UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

August 16, 1979

Honorable Joseph M. Hendrie
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: PIPE CRACKING IN LIGHT WATER REACTORS

Dear Dr. Hendrie:

There have been a significant number of occurrences of pipe cracking in boiling water reactors (BWRs), the Duane Arnold incident in 1978 representing the most severe example thus far. For pressurized water reactors (PWRs), leaks and deterioration of steam generator tubing have been significant problems and recently, cracking of a related but unpredicted type has been found in PWR steam generator feedwater nozzles.

The Nuclear Regulatory Commission's Pipe Crack Study Group issued a report in 1975 (NUREG-75/067) which reviewed BWR pipe cracking and made recommendations to reduce the incidence and severity of cracking. A second report (NUREG-0531) was issued in early 1979 which again examined the status of the incidence of pipe cracking and made further recommendations, primarily related to the influence of the choice of material and to the potential for inservice inspection.

The ACRS believes that it is appropriate to extend the scope of the NRC Staff review beyond that examined in NUREG-0531. The relatively high frequency of BWR pipe cracking suggests that there may be a significant probability of a loss of coolant accident (LOCA), particularly a small LOCA, and that it may be relevant to examine, in greater depth than usual, a range of matters including the following:

1. The reliability of the safety features needed to cope with such an event.

2. The possibility of determining the location of a leak or break more rapidly and more directly than is now the practice.

3. The adequacy of operational procedures for such LOCAs, including combinations of circumstances that could arise in connection with such an event.

Furthermore, the seeming long-time existence of large, deep cracks in the recirculation pipes at Duane Arnold suggests that a range of possible accident initiators such as water hammer, earthquakes or other potential sources of

large additional forces could lead to a previously unexplored accident such as concurrent multiple failures. If so, consideration may have to be given to further analysis of the course of such an event in order to ascertain what, if any, additional measures are needed to reduce the probability of the accident or to mitigate its consequences.

The presence of the large, multiple cracks at Duane Arnold in sections of the pipe in which no inservice inspection was required, points to a need for a comprehensive reexamination of all safety-related piping systems for similar or equivalent design, fabrication or construction flaws, as well as the adequacy of the NRC requirements for inservice inspection. Furthermore, high priority should be given by both the industry and the NRC to the early implementation of improved crack detection capability.

Some types of cracking in PWRs and BWRs can be retarded through the control of water purity. For example, most foreign and some domestic BWRs deaerate the primary coolant during reactor startup. The NRC Staff is considering a regulatory guide on this matter. A program should be initiated to develop optimum water specifications, particularly in the areas of BWR primary coolant and PWR secondary coolant.

Sincerely yours,

Max W. Carbon
Chairman

References

1. NUREG-75/067, "Technical Report -- Investigation and Evaluation of Cracking of Cracking in Austenitic Stainless Steel Piping in Boiling Water Reactor Plants," Pipe Crack Study Group, U.S. Nuclear Regulatory Commission, October 1975.
2. NUREG-0531, "Investigation and Evaluation of Stress-Corrosion Cracking in Piping of Light Water Reactor Plants," Pipe Crack Study Group, U.S. Nuclear Regulatory Commission, February 1979.
3. "Metallurgical Investigation of Cracking in a Reactor Vessel Nozzle, Safe-End, Final Report," Southwest Research Institute, dated December 26 1978.