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

July 16, 1980

Honorable John F. Ahearne
Chairman
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: ADDITIONAL ACRS COMMENTS ON THE RCP TRIP AND HPI TERMINATION CRITERIA

Dear Dr. Ahearne:

In your letter of April 1, 1980, you requested that we clarify our concerns with the present reactor coolant pump (RCP) trip and the high pressure injection (HPI) termination criterion. You also indicated in a memorandum to R. Fraley on February 22, 1980 that you would welcome our comments on NUREG-0623, "Generic Assessment of Delayed Reactor Coolant Pump Trip During Small Break Loss-of-Coolant Accidents in Pressurized Water Reactors."

The present requirements for RCP trip and HPI termination have developed from the lessons learned from the Three Mile Island accident and from the extensive number of small break LOCA calculations subsequently carried out. There are two distinct requirements in the I&E Bulletins issued, as referenced below, which can be considered separately. The first concerns the directive which requires prompt shutdown of all reactor coolant pumps in PWRs following a depressurization transient which initiates safety injection. The second is the requirement that the safety injection system continue to be operated until a specified degree of subcooling is attained in the primary system.

The prompt reactor coolant pump trip mandated by the Bulletins followed analyses by the vendors of nuclear steam supply systems which seemed to show that there was a "window" of break sizes and pump trip delay times which would lead to calculated peak cladding temperatures in excess of the 2200°F licensing limit. These same methods of analysis indicated that with prompt pump trip the peak cladding temperatures would remain below 2200°F. The NRC Staff prepared a useful critique in NUREG-0623 of these vendor calculations and, while this report clearly presented the deficiencies in the analytical methods used, the report agreed with the vendors' conclusions. The short-term action by the Staff therefore was the requirement of prompt trip of the reactor coolant pumps; as a long-term action the Staff recommended that licensees propose and submit design changes that will assure automatic trip of all reactor coolant pumps.

We do not, at this time, disagree entirely with the Staff's requirement of prompt coolant pump trip, but in view of the analytical limitations upon which prompt trip is based we believe that the emphasis on immediacy of the trip and on eventual automatic trip may not be desirable. Recent experimental data has put doubt on the existence of the "window" which is the basis

for requiring prompt pump trip. Additional experimental data will become available before the end of the year. The prompt trip has been carried out in four transients since the Bulletins have appeared. In none of these was there a LOCA in the primary system; all of these transients arose from disturbances on the secondary side. No significant plant damage ensued in these transients and there was no harm to plant personnel or to the public. There has been complaint, however, that without reactor coolant pump flow the operator loses reactor pressurizer control since, in many PWRs, pressurizer spray flow depends on coolant pump flow. Further, natural circulation must also be established to remove decay heat. It must be said that the Staff's hope to develop a clear distinction between depressurization from a small break on the primary side and depressurization from a secondary side transient seems quite optimistic.

We believe that reactor coolant pump trip upon primary depressurization is an acceptable procedure, but we see no urgency at this time for installation of automatic pump trip. With regard to primary pressure control, we believe that it is desirable to provide pressurizer spray flow which is independent of main coolant pump flow.

The present set of requirements for HPI termination criteria is based upon achieving a specified degree of subcooling in the primary coolant system along with, in some cases, a specified water level in the pressurizer and steam generators. These requirements are intended to prevent a recurrence of the TMI-2 situation in which HPI flow was terminated while still necessary; these requirements, however, do not address the conditions in which HPI should be terminated when not required. We are concerned that relatively frequent system transients which activate HPI might progress to liquid discharge through safety valves or PORVs, valve failure under liquid flow, and a resultant small break LOCA. It should also be pointed out that Westinghouse has recently reported a significant deficiency under 10 CFR 50.55(e) for a number of reactors with high head centrifugal charging/safety injection pumps. Failure to stop these pumps promptly when high pressures are reached could result in pump failure from low flow - a common mode failure of the redundant HPI pumps. Changes in operational procedures may also affect the design limits of other components. These interactions need to be carefully reviewed.

We note that a number of plant transients that have occurred in the past year have been affected by the NRC approved HPI termination and RCP trip criteria. These include events, as referenced below, at North Anna, Unit 1, September 26, 1979; Prairie Island, Unit 1, October 2, 1979; and ANO, Unit 2, January 29, 1980. Some changes have been made in criteria in response to these events. We believe that continued Staff attention in this area is required.

Sincerely,

Milton S. Plesset

Milton S. Plesset
Chairman

References:

1. U.S. Nuclear Regulatory Commission, Office of Inspection and Enforcement, "I&E Bulletin 79-05A," April 5, 1979.
2. U.S. Nuclear Regulatory Commission, Office of Inspection and Enforcement, "I&E Bulletin 79-06A," April 14, 1979.
3. U.S. Nuclear Regulatory Commission, Office of Inspection and Enforcement, "I&E Bulletin 79-06B," April 14, 1979.
4. U. S. Nuclear Regulatory Commission, Office of Inspection and Enforcement, "I&E Bulletin 79-05C and 79-06C," July 26, 1979.
5. NUREG-0623, "Generic Assessment of Delayed Reactor Coolant Pump Trip During Small Break Loss-of-Coolant Accidents in Pressurized Water Reactors," November 1979.
6. Letter, C. M. Stallings, VEPCO, to J. P. O'Reilly, NRC, Submitting Licensee Event Report for September 25, 1979 North Anna Number 1 Cooldown Incident (October 9, 1979).
7. Letter, L. O. Mayer, NSP, to J. G. Keppler, NRC, Submitting Licensee Event Report for October 2, 1979 Steam Generator Tube Rupture Incident (October 16, 1979).
8. U.S. Nuclear Regulatory Commission Preliminary Notification of Event or Unusual Occurrence, PNO-IV-80-05, January 30, 1980.
9. Letter, D. C. Trimble, AP&L, to R. W. Reid, NRC, Submitting Startup Report, Supplement 2 for ANO-Unit 2, March 6, 1980.