April 23, 1996

The Honorable Shirley Ann Jackson
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Chairman Jackson:

SUBJECT: PROBABILISTIC RISK ASSESSMENT FRAMEWORK, PILOT APPLICATIONS, AND NEXT STEPS TO EXPAND THE USE OF PRA IN THE REGULATORY DECISION-MAKING PROCESS

During the 430th meeting of the Advisory Committee on Reactor Safeguards, April 11-13, 1996, we continued our deliberations on risk-informed and performance-oriented regulation (RIPOR). We met with representatives of the NRC staff and the Nuclear Energy Institute (NEI) during our 429th meeting on March 7-9, 1996. Our Subcommittee on Probabilistic Risk Assessment (PRA) also met on October 26-27, 1995, with representatives of the NRC staff and of the nuclear industry, and on February 27-28, 1996, with the NRC staff and two invited experts, Dr. D. M. Karydas (performance-based standards for fire protection) and Professor T. G. Theofanous (on the proper formulation of safety goals and assessment of safety margins for rare and high-consequence hazards). We also had the benefit of the documents referenced.

This report is in response to the Staff Requirements Memorandum dated December 27, 1995, in which the Commission requested "ACRS views on the PRA framework document, its relationship to the pilot applications (SECY-95-280), and the next steps in the process to expand the use of PRA in the regulatory decision-making process."

PRA Framework Document

The PRA framework document provides a good starting point in the development of RIPOR. The six-step process described in the document is a reasonable way to proceed. We agree with the staff that the focus should be on the integration of probabilistic and deterministic approaches to regulation.

The PRA framework document, however, does not articulate an overall philosophy for RIPOR. We believe that such a philosophy should be developed. Some important high-level principles that should be included are:

1. RIPOR should consider risk from all modes of nuclear plant operations, including full power, shutdown, and transition.

2. The Commission's safety goals should serve as the top-level acceptance criteria.

3. Subsidiary performance-based acceptance criteria should be determined in a consistent way and must be measurable or calculable. The licensee should be granted flexibility in choosing the means to meet the criteria.

4. The relationship between RIPOR and defense-in-depth should be explained. The role of defense-in-depth in the determination of performance criteria to accommodate uncertainty and incompleteness in risk assessments should be established.

5. Criteria for the adoption of prescriptive regulations should be clearly delineated.

6. The acceptance criteria should be set at the highest level of plant system hierarchy that is consistent with the other principles noted above.

Discussion

It is indicative of the novelty of these concepts that we have spent a considerable amount of time discussing the meaning of "performance" among ourselves and with the staff and NEI. Some interpret performance in a limited way; i.e., its measures are simply the reliability and availability (or related quantities) of plant systems and components. Others take a broader view and interpret it as the overall performance of the licensee, including operations, maintenance, training, and the prevailing safety culture at the plant.

Similarly, the definition of performance criteria varies widely. At one extreme, we have simple measures that are either directly measurable or that involve calculations (e.g., the reliabilities and unavailabilities mentioned above). At the other extreme, performance criteria can be probabilistic or nonprobabilistic and can be set at any level. Observations and statistical or experimental evidence from the plant or other sources in conjunction with models can be used to demonstrate that the criteria have been met. As part of an overall philosophy, the staff needs to resolve the ambiguity in the definition of performance criteria.

Pilot Applications

While we support the staff's use of pilot applications, we are concerned that there seems to be no integrated justification for their selection. We would like to see the development of a list of important issues that are expected to arise on the road to RIPOR,

along with a discussion of how the selected pilot projects will help. The staff has agreed to look into these issues.

We also recommend that, for each pilot project, attempts be made to establish performance-based decision criteria along with the methods that would be used for demonstrating compliance. Such an exercise should provide useful insights regarding the overall feasibility of a performance-oriented approach to regulation.

Next Steps to Expand the Use of PRA in the Regulatory Decision-making Process

We believe that the NRC needs to take a number of important additional steps before a RIPOR environment can be achieved. These are discussed below.

Safety Goals

A restatement of the Commission's safety goal policy is needed that will allow the use of safety goals on a plant-specific basis.

