June 13, 2014

MEMORANDUM TO: Chairman Macfarlane
Commissioner Svinicki
Commissioner Ostendorff

FROM: Commissioner Magwood ***/RA/***
Commissioner Apostolakis ***/RA/***

SUBJECT: **Improving Safety and Regulatory Effectiveness by Enhancing the NRC's Framework for Risk-Informed Decision Making**

I. Objective

The principal objective of this initiative is to enhance the safety of the operating reactor fleet and improve regulatory effectiveness by providing the NRC and its licensees with an enhanced basis from which to analyze and make decisions on the site-specific safety impact of regulatory changes, plant modifications, and assessment of internal and external hazards. This can be accomplished by requiring licensees to submit summary PRA information delineating the dominant risk contributors and to maintain and update their PRAs, as appropriate. We propose that this requirement become effective within ten years after the issuance of a Staff Requirements Memorandum (SRM) and apply to all operating U.S. nuclear power plants.

The agency is considering potential strategies that could enable us to implement regulatory programs on a much more effective and efficient basis. The most advantageous realization of such efforts would reflect fully the actual state of each plant in terms of its risk profile, regulatory posture, equipment and configuration, and operational practices. If successful, such approaches would result in more effective protection of public health and safety by assuring that regulatory actions are focused on the risk contributors for each site and on issues that provide safety benefits on a site-specific basis.

In our view, these benefits cannot be achieved without the availability of high-quality PRAs for each plant. This approach is consistent with the Final Policy Statement on Use of Probabilistic Risk Assessment (PRA) Methods in Nuclear Regulatory Activities issued on August 16, 1995 [60 FR 42622] and reflects the general direction regulation in the United States has followed for the last two decades. This initiative is a logical next step that will provide real benefits to the agency's mission.

II. Background

Commercial nuclear power reactors in the U.S. have been licensed using 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." Implementation of 10 CFR Part 50 has been achieved, for the most part, using "deterministic" methods and acceptance criteria. From a safety perspective and for each site, a set of licensing-basis events is established that is intended to ensure conservatism in design and protection from a wide spectrum of postulated

events, up to and including design-basis accidents (DBAs). These postulated accidents are highly stylized.

PRA was developed in the early 1970s for nuclear power reactors, after the designs of essentially all operating plants were fixed. This first PRA (WASH-1400, 1975) introduced a new way to measure nuclear safety and the effectiveness of the NRC's regulations. The Commission subsequently established a policy on how risk assessment methods should be used to complement the NRC's established regulations in all its regulatory programs. The Commission's 1995 PRA Policy Statement states, in part:

> The use of PRA technology should be increased in all regulatory matters to the extent supported by the state-of-the art in PRA methods and data and in a manner that complements the NRC's deterministic approach and supports the NRC's traditional defense-in-depth philosophy.

This policy, coupled with additional Commission guidance issued in 1999[1], has resulted in a variety of program-specific improvements. The NRC uses risk assessment in a way that recognizes the particular strengths of this approach and complements the traditional approach (Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis"). Risk assessments provide:

- A systematic approach for assessing the wide variety of hazards that can challenge the safety of an NRC-licensed facility.
- A logical method for characterizing the capability of a facility's design and operation to respond to the identified hazards.
- A method for estimating the consequences of combinations of hazards and unsuccessful responses to these hazards (thousands of realistic accident sequences are investigated, in contrast to the limited number of stylized DBAs considered in the traditional approach).
- A site-specific identification of accident sequences leading to core damage and release of radioactive material.
- The evaluation of the frequency of these sequences.
- Ranking of accident sequences according to their frequency of occurrence.
- Integral estimates of plant risk, such as the frequency of core damage (CDF) and the frequency of large, early release (LERF) of radioactive materials to the atmosphere.
- An effective means for communicating to stakeholders the level of safety of nuclear power plants using, among other things, summary metrics such as CDF and LERF.

[1] Letter from A.L. Vietti-Cook, Secretary, to W.D. Travers, Executive Director for Operations, NRC. SUBJECT: STAFF REQUIREMENTS - SECY-98-144 - WHITE PAPER ON RISK-INFORMED AND PERFORMANCE-BASED REGULATION [ADAMS Accession Number ML1003753593]

While progress has been made in implementing the Commission's policies related to the use of risk information, site-specific PRAs have not been adopted consistently as a tool to better understand plant vulnerabilities and prioritize activities according to their ability to affect plant risk. It is our view that a regulatory system that acknowledges the site-specific nature of risk will be the most effective in ensuring public health and safety. We note that this consideration is consistent with staff's ongoing Risk Prioritization Initiative, which we endorse.

A recent letter from the Nuclear Energy Institute (NEI)[2] states, in part, that there is a need to "provide a vision for the development of appropriately comprehensive plant-specific risk insights to support industry and NRC decision making." In our view, the value of a site-specific PRA cannot be overstated.[3]

We also support the comments made by ACRS Chairman John W. Stetkar and five additional ACRS members in the May 22, 2014, report from the Advisory Committee on Reactor Safeguards on SECY-14-0016, "Ongoing Staff Activities to Assess Regulatory Considerations for Power Reactor Subsequent License Renewal," where they stated:

> In 2045, the Commission policy statement on PRA will mark its 50-year anniversary. The first new reactors licensed under 10 CFR Part 52 will be past the mid-point of their first 40 years of operation. Other new reactors may have been licensed under 10 CFR Part 50. Some currently operating reactors may be in their period of extended operation beyond 60 years. By that time in our long history of nuclear power operation, it is incongruous that licensees and regulators would not benefit from consistent use of the risk information afforded by full-scope plant-specific PRAs for the entire fleet of operating reactors.

