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

May 16, 1979

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

Subject: INTERIM REPORT NO. 2 ON THREE MILE ISLAND NUCLEAR STATION UNIT 2

Dear Dr. Hendrie:

During its 229th meeting May 10-12, 1979, the Advisory Committee on Reactor Safeguards continued its review of the circumstances relating to the recent accident at Three Mile Island Nuclear Station Unit 2 (TMI-2). The recommendations presented orally to the Commissioners on April 17, 1979 were reviewed by the full Committee and are repeated in somewhat amplified form herein. Amplification of these items is responsive to the request of Acting NRC Chairman Victor Gilinsky dated April 18, 1979.

Natural Circulation - Procedures

It is evident from the experience at TMI-2 that there was failure to establish natural circulation of water in the primary system and failure to recognize in a timely manner that natural circulation had not been achieved. The need for natural circulation under certain circumstances is common to all PWRs.

The Committee recommends that procedures be developed by all operators of PWRs for initiating natural circulation in a safe manner and for providing the operator with assurance that circulation has in fact been established. These procedures should take into account the behavior of the systems under a variety of abnormal conditions.

As a first step, the NRC Staff should initiate immediately a survey of operating procedures for achieving natural circulation, including the case when offsite power is lost. At the same time, the operators of all PWR plants should be requested to develop detailed analyses of the behavior of their plants following anticipated transients and small breaks in the primary system, with appropriate consideration of potential abnormal conditions, operator errors and failures of equipment, power sources, or instrumentation. These analyses are necessary for the

development of suitable operating procedures. The review and evaluation of these analyses by the NRC Staff should receive a priority consistent with the priority being given to changes in operating procedures.

Natural Circulation - Pressurizer Heaters

The use of natural circulation for decay heat removal following an accident in a PWR normally requires the maintenance of a suitable overpressure on the reactor coolant system in order to prevent the generation of steam which can impede circulation. For many transients, maintenance of this overpressure is best accomplished by use of the pressurizer heaters.

Although the pressurizer heaters at TMI-2 continued to receive power from offsite sources during the entire accident, the availability of offsite power cannot be assured for all transients or accidents during which, or following which, natural circulation must be established. The Committee recommends that the NRC Staff initiate immediately a survey of all PWRs licensed for operation to determine whether the pressurizer heaters are now or can be supplied with power from qualified onsite sources with suitable redundancy.

Natural Circulation - Saturation Conditions

The plant operators should be informed adequately at all times of those conditions in the reactor coolant system that might affect their capability to place the system in the natural circulation mode or to sustain it in such a mode. Information indicating that coolant pressure is approaching the saturation pressure corresponding to the core exit temperature would be especially useful, since an impending loss of overpressure would signal to the operator a potential loss of natural circulation. This information can be derived from available pressurizer pressure and hot leg temperature measurements, in conjuction with conventional steam tables.

The Committee recommends that information for detecting an approach to saturation pressure be displayed to the operator in a suitable form at all times. Since there may be several equally acceptable means of providing this information, there is no need for the NRC Staff to assign a high priority to the development of prescriptive requirements for such displays. However, a reasonably early request that licensees and vendors consider and comment on the need for such a display would be appropriate.

Core Exit Thermocouples

The NRC Staff should request licensees and vendors to consider whether the core exit temperature measurements might be utilized, where available, to provide additional indication regarding natural circulation or the status of the core. For the latter purpose, it is recommended that the full temperature range of the core exit thermocouples be utilized. At TMI-2, the temperatures displayed and recorded did not include the full range of the thermocouples.

The Committee believes it would be appropriate for the NRC Staff to request licensees and vendors to consider and comment on this recommendation. This request should be made as soon as convenient and the time allowed for responses should be such as not to degrade responses on higher priority matters. Plant changes that might result eventually from consideration of this recommendation would not at this time seem to require a high priority.

Instrumentation to Follow the Course of an Accident

The ability to follow and predict the course of an accident is essential for its mitigation and for the provision of credible and reliable predictions of potential offsite consequences. Instrumentation to follow the course of an accident in power reactors of all types has long been a concern of the ACRS, is the subject of Regulatory Guide 1.97 (which has not yet been implemented on an operating plant), and is the subject of an NRC Staff Task Action Plan for the resolution of generic issues.

The Committee believes that the positions of Regulatory Guide 1.97 should be reviewed, and redefined as necessary, and that the Task Action Plan should be reexamined, as soon as manpower is available. The lessons learned from TMI-2 should be the bases for these reviews. For example, improved sampling procedures under accident conditions should be considered.

Although review and reexamination of existing criteria may take some time, the studies completed to date, together with the understanding gained from the accident at TMI-2, should provide sufficient basis for planned and appropriately phased actions. The Committee believes that the installation of improved instrumentation on operating reactors of all types should be underway within one year.

Reactor Safety Research

The ACRS recommends that safety research on the behavior of light-water reactors during anomalous transients be initiated as soon as possible and be assigned a high priority. The ACRS would expect to see plans and proposals within about three months, preliminary results within an additional six months, and more comprehensive results within a year.

Of particular interest would be the development of the capability to simulate a wide range of postulated transient or accident conditions, including various abnormal or low probability mechanical failures, electrical failures, or human errors, in order to gain increased insight into measures that can be taken to improve safety.

The new program of research to improve reactor safety has been initiated only recently, and then only on a relatively small scale. The Committee reiterates its previous recommendations that this program be pursued and its expansion sought by the Commission with a greater sense of urgency.

Status Monitoring

Although the closed auxiliary feedwater system valves may not have contributed directly or significantly to the core damage or environmental releases at TMI-2, the potentially much more severe consequences of unavailability of engineered safety features in plants of any type is of concern and deserving of attention. Status monitoring not dependent chiefly on administrative control, and thus possibly less subject to human error, might help assure the availability of essential features.

A request should be made within the next few months that licensees consider additional status monitoring of various engineered safety features and their supporting services. The NRC Staff should begin studies on the advantages and disadvantages of such monitoring on about the same time scale. Responses from licensees should be expected in about one year, at which time the NRC Staff should be in a position to review and evaluate them.

The Committee recognizes that some of the recommended actions in this report have already been taken by the NRC Staff.

Sincerely,

Max W. Carbon
Chairman