Performance-Based Regulatory Criteria

A methodology is needed to determine performance-based criteria for regulatory action that are consistent with the top-level safety goals, as stated in the high-level principles. A "top-down" approach will ensure that this happens. An important element should be the preservation of the concept of defense-in-depth. The development of this methodology will also provide the opportunity to reexamine the validity of Level 2 subsidiary goals, which appear to be controversial at this time.

Programmatic Issues

Developing a RIPOR system should be a participative effort between the staff and the industry. We believe that the magnitude and significance of the task that the staff has undertaken requires a cooperative effort. Also, we recommend that the staff work with foreign researchers and regulatory agencies.

Conclusion

The intellectual and practical issues that the staff must confront in developing a RIPOR structure are significant. The staff has made a good start, but much remains to be done. We are pleased that the staff has agreed to meet with us periodically. Recent meetings have demonstrated that the staff is receptive to suggestions on how to deal with these complex issues. We applaud this attitude. We will keep you informed as these efforts progress.

Additional comments by ACRS Members Thomas S. Kress and Don W. Miller are presented below.

Sincerely,

/S/

T. S. Kress
Chairman

Additional Comments by ACRS Members Thomas S. Kress and Don W. Miller

While we agree with most of the Committee's report on this subject, we find it to lack coherence. The major problem we have with the Committee report is its treatment of the concept of "performance-based" regulation. We conceive of basically two meanings to the word "performance" in this context: (1) the performance of equipment (systems and components) in carrying out the intended function, or (2) the performance of the licensee in performing its function (operation, maintenance, inspection, training, etc.). The first of these could further relate to either the operability of the specific equipment (e.g., does it turn on or off, and, in the case of a pump, for example, does it provide the required flow) or to the reliability/availability of the equipment. In our view, the former does not provide any basis on which to develop a regulatory structure (there are no meaningful acceptance criteria that relate to risk). On the other hand, the latter can clearly be anchored in risk. This, however, would be purely risk-based regulation. The word "performance" in this context becomes synonymous with "risk" and such a regulatory concept should be designated as risk-based and should not be called performance-based.

The second possible meaning of performance, the performance of the licensee, obviously has a nexus to risk. This connotation of performance, however, is what we have been calling organizational factors. To date, a methodology has not been developed by which objective performance measures can be identified and be factored directly into PRA to quantify risk implications. Therefore, at this time, we do not have the capability to develop such performance-based regulations in any coherent manner. This would, however, be an area worth pursuing in the future with additional research.

This leads us to our main point. At this time, we should be striving for risk-based or risk-informed regulations and should relegate the concept of "performance" regulation to being a remote possibility that needs substantial research to determine feasibility.

References:

1. Memorandum dated December 27, 1995, from J. Hoyle, Secretary of NRC, to J. Larkins, ACRS, Subject: Staff Requirements Memorandum dated December 27, 1995
2. Memorandum dated June 16, 1995, from A. Bates, Office of the Secretary, NRC, to File, Subject: Staff Requirements Memorandum dated June 16, 1995
3. Letter dated February 6, 1996, from J. Milhoan, Office of the Executive Director for Operations, NRC, to W. Rasin, Nuclear Energy Institute, Subject: Improving the Regulatory Process through Risk-Based and Performance-Based Regulation
4. Letter dated January 3, 1996, from J. Taylor, Executive

Director for Operations, NRC, to Chairman Jackson, NRC, Subject: Improvements Associated With Managing the Utilization of Probabilistic Risk Assessment (PRA) and Digital Instrumentation and Control Technology

5. Letter dated November 30, 1995, from Chairman Jackson, NRC, to J. Taylor, Executive Director for Operations, NRC, Subject: Follow-up Requests in Probabilistic Risk Assessment and Digital Instrumentation and Control

6. SECY-95-280, "Framework for Applying Probabilistic Risk Analysis in Reactor Regulation," dated November 27, 1995

7. Letter dated November 14, 1995, from W. Rasin, Nuclear Energy Institute, to J. Milhoan, Office of Executive Director for Operations, NRC, Subject: Draft report, "Improving the Regulatory Process Through Risk-Based and Performance-Based Regulation"

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