The NRC Strategic Plan notes that the expanded use of risk-informed and performance-based insights and the use of state-of-the-art technologies are the means by which the agency enhances the effectiveness and realism of NRC actions. The Principles of Good Regulation reinforce these points, noting that regulatory activities should be consistent with the degree of risk reduction they achieve.

A. Experience Thus Far in Requiring PRAs

The agency has successfully implemented a regulatory approach to provide a strong risk quantification framework for new nuclear power plants in this country—those being licensed under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." The technologies being licensed under these newer regulatory processes are quite similar, in most ways, to operating nuclear power plants and the regulations covering them essentially

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[2] Letter from A. R. Pietrangelo, Senior Vice President, NEI, to A. M. Macfarlane, Chairman, NRC. Subject: Industry Support and Use of PRA and Risk-Informed Regulation. December 19, 2013. Attachment 2.

3 In the 1980s, the industry sponsored several plant-specific PRAs. Summarizing the resulting lessons learned, the director of these studies states: "The extent to which risk is plant specific was demonstrated by the differences in risk levels and contributors between Indian Point Units 2 and 3, which are sister units." (B. J. Garrick, "Recent Case Studies and Advancements in Probabilistic Risk Assessment," Risk Analysis, 4:267- 279, 1984.)

reference 10 CFR Part 50 in all technical areas. That is, new power reactors are licensed using the same set of licensing-basis events, including design-basis events that include qualitative requirements such as the single failure criterion. Recognizing the value of PRA in providing a complementary view of safety, each new design is required to have a PRA, and any plant referencing that design is required to update the PRA by the time of fuel loading to reflect the final design and operational characteristics. As envisioned in the NRC's Severe Accident Policy Statement, new reactors must satisfy a regulatory requirement in 10 CFR Part 52 to include severe accident features in their designs.

At the same time, however, plants licensed under 10 CFR Part 50 use PRAs only on a voluntary basis. The difficulties these divergent approaches present will become readily apparent as 10 CFR Part 52 plants enter operation or if a future applicant chooses to license a new plant under 10 CFR Part 50. For plants licensed under Part 52, the NRC and its licensees will have enhanced ability to quantify and communicate the safety impact of proposed regulations for new, safer designs but will not have that benefit while assessing those same changes to plants based on decades-old designs. It is unfortunate that, nearly 20 years after issuance of the PRA Policy Statement, the agency would find itself in such a situation.

B. Challenge to Prioritize Regulatory Actions: How Do We Know When Enough is Enough?

We are also challenged when it comes to prioritizing our own work. When asked by one of our Congressional Oversight Committees, "What percentage of original concerns identified by the NTTF [Near-Term Task Force] Recommendations has this work done or ordered to date addressed," we could not provide a clear answer because the agency has not quantified the safety benefits undertaken as a result of the NTTF recommendations. Without the benefit of quantitative risk metrics, it has been difficult to explain the basis for our prioritization of the Fukushima recommendations or how the prioritization of these new activities is being integrated with all other very important agency activities, such as fire protection.

As we consider additional potential post-Fukushima actions, it becomes increasingly difficult to assess which additional actions are actually necessary given the corresponding safety benefits of actions already taken, and exactly what safety benefit new actions will provide if we choose to implement them. It is unfortunate that we could not rely upon a strong base of site-specific PRAs as the agency considered actions to be taken in the aftermath of Fukushima; we might have made different decisions about the requirements to be placed on each plant.

C. Improve Our Ability to Communicate

We are convinced that requiring operating reactor licensees to have and maintain quality PRAs, and to submit PRA summary information to the NRC, will go a long way toward helping both the licensees and the NRC convey to stakeholders the continued safety of these operating reactors over the long-term. In addition, the baseline metrics provided by a site-specific PRA would help the NRC and its licensees more completely assess whether safety is improving or declining at an individual plant.

III. Proposed Staff Direction

A. PRA Rulemaking for Operating Reactors

The staff should develop for Commission review a proposed rule to require operating reactor licensees to submit summary PRA information delineating the dominant risk contributors. Licensees should also be required to maintain and update their PRAs, as appropriate. This direction applies the approach already in place for new reactor applicants under 10 CFR 52.79(a)(46) and 10 CFR 50.71(h). Staff should also recommend a schedule for this activity consistent with enabling the required PRA summaries to be available within ten years of the issuance of the SRM associated with this memorandum.

Although it is clear that PRAs have already and will continue to contribute significantly to the effectiveness of regulatory activities, the safety benefits from site-specific PRAs are broad and have sometimes proven difficult to quantify, e.g., improving plant operations. Further, industry representatives have indicated that most plants already have good PRA models and that these models will be enhanced over the next several years.[2] In addition, ongoing activities such as implementation of NFPA 805 and development of seismic PRAs provide many licensees with additional analyses of plant systems. Thus, in analyzing the costs and benefits of requiring PRAs for operating reactors, the staff should consider only the appropriate additional costs to meet the proposed requirement and all of the benefits associated with having high-quality, living PRAs.

B. Update PRA Policy Statement

In addition to developing PRA requirements for operating reactors, the staff should review the Commission's 1995 PRA Policy Statement, considering experience gained through the use of risk information in regulatory activities and advancements in the state-of-the-art in PRA methods. The staff should determine whether any necessary enhancements to the policy statement reflective of the current state of risk assessment methods and the current regulatory environment are warranted and provide recommendations to the Commission.

Secy, please track.

cc: SECY
CFO
OGC
EDO