings and/or on flexibility for power operations and the duration of these restrictions should be evaluated on a case-by-case basis until a standardized approach has evolved through implementation of the Position.

The Committee believes that the Concluding Statement of the Regulatory Staff represents an acceptable Position, that possible ECCS design improvements should be pursued for plants in operation or under construction, and that reactors filing for construction permits after January 7, 1972, should have significantly improved ECCS capability.

Sincerely yours,

H. G. Mangelsdorf

H. G. Mangelsdorf
Chairman

References:

1) Concluding Statement of the Regulatory Staff entitled "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water-Cooled Reactors," April 16, 1973

2) Final Environmental Statement concerning the Proposed Rulemaking Action: Acceptance Criteria for Emergency Core Cooling Systems for Light-Water-Cooled Nuclear Power Reactors, dated May 9, 1973 (Volumes 1 and 2)

3) Supplementary Concluding Statement of Position of the Regulatory Staff's Public Rulemaking Hearing on Acceptance Criteria for ECCS for Light-Water-Cooled Nuclear Power Reactors, dated August 9, 1973

FOR SEPTEMBER 11, 1973 LTR TO DIXY LEE RAY, TRANSMITTING MANGELSDORF MEMO TO MUNTZING RE FORKED RIVER, SAN ONOFRE 2&3, AND WATERFORD 3 ECCS DESIGNS, SEE PAGES 613-615 UNDER "FORKED RIVER".