

March 19, 2002

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

Dear Dr. Travers:

SUBJECT: PROPOSED RULEMAKING AND ASSOCIATED GUIDANCE FOR RISK-INFORMING THE SPECIAL TREATMENT REQUIREMENTS OF 10 CFR PART 50 (OPTION 2)

During the 490th meeting of the Advisory Committee on Reactor Safeguards, March 7-9, 2002, we met with representatives of the NRC staff and the Nuclear Energy Institute (NEI) to discuss the proposed rulemaking and associated guidance for risk-informing the special treatment requirements of 10 CFR Part 50 (Option 2). We discussed the staff's draft rule language for 10 CFR 50.69 and proposed industry guidance in NEI 00-04, Revision B, "Option 2 Implementation Guideline." Our Subcommittee on Reliability and Probabilistic Risk Assessment discussed these matters during meetings on December 4, 2001, and February 22, 2002. We also had the benefit of the documents referenced. This report focuses primarily on the proposed industry guidance in NEI 00-04, Revision B.

Conclusion and Recommendations

1. The criteria used by the Integrated Decision-making Panel (IDP) for categorizing structures, systems, and components (SSCs) should be made explicit and should include consideration of risk metrics that supplement core damage frequency (CDF) and large early release frequency (LERF), such as late containment failure and inadvertent release of radioactive material.
2. Categorization of SSCs performed with a more complete set of risk metrics may allow the elimination of additional treatment requirements for components in the risk-informed safety class 3 (RISC-3) category (safety related, low safety significant).
3. The rigor in the treatment of uncertainties in probabilistic risk assessment (PRA) results should be made consistent with the current capabilities of PRA software and data. When simplified methods are used, comparison with more rigorous analyses should be available to demonstrate the adequacy of these methods.

Discussion

The overall categorization process described in NEI 00-04, Revision B, relies heavily on the judgments of the IDP. The Panel's decision concerning the assignment of an SSC to a risk-informed safety class is based on a variety of qualitative and quantitative inputs. The quantitative inputs are produced by a PRA, if available. A large majority of SSCs are categorized without the benefit of quantitative inputs from a PRA. Two major elements of the categorization process are the risk-informed decision criteria and the processes used by the IDP in making judgments.

In our report dated October 12, 1999, we commented extensively on the decision-making process and the need for guidance and training in conducting expert-panel sessions. Our comments on the processes described in the then-proposed Appendix T to 10 CFR Part 50 remain valid and are a continuing concern. This report focuses on additional issues that warrant attention in the revision of NEI 00-04 to support the proposed 10 CFR 50.69 rulemaking.

The traditional criteria for evaluating risk significance use the metrics CDF and LERF. The initial screening of SSCs for which PRA results are available is carried out by using importance measures that are based on these two metrics. We believe that the probability of late containment failure should be added to CDF and LERF to provide a more complete characterization of risk.

In categorizing SSCs for which PRA results are unavailable, qualitative considerations serve as the primary basis for decisionmaking. Even when PRA results are available, the risk-informed approach requires that the IDP consider qualitative inputs based on defense in depth and safety margins, as articulated by the principles in Regulatory Guide 1.174. NEI 00-04, Revision B, provides very little guidance to assist the Panel in making these qualitative assessments. Explicit criteria should be developed for the qualitative categorization of SSCs and the decision-making process needs to be scrutable with results that can be documented. Guidance to accomplish this should be included in NEI 00-04.

The qualitative considerations used by the IDP should include defense in depth and the traditional graded approach in which relatively frequent events are intended to not fail any of the barriers to the release of radioactivity, but relatively infrequent events are allowed some fuel damage provided that the resulting release is limited by the requirements of 10 CFR Part 100. Specific guidance to the IDP could include requirements for the Panel to determine whether (1) the SSC supports a system that acts as a barrier to fission product release during severe accidents; (2) the SSC is relied upon in the emergency operating procedures or the severe accident management guidelines; and (3) failure of the SSC will result in the inadvertent release of radioactive material even in the absence of severe accident conditions.

If any of the above conditions are true, the IDP should consider including such SSCs in RISC-1 (safety related, safety significant) or RISC-2 (non-safety related, safety significant) category. The IDP could justify its conclusions in the risk categorization by demonstrating that one of the following conditions are met:

- Relaxing the requirements will have minimal impact on the failure rate increase.
- Showing that adequate data are available to demonstrate that failure modes that prevent the SSC from fulfilling its function are unlikely to occur.
- Such failure modes can be detected in a timely manner.

The choice of appropriate treatment for RISC-3 has been a difficult issue for staff and industry. We believe that much of this difficulty has arisen because the staff recognizes that risk concerns cannot be completely addressed by CDF and LERF and is, therefore, reluctant to relax some special treatment requirements. By explicitly addressing all risk concerns in the categorization process, as discussed above, it may be easier to obtain agreement that components assigned to RISC-3 do not require any treatment beyond “commercial practice.”

We note that materials degradation is not directly assessed in NEI 00-04, Revision B. We believe that aging phenomena and the management of degradation must be considered in the IDP deliberations concerning affected SSCs and passive system components.

