

January 14, 2004

MEMORANDUM TO: J. E. Dyer, Director  
Office of Nuclear Reactor Regulation

FROM: Ashok C. Thadani, Director **/RA/** Ashok C. Thadani  
Office of Nuclear Regulatory Research

SUBJECT: FINAL REPORT NUREG/CR-6832, "REGULATORY EFFECTIVENESS  
OF UNRESOLVED SAFETY ISSUE (USI) A-45, 'SHUTDOWN DECAY  
HEAT REMOVAL REQUIREMENTS'"

We have completed our regulatory effectiveness assessment of the resolution of USI A-45. The attached NUREG report (NUREG/CR-6832) provides the technical basis for our findings and conclusions. The effectiveness study found that all plants generally met USI A-45 resolution expectations without the imposition of generic hardware fixes to improve DHR reliability. The overall conclusion of the study indicated that the approach used to resolve USI A-45 had been reasonable and effective, and that additional follow-on action is not necessary.

USI A-45 had been resolved based on the request for plant-specific analyses to be conducted under the Individual Plant Examinations (IPE) and Individual Plant Examinations of External Events (IPEEE) programs, including examination of the DHR system to identify vulnerabilities. The attached NUREG/CR report indicates that licensee programs used to resolve USI A-45 generally met expectations without the imposition of generic hardware fixes to improve DHR reliability. The report notes that DHR enhancements also resulted from the combined effects of other regulatory initiatives including resolution of USI A-44, "Station Blackout," USI A-46, "Seismic Equipment Qualification of Equipment in Operating Plants," GI-124, "Auxiliary Feedwater System Reliability," and installation of boiling water reactor hardened vents. We further note that significant enhancements also resulted from contributions in areas such as procedure and planning improvements. These enhancements taken together with those that stemmed from the IPE/IPEEE programs, indicate that the approach used to resolve USI A-45 was reasonable and effective.

It should be noted that many licensee DHR reliability studies, performed as part of their IPE and IPEEE, took credit for alternate DHR strategies not required by NRC regulations. In some cases, these strategies resulted in a substantial reduction in core damage frequencies (CDF). In many of these cases, strategies relied upon non-safety equipment to introduce diversity in the decay heat removal function to reduce the CDF. These strategies are not required by CFR 10 Part 50, App. A criterion 34, but were relied upon for closure of severe accident concerns. The effectiveness of the resolution of USI A-45, therefore, depends to a large extent on the commitment of individual licensees to implement and maintain the credited DHR strategies. In this regard, insights from the attached study can be used to identify risk significant areas in support of plant reviews and inspections.

Based on the USI A-45 regulatory effectiveness study and associated NUREG/CR-6832 that provides the technical basis for the evaluation findings, we believe follow-on activities are appropriate to confirm the effectiveness of DHR system performance. These areas include: 1) the effectiveness of DHR system performance under shutdown operating conditions, including consideration of non-safety related equipment relied on for DHR performance in our operating experience reviews, and 2) performing thermal hydraulic analyses to confirm assumed DHR system performance.

The scope of USI A-45 only addressed challenges to DHR initiated from full power operation. Events initiated from shutdown and refueling conditions were outside the scope and not captured by the resolution process. Nevertheless, shutdown PRAs have indicated that the DHR function during shutdown can be an important component of risk. In addition, SRM 97-168 dated 12/11/97 indicated that the Commission expects the staff to monitor shutdown risk, to ensure that changes have not occurred, that would otherwise warrant reconsideration of a shutdown rule. We, therefore, believe that operating experience reviews should be performed of licensee performance in the area of shutdown operations, to ensure that the current level of safety is maintained at all modes of operation. Our staffs have met and discussed possible future RES activities to support NRR in this area.

Our effectiveness review heightened the sensitivity of the DHR function on the use of non-safety related equipment, and the implicit assumptions regarding equipment availability and reliability. The attached NUREG/CR-6832 can provide valuable insights in supporting such reviews and in identifying areas needing further consideration. Areas of interest include situations where in the context of assessing the reliability of the DHR function:

- a. substantial credit has been taken for non-safety related equipment and
- b. analytical assumptions can significantly impact the DHR CDF contribution.

Therefore, in our ongoing reviews of operating experience and plant assessments we plan to include consideration of the uncertainties associated with these limitations, to ensure that consistency exists between what had been credited in licensees IPE/IPEEEs, and the actual reliability and availability of DHR components during plant operation.

In addition, because mitigative features have neither been demonstrated, nor thermal-hydraulic analyses performed to support assumed system success criteria under loss of heat sink conditions, we plan to perform thermal-hydraulic analyses. The purpose of these analyses is to quantify the effect of uncertainties associated with credit taken for enhancing the DHR function, and associated safety margin. We will use the Planning, Budget & Performance Management (PBPM) process to prioritize and adjust resources accordingly. RES will continue to meet with NRR staff to get their input on these confirmatory activities.

Attachment: As stated

cc: w/o att.:

C. Paperiello, DEDMRS

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