



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. 3 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 recent accident at Three Mile Island Nuclear Station Unit 2 (TMI-2), including implications drawn from the occurrence of this accident. The Committee has several additional recommendations to make at this time.

Reactor Pressure Vessel Level Indication

The Committee believes that it would be prudent to consider expeditiously the provision of instrumentation that will provide an unambiguous indication of the level of fluid in the reactor vessel. We suggest that licensees of all pressurized water reactors be requested to submit design proposals and schedules for accomplishing this action. This would assure the timely availability of reviewed designs if the Staff ongoing studies should indicate that early implementation is required. The Committee believes that as a minimum, the level indication should range from the bottom of the hot leg piping to the reactor vessel flange area.

Operator Training and Qualification

The NRC Staff should examine operator qualifications, training, and licensing to determine what changes are needed. Consideration should be given to educational background, to training methods, and to content of the training program. Attention should also be given to testing methods, with specific concern for the ability of the testing methods to predict operator capability. Examination of licensing procedures should determine whether they are responsive to new information that is developed about plant or operator performance. Effort should also be made to determine whether results of examinations can be correlated with operator ability. Requalification training and testing should be similarly

examined to insure that they take account of information that is developed by operation in the plant, and to determine that relevant information about other plants is made available to operators, and is made part of the training and requalification program. As part of this and of other more extensive studies, continuing attention must be given to the amount of information which an operator can assimilate and use in normal and in emergency situations and to the best method of presenting the information to the operator. The use and limitations of simulators for operator training should receive careful consideration.

Evaluation of Licensee Event Reports

Because of the potentially valuable information contained in Licensee Event Reports (LERs), the Committee recommends that the NRC Staff establish formal procedures for the use of this information in the training of supervisory and maintenance staffs and in the licensing and requalification of operating personnel at commercial nuclear power plants. The information in LERs may also be useful in anticipating safety problems. At the present time some utilities routinely request that they be provided copies of all LERs applicable to plants of the type they operate or to specific systems and components in a given class of plants similar to their plant. Certain reactor vendors have made similar requests and use the LERs to review and evaluate the performance of their plants. In addition, the NRC operator licensing staff has indicated that they use LERs in reviewing operating experience at commercial facilities.

The large number of LERs that attribute the cause to personnel error would tend to indicate that a formalized program of LER review would be useful in the training, licensing and requalification of nuclear power plant personnel. The extent to which such a program could be used to anticipate safety problems should also be considered.

Operating Procedures

Safety aspects of individual reactors during normal operation and under accident conditions are reviewed in detail by the NRC Staff and discussed with the ACRS. Acceptable limits for normal operations are formalized by Technical Specifications, submitted by the licensee and approved by the NRC Staff. Operating procedures for severe transients have received less detailed review by the NRC Staff. It appears that such procedures would benefit from review by an interdisciplinary team which includes personnel expert both in operations and in system behavior. Also, for the longer term, there may be merit in considering the development of more standardized formats for such procedures.

Reliability of Electric Power Supplies

During the past several years there have been several operating experiences involving a loss of AC power to important engineered safeguards. The ACRS believes it important that a comprehensive reexamination be made by the NRC and the reactor licensees of the adequacy of design, testing, and maintenance of offsite and onsite AC and DC power supplies. In particular, failure modes and effects analyses should be made, if not already performed, more systematic testing of power system reliability, including abnormal or anomalous system transients, should be considered, and improved quality assurance and status monitoring of power supply systems should be sought.

Analysis of Transients

The ACRS recommends that each licensee and holder of a construction permit be asked to make a detailed evaluation of his current capability to withstand station blackout (loss of offsite and onsite AC power) including additional complicating factors that might be reasonably considered. The evaluation should include examination of natural circulation capability, the continuing availability of components needed for long-term cooling, and the potential for improvement in capability to survive extended station blackout.

The ACRS also recommends that each licensee and construction permit holder should examine a wide range of anomalous transients and degraded accident conditions which might lead to water hammer. Methods of controlling or preventing such conditions should be evaluated, as should research to provide a better basis for such evaluations. The Committee expects it would be appropriate to have such studies done generically first, for classes of reactor designs and system types.

Emergency Planning

An effort should be undertaken to plan and define the role NRC will play in emergencies and what their contribution and interaction will be with the licensee and other emergency plan participants including other government agencies, industry representatives, and national laboratories. Such planning should consider:

- assurance that formal documentation of plans, procedures and organization are in place for action in an emergency,
- designation of a technical advisory team with names and alternates for the anticipated needs of an emergency situation,

- . compilation of an inventory of equipment and materials which may be needed for unusual conditions including its description, location, availability and the organization which controls its release.

The Committee recommends that each licensee be asked to review and revise within about three months:

- . his bases for obtaining offsite advice and assistance in emergencies, from within and outside the company,
- . current bases for notifying and providing information to authorities offsite in case of emergency.