The use of risk information in regulatory decisionmaking is relatively new. Some within the NRC, the industry, and the public view this evolution with skepticism. The NRC Strategic Plan has established increasing public confidence as a performance goal. The use of rigorous methods to produce risk information is essential to achieving this goal.¹ In many instances, simplified methods can yield satisfactory results. It should be demonstrated, however, that these simplified methods yield results that are consistent with those provided by more rigorous methods and that their limitations are well understood.

In our reports dated October 12, 1999 and February 11, 2000, we commented extensively on the limitations of importance measures. The requirement to use sensitivity studies to determine Δ CDF and Δ LERF provides evidence that NEI 00-04, Revision B, recognizes the major limitation of importance measures, namely, their inability to determine the change in risk associated with a group of components. We

¹In his speech to the Regulatory Information Conference on March 5, 2002, Commissioner Diaz stated: “This is the year 2002, almost 30 years after WASH-1400, and it is time that all licensees have a quality Level 2 PRA so they can effectively utilize our regulatory processes.”

believe that the IDP would benefit from an explicit identification and discussion of this and other limitations that have been identified in the literature (References 8 and 9).

NEI 00-04, Revision B, shies away from providing guidance or encouragement for licensees to perform uncertainty analyses and relies heavily on sensitivity studies that are substitutes for uncertainty analyses. Modern PRA tools make it relatively routine to perform a genuine uncertainty analysis, i.e., one that propagates the uncertainties in failure rates, and such analysis should be performed where possible.

The argument has been made that using mean values for the failure rates in performing the PRA and the screening is “good enough.” We agree that, in the majority of cases, this argument may be true provided that mean values are indeed used, although relatively few investigations are available in the literature (References 8 and 11) to substantiate this claim. We object to the practice of taking arbitrary “point” values of the parameters and declaring them as mean values. Such practices do not contribute to the credibility of the categorization process.

One of the most significant limitations of importance measures is that they measure the impact of individual SSCs on risk, and, consequently, they cannot be used directly to estimate changes in risk for a group of SSCs. This limitation is recognized in NEI 00-04, Revision B, and additional sensitivity studies are suggested to attempt to assess the impact of changing treatment requirements on a group of components. In NEI 00-04, Revision B, it is suggested that the failure rates of RISC-3 SSCs be increased by factors ranging from 2 to 5 to evaluate changes in CDF and LERF. The current justification for this choice of values is weak, and a better justification is needed, especially since these factors are smaller than the factor of 10 used in the South Texas Project multiple exemption request. A distinction between parameter and model uncertainties would be very useful in this case.

We look forward to reviewing the draft final rule language and associated guidance as more progress is made.

Sincerely,

/RA/

George E. Apostolakis
Chairman

References:

1. U.S. Nuclear Regulatory Commission, Draft Rule Language to amend Title 10 of the *Code of Federal Regulations* (10 CFR) by adding Section 50.69, “Risk-Informed Treatment of Structures, Systems, and Components,” dated November 19, 2001.
2. Nuclear Energy Institute, NEI 00-04, Draft Revision B, “Option 2 Implementation

- Guideline,” May 2001.
3. Memorandum dated January 24, 2002, from Michael T. Markley, ACRS staff, to Cynthia Carpenter, Office of Nuclear Reactor Regulation, NRC, Subject: Questions on NEI 00-04, “Option 2 Implementation Guideline.”
 4. Letter dated February 8, 2002, from Cynthia A. Carpenter, Office of Nuclear Reactor Regulation, NRC, to Anthony R. Pietrangelo, NEI, Subject: NRC Staff Review of Draft Revision B of NEI 00-04, “Option 2 Implementation Guideline.”
 5. Report dated October 12, 1999, from Dana A. Powers, Chairman, ACRS, to Greta Joy Dicus, Chairman, NRC, Subject: Proposed Plans for Developing Risk-Informed Revisions to 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities.”
 6. Report dated February 11, 2000, from Dana A. Powers, Chairman, ACRS, to Richard A. Meserve, Chairman, NRC, Subject: Importance Measures Derived from Probabilistic Risk Assessments.
 7. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.174, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis,” July 1998.
 8. M.C. Cheok, G.W. Parry, and R.R. Sherry, “Use of Importance Measures in Risk-Informed Regulatory Applications,” *Reliability Engineering and System Safety*, 60, 213-226, 1998.
 9. W.E. Vesely, “Reservations on ‘ASME Risk-Based Inservice Inspection and Testing: An Outlook to the Future,’” *Risk Analysis*, 18, 423-425, 1998.
 10. U.S. Nuclear Regulatory Commission, NUREG-1150, Vols. 1-3, “Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants,” December 1990
 11. M. Modarres and M. Agarwal, “Consideration of Probabilistic Uncertainty in Risk-Based Importance Ranking,” Proceedings of the International Topical Meeting on Probabilistic Safety Assessment, PSA ‘96, *Moving Toward Risk-Based Regulation*, Park City, Utah, September 29-October 3, 1996, 230-236, American Nuclear Society.
 12. N.J. Diaz, “When...Large is Small and Small is Large,” Remarks at the U.S. Nuclear Regulatory Commission, 2002 Regulatory Information Conference, March 5-7, 2002.