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

August 12, 1980

Mr. William J. Dircks, Acting Executive
Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: CASCADING FAILURES IN NUCLEAR PLANTS

Dear Mr. Dircks:

The Committee has, in the recent past, had occasion to address several matters which may have had accident or failure "cascades" as a common element. The Committee has been increasingly concerned that this aspect has not always had the early and vigorous attention that it warrants when it has arisen either in the course of a licensing review or as the result of analysis of operating events.

In general, a cascade may be visualized as a series of failures each occurring as a consequence of some previous event which gave rise to a set of conditions (environmental, electrical, mechanical, etc.) not originally considered in the design. As a rule, the later failures in such sequences tend not to be considered in the same depth, if at all, as those occurring earliest, even though they may be causally related. Examples are:

- The potential environmental effects of operation of the PORV and block valves operated in a bleed-feed mode, on equipment in containment, and in particular on the power and control circuitry associated with those same valves;

- The potential for BWR containment overpressurization due to failure of a safety/relief valve discharge line as a result of sustained flow at resonance conditions through a stuck-open relief valve (the initial failure);

- The consequences of an instrument line failure if this small break LOCA can also lead to a loss of control or safety function. Generally, instrument line failure analyses stop with evaluation of the resulting SBLOCA;

- The effects on containment electrical penetrations of "post-accident" conditions within containment which could cause overcurrent or short-circuit conditions of non-IE equipment therein. This should be considered in light of the nonqualified nature of much of the equipment currently used to clear such faults; and

- The consequences of failure of an HPCI steam supply line, outboard of the isolation valves in that line, particularly in light of the probable effects of such a break on these valves and their controls.

In NUREG-0572, "Review of Licensee Event Reports (1976-1978)," the Committee observed in a discussion of Systems Interaction,

> "Redundancy and defense in depth are widely used in essential reactor systems to assure their availability. Implicit in such usage is the assumption that a high degree of independence exists between the redundant elements (or the various echelons of defense in depth). Occasionally an LER discloses an unintentional or previously unrecognized interdependence between such elements. ... Because of the potentially serious implications of such situations, more attention needs to be directed to seeking them out."

The Committee believes that many considerations of failure consequences are often either unrealistically narrow or are not investigated at all if they appear to have obvious primary effects which are supported by a general analysis. The instrument line failure is a good example.

The Committee recognizes that this is a complex subject and that any decision on an approach to requiring the consideration of cascades as the rule rather than the exception will require a great deal of study and interpretation. We expect, therefore, to have our Subcommittee on Safety Philosophy, Technology and Criteria begin in the near future to schedule discussions for consideration of these matters. The Committee would appreciate your identifying for us appropriate points of contact within the NRC Staff for this purpose.

Sincerely,

Milton S. Plesset

Milton S. Plesset
Chairman