This review and evaluation should be in terms of accidents having a broad range of consequences. The results of this review should be reported to the NRC.

Decontamination and Recovery

The Committee wishes to call attention to the importance of a program designed to learn directly about the behavior, failure modes, survivability, and other aspects of component and system behavior at TMI-2 as part of the long-term recovery process. This program should also examine the lessons learned at TMI-2 to determine if design changes are necessary to facilitate the decontamination and recovery of major nuclear power plant systems.

Safety Review Procedures

The TMI-2 accident has imposed large new pressures on the availability of manpower resources within the NRC Staff. If progress is to be expedited on the new questions which have arisen and on existing unresolved safety issues, the ACRS believes that new mechanisms should be sought and implemented. For those safety concerns where such a mechanism is appropriate the Committee recommends that the Commission should request licensees to perform suitable studies on a timely basis, including an evaluation of the pros and cons, and proposals for possible implementation of safety improvements. The NRC Staff should concurrently establish its own capability to evaluate such studies by arranging for support by its consultants and contractors. In this fashion, the Committee anticipates that the information on which judgments will be based can be developed much more expeditiously, and an earlier resolution of many safety concerns may be achieved.

Capability of the NRC Staff

The Committee recommends that the capability of the NRC Staff to deal with basic and engineering problems in what may be termed broadly as reactor and fuel cycle chemistry be augmented expeditiously. This should include establishment of expertise within the NRC, with assistance arranged from consultants and contractors, in such important technical areas as the behavior of PWR and BWR coolants and other materials under radiation conditions; generation, handling and disposal of radiolytic or other hydrogen at nuclear facilities; performance of various chemical additives in containment sprays; processing and disposal techniques for low and high level radioactive wastes; chemical operations in other parts of the nuclear fuel cycle; and in the chemical treatment operations involved in recovery, decontamination, or decommissioning of nuclear facilities. The Committee wishes to emphasize the importance of providing this expertise in both the research and licensing management elements of the NRC.

Single Failure Criterion

The NRC should begin a study to determine if use of the single failure criterion establishes an appropriate level of reliability for reactor safety systems. Operating experience suggests that multiple failures and common mode failures are encountered with sufficient frequency that they need more specific consideration. This study should be accompanied by concurrent consideration of how the licensing process can be modified to take account of a new set of criteria as appropriate.

Safety Research

The ACRS believes that, as a result of the TMI-2 accident, various safety research areas will warrant initiation or much greater emphasis, as appropriate. The Committee suggests that consideration be given to an augmentation of the NRC safety research budget for FY 80.

Also, the Committee believes that a larger part of the safety research program should be oriented toward exploratory research as contrasted to confirmatory research, with some degree of freedom from immediate licensing requirements. The ACRS plans to have a Subcommittee meeting on this subject with representatives of the NRC Office of Nuclear Regulatory Research in the near future.

The Committee is continuing to review these matters and will report further as additional recommendations are developed.

May 16, 1979

Additional comments by Messrs. H. Lewis, D. Moeller, D. Okrent, and J. Ray are presented below.

Sincerely,



Max W. Carbon
Chairman

Additional Comments by Messrs. H. Lewis, D. Moeller, D. Okrent, and J. Ray

The potential for a reduction in risk to the public in the case of a serious reactor accident by the implementation of a means for controlled, filtered venting of a containment which could retain particulates and the bulk of the iodine has been recognized for more than a decade. The concept was recommended for study more recently in the American Physical Society Report on light-water reactor safety and in the Ford Foundation-Mitre Report, "Nuclear Power - Issues and Choices." It is a high priority item in the NRC plan submitted to Congress for Research to Improve the Safety of Light-Water Nuclear Power Plants (NUREG-0438). The study performed for the State of California on underground siting concluded that filtered, vented containment was a favored option to explore in connection with possible means to mitigate the consequences of serious reactor accidents. However, little progress has been made on the development of sufficiently detailed design information on which to evaluate the efficacy and other factors relevant to a decision on possible implementation of such consequence ameliorating systems.

The TMI-2 accident suggests that the probability of a serious accident in which a filtered vented containment could be useful is larger than many had anticipated.

We recommend that the Commission request each power reactor licensee and construction permit holder to perform design studies of a system which adds the option of filtered venting or purging of containment in the event of a serious accident. The system should be capable of withstanding a steam and hydrogen environment and of removing and retaining for as long a time as necessary radioactive particulates and the great bulk of the iodine for accidents involving degraded situations up to and including core melt. Such studies could be done generically for several reactor-containment types, and should evaluate the practicality, pros and cons, the costs, and the potential for risk reduction. A period of about twelve months for a report to the NRC by licensees and construction permit holders appears to represent a possible schedule.