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The Honorable Lando W. Zech, Jr.
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Zech:

SUBJECT: PROPOSED RESOLUTION OF UNRESOLVED SAFETY ISSUE A-45, "SHUTDOWN DECAY HEAT REMOVAL REQUIREMENTS"

During the 341st meeting of the Advisory Committee on Reactor Safeguards, September 8-10, 1988, we discussed the proposed resolution of USI A-45, "Shutdown Decay Heat Removal Requirements." We had previously met with members of the NRC staff and representatives of NUMARC during our 340th meeting, August 11-13, 1988. Our subcommittee on Decay Heat Removal Systems also recently met with the NRC staff and with industry representatives to discuss this subject. In addition, there have been a series of reviews of this subject by the subcommittee and the full committee dating back to 1981. We also had the benefit of the documents referenced.

Background

Task Action Plan A-45 was intended to answer the question of whether decay heat removal systems in existing U.S. nuclear power plants can be counted on to reliably transfer core decay heat to an ultimate heat sink under a variety of situations and challenges. Experience and analyses indicated failures in decay heat removal systems to be a leading contributor to core melt risk. In addition, several European nations initiated programs to add dedicated decay heat removal systems to some of their existing plants. Through USI A-45, the staff undertook to determine whether significant vulnerabilities existed in operating U.S. plants, whether regulations related to decay heat removal were adequate, and, in particular, whether add-on systems might be warranted.

The heart of the USI A-45 program was a limited PRA study of six plants selected as a sample of the general population. The study was limited in that it concentrated on the decay heat removal systems and their contributions to core melt risk, it was conducted only as a Level 1 PRA, and it used approximate analytical methods in some instances. The study did, however, assess the consequences of both external as well as internal initiators. It was, in fact, when compared with other less-than-full-scope PRAs, a thorough and comprehensive risk analysis.

In addition to the risk analyses, the A-45 program included preliminary designs of concepts for possible decay heat removal system improvements, including dedicated add-on systems. Cost estimates were made for these improvements, as well as estimates of expected benefits in terms of reduction in the risk of core melt.

Resolution Proposed by the NRC Staff

The NRC staff has concluded that add-on, dedicated decay heat removal systems should not be required as backfits for existing plants. Further, they have proposed that no specific resolution be provided for USI A-45. While important vulnerabilities in decay heat removal systems were identified in the A-45 study, it appears that they are highly dependent on specific details of each plant design. Therefore, the staff has proposed that the issues important to safe decay heat removal be subsumed by the program for individual plant examinations (IPEs) being developed under the Severe Accident Policy.

ACRS Recommendation

We agree that a general new requirement for add-on decay heat removal systems is not warranted, and we have no quarrel with the general strategy for incorporating the A-45 issue into the IPEs. We have, in fact, recently proposed to you that the IPEs should be made more comprehensive in covering a wide range of outstanding safety issues.

We do, however, have suggestions for additional steps that should be considered as a part of the A-45 resolution. We believe enough has been learned in the A-45 program to suggest that certain actions related to plant decay heat removal systems may be prudent, even if they are not justified by specific risk reduction arguments.

Given this perspective, we suggest consideration be given to three additions to the A-45 resolution:

1. Certification of Feed-and-Bleed Capability At Each Plant. Studies in A-45 and other programs have shown that feed-and-bleed cooling can be an important contributor to reducing the risk of core melt in operating nuclear power plants. There is evidence, however, that the efficacy and reliability of this cooling method may be very different at some plants. The process has been analyzed for all plants. Whether feed-and-bleed cooling can be accomplished depends upon several characteristics of a plant, including the arrangement of major reactor system components, the capability and reliability of key pumps and valves, the accuracy and completeness of procedures, and the training of operators.

   We note that most of the equipment called on for the feed-and-bleed operation is not safety grade. This has led to ambiguity about the extent to which NRC should regulate or influence operation of systems used for feed-and-bleed. For this reason, we believe that each licensee claiming specific benefit from feed-and-bleed cooling should be required to certify that its plant has the capability, in both hardware and in procedures and training to successfully cool by this means. The certification would include a description of the entire path from the core to an ultimate heat sink. This would incorporate the ability both to supply and remove sufficient flow from the reactor coolant system and also to remove heat from the containment for the period and in the circumstances necessary.

   Alternatives to feed-and-bleed cooling could be certified for

plants where this is possible and necessary. For some PWR plants, it might be shown that secondary side blowdown and condenser cooling accompanied by primary depressurization using high-capacity pressurizer spray systems is adequate for emergency decay heat removal.

What we mean by "certification" is documentation that sufficient analysis has been done to demonstrate to the satisfaction of the NRC staff that feed-and-bleed can reasonably be relied upon as an emergency means for cooling the core. The certification process should be designed by the staff to avoid unnecessary and burdensome requirements.

We realize that this recommended certification effort could be a part of the IPE and accident management programs, but believe that it is worth mentioning specifically at this time.

2. Direct Use of Feedback From Experience. The Institute of Nuclear Power Operations (INPO) has studied operating experience with decay heat removal systems and concluded that a number of improvements in plant equipment and procedures would increase the reliability of these systems. These recommendations have been published in a number of Significant Operating Event Reports (SOERs). These SOER recommendations have not, as we understand, been justified by risk arguments but were derived more directly from experience and judgment. We believe that licensees could make use of these recommendations in the course of their IPEs.

3. Protection Against Sabotage. Finally, the original intent of A-45 was to include consideration of the need for protection of the decay heat removal function against sabotage. Dedicated add-on systems might have been configured to add such protection, but this possibility has been lost with the decision against requiring such special systems. It is probably more sensible to consider the need for sabotage protection from a broader perspective than just decay heat removal. However, the IPE program will not consider sabotage because it has been found generally not useful to treat sabotage in a risk perspective. We have recommended elsewhere that design for sabotage resistance should be considered in the advanced reactors program. Consideration should be given to a continued study of how sabotage resistance might be improved in existing plants.

We trust that these recommendations will be helpful.

Sincerely,

William Kerr
Chairman

References:

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