UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

ACRSR-2059

November 18, 2003

Dr. William D. Travers
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Dr. Travers:

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

During the 507th meeting of the Advisory Committee on Reactor Safeguards, November 5-7, 2003, we reviewed NUREG/CR-6832, "Regulatory Effectiveness of Unresolved Safety Issue (USI) A-45, 'Shutdown Decay Heat Removal Requirements'." During our review, we had the benefit of discussions with representatives of the NRC staff. We also had the benefit of the documents referenced.

Conclusions and Recommendations

1. The assessment of the actions taken in the resolution of USI A-45 suggests that in most cases the associated risk is consistent with the NRC safety goals and defense-in-depth expectations. At 11 pressurized water reactors (PWRs) the risks associated with the loss of decay heat removal (DHR) are not consistent with the staff's expectations.

2. The staff should not continue to rely on the results of the Individual Plant Examinations (IPEs) to assess the effectiveness of NRC regulations. Either more access to current licensee risk information must be obtained or further efforts to upgrade the Standardized Plant Analysis Risk (SPAR) models should be pursued.

3. Assessment of the effectiveness of NRC regulations is important and should be continued.

Discussion

Failure of DHR systems can be a significant contributor to core damage frequency (CDF) and the frequency of large releases of radioactive material. In March 1981, the NRC designated "Shutdown Decay Heat Removal Requirements" as USI A-45. The staff concluded that risks due to loss of DHR could be "unduly" high for some plants. However, DHR vulnerabilities are very plant specific and detailed plant-specific analyses were needed to resolve this issue. Rather than develop a separate program to analyze DHR vulnerabilities, the staff decided to include these analyses in the IPE program.

The staff expectations for adequate resolution of USI A-45 were expressed in risk terms. The goal was to ensure that the contribution of DHR events to CDF was not unduly large compared to the safety goal for CDF. In NUREG-1289, the staff proposed a classification scheme for susceptibility to DHR events, as shown in the table below.

Category	Classification of Level 1 DHR Vulnerability	Criterion(/RY)
C1	Frequency of core damage due to failures of DHR function acceptably small, or reducible to an acceptable level by simple improvements	Less than 3.0E-05
C2	DHR performance characteristics intermediate between Categories 1 and 3	Less than 3.0E-04 but greater than 3.0E-05
C3	Frequency of core damage so large that prompt action to reduce the probability of core damage to an acceptable level is necessary	Greater than 3.0E-04

The assessment report, NUREG/CR-6832, uses IPE results to classify operating plants according to this classification scheme. No reactors were found to be in Category C3. All boiling water reactors and the majority of PWRs were found to be in Category C1. Eleven PWRs, however, were found to be in Category C2.

Based on the results of this assessment, the staff concludes that a significant reduction in the risk associated with the loss of DHR was achieved as a result of plant changes from the implementation of regulatory initiatives such as USI A-44, “Station Blackout,” USI A-46, “Seismic Qualification of Equipment in Operating Plants,” Generic Issue 124, “Auxiliary Feedwater System Reliability,” and Generic Letter 89-16, “Installation of a Hardened Wetwell Vent,” as well as from modifications made during the development of the plant-specific IPEs and Individual Plant Examination of External Events.

The assessment report, however, does not discuss whether any follow-up actions are planned for the 11 PWRs in Category 2. Are additional plant-specific actions appropriate for these plants? Would more sophisticated analyses show that the estimates based on the IPEs are overly conservative? Is it possible to make independent assessments of these plants with SPAR models?

Additional analyses were also performed to evaluate the effect of the feed-and-bleed capability on reducing plant CDF. The change in CDF ranged from 2.20E-05/RY to 8.60E-05/RY for the four plant models examined. The results confirm that the feed-and-bleed capability is very important in many PWRs in assuring adequate response to DHR events. However, use of feed-and-bleed is clearly a last resort. In addition, there is a limited time window in which the decision to use feed-and-bleed must be made. During our meeting, the staff could not provide assurance that the feed-and-bleed capabilities had been adequately evaluated. However, the staff did state that it planned to do some additional analyses of feed-and-bleed to ensure that

realistic success criteria have been used in the SPAR models. This is helpful, but does not directly address the problem of ensuring that the licensees' evaluations have been realistic.

The assessment was based on results from the IPEs. The IPEs were primarily intended to assess severe accident vulnerabilities, and do not necessarily provide realistic estimates of CDF even for internal events. Better risk information is needed to more realistically assess the effectiveness of the regulations. One possibility is that the staff must have more access to licensee PRAs. There may be problems using this information for regulatory purposes since the staff has not performed a comprehensive review of all of the licensee PRAs, although virtually all licensee PRAs have now been through an industry peer review. However, a similar criticism can be made about the IPEs which were not subjected to complete review. Another possibility is further upgrading the capability of the SPAR models. Some (about 20) of these models have recently been upgraded for use in developing an integrated safety indicator. These models have been benchmarked against licensee models, and we have been informed that either the results are now in good agreement or the staff understands the reasons for the differences and has decided to use its own models. Upgrading the remainder of the SPAR models would give the staff an independent capability to assess the effectiveness of current and proposed regulations, and to improve the significance determination process.

Sincerely,

/RA/

Mario V. Bonaca
Chairman

References:

1. U. S. Nuclear Regulatory Commission, NUREG/CR-6832, "Regulatory Effectiveness of Unresolved Safety Issue (USI) A-45, 'Shutdown Decay Heat Removal Requirements', " August 2003.
2. U. S. Nuclear Regulatory Commission, NUREG-1289, "Regulatory and Backfit Analysis: Unresolved Safety Issue A-45, Shutdown Decay Heat Removal Requirements," November 1988.