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

March 16, 2011

The Honorable Gregory B. Jaczko
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: SECY-11-0024, "USE OF RISK INSIGHTS TO ENHANCE THE SAFETY FOCUS OF SMALL MODULAR REACTOR REVIEWS"

Dear Chairman Jaczko:

During the 581st meeting of the Advisory Committee on Reactor Safeguards, March 10-12, 2011, we reviewed SECY-11-0024, "Use of Risk Insights to Enhance the Safety Focus of Small Modular Reactor Reviews." Our Future Plant Designs Subcommittee also reviewed this matter during a meeting on February 9, 2011. During these meetings we had the benefit of discussions with representatives of the NRC staff and the Nuclear Energy Institute. We also had the benefit of the documents referenced.

CONCLUSIONS AND RECOMMENDATION

1. The approach described in the revised draft introduction of NUREG-0800 for license review of integrated pressurized water reactors (iPWRs) is an appropriate first step for near-term Small Modular Reactor (SMR) applications.

2. Development of design-specific review plans for iPWRs is a crucial step to ensure that high safety standards are maintained for unique designs. Progress in this area is linked to development of complete and stable designs.

3. The staff should consider the use of PIRT[1]-like processes to guide development of the design-specific review plans.

4. The longer-term approach for license review of non-Light Water Reactor (LWR) SMRs is the logical extension of NUREG-1860. The proposed pilot studies can provide necessary information for full development of a new framework, while not putting the licensing process at risk.

[1] PIRT - Phenomena Identification and Ranking Tables

BACKGROUND

The Commission issued a Staff Requirements Memorandum (SRM) dated August 31, 2010, directing the staff to integrate risk insights and develop risk-informed licensing review plans for each SMR design. The SRM also required the staff to build on the SMR and Next Generation Nuclear Plant (NGNP) review insights, as well as the earlier technology neutral framework of NUREG-1860, to develop a new risk-informed licensing framework for the longer term. A number of policy issues related to SMR licensing were identified in SECY-10-0034, and the Commission asked the staff to identify resolution strategies. The staff is preparing a series of SECY papers on these policy issues over the coming year. SECY-11-0024 was the first of these to be sent to the Commission.

DISCUSSION

The approach developed by the staff for using risk insights to enhance the safety focus of SMR reviews includes two elements: a risk-informed review framework for near term iPWR designs; and a longer term risk-informed, performance-based, regulatory framework for the licensing of non-LWR SMRs. The framework for the review of iPWRs will be provided in a revised introduction section of NUREG-0800, Standard Review Plan (SRP) for the Review of Safety Analysis Reports for Nuclear Power Plants. Based on the iPWR framework, design-specific review plans will be developed to tailor the guidance in the SRP for each SMR design.

A draft version of the risk-informed framework for the review of iPWRs was included as an enclosure to SECY-11-0024. It includes several examples of applying the framework to specific systems. Work is underway on design-specific review plans for the designs deemed most likely to be submitted early. The staff has begun incorporating lessons learned from recent design certification reviews into these design-specific review plans for iPWRs.

We see the draft framework as a good first step and look forward to working with the staff as the framework and design-specific review plans are faired out through the first applications. In general, the approach is developing along practical lines and will be an improvement over trying to force-fit SMR reviews to guidance for traditional LWRs. PIRT-like processes that systematically identify key technical issues for each SMR design could enhance the process of developing design-specific review plans.

The framework is intended to be consistent with current regulatory requirements and Commission policy statements. The stated goal is to provide guidance to the staff on aligning the review focus and resources to aspects of the design that contribute most to safety in order to enhance the efficiency of the review process. This will require intensive examination of unique design features that may not have been clearly called out in the traditional LWR SRP. It may also eliminate some aspects of the LWR SRP that do not apply to the specific SMR and should reduce emphasis on system elements shown to be less important to safety.

It is expected that some elements of the SMR applications will be risk informed. Therefore, they may require more complete and design-specific probabilistic risk assessments (PRAs) than those commonly associated with traditional LWR design certification applications.

Technically effective and efficient implementation of the proposed risk-informed review framework requires early confidence that structures, systems and components (SSCs) and licensing basis events are categorized appropriately according to their relative risk significance. The categorization process will rely heavily on the quantitative results from the design-specific PRA, supplemented as necessary by qualitative input from expert panels.

To facilitate a balanced assessment of the relative risk significance of specific SSCs for the full spectrum of potentially important accident scenarios, the PRA should contain an integrated quantification of the risks from internal and external events including fires, flooding, severe weather phenomena, seismic hazards, and other identified design-specific vulnerabilities. This implies either a site-specific PRA or a PRA of a pseudo site that must bound the external events for all potential sites.

The PRA models should be of sufficient scope, depth of detail, and technical quality to support the risk significance determinations with high confidence that the results and conclusions will remain stable throughout the design review process. Although specific details of the plant design may continue to evolve, the fundamental PRA scope, technical quality, assumptions, and data should be confirmed at the start of the design review. Experience has shown that initial use of simplified models to make preliminary risk determinations with later development of a more complete PRA should be avoided, because that process will likely introduce inefficient and counter-productive review iterations as the SSC populations in each significance category change over time.

Because SMRs could be desired for application in remote and harsh environments (severe cold, strong wind driven dust from desert sand, unusual contaminants in available water supplies, etc.), sufficient caveats should accompany the design and its PRA as to the range of environmental conditions that would require specialization of data and design assumptions.

Consistent with our past reports on the development of the technology neutral framework, we support the staff's recommendation to develop a new risk-informed, performance-based regulatory framework for non-LWR SMRs over the next several years. As we recommended previously, applying the concepts from NUREG-1860 to specific designs is the best way to move that process toward fruition. The idea of developing pilot applications is a good one. The staff plans a pilot study based on NGNP that progresses in parallel with the chosen regulatory pathway described in a report titled "Next Generation Nuclear Plant Licensing Strategy - A Report to Congress," dated August 2008, and another pilot study based on an iPWR that will also run in parallel with the formal review based on the iPWR framework discussed earlier. The benefits of this approach could be substantial. It would provide evidence about the actual feasibility of the new framework and would provide a comparison with more traditional approaches, facilitating evaluation of potential impacts on efficiency and effectiveness.

Although not directly related to the subject of this letter, we would like to observe that SMRs are generally novel reactor designs for which there is not an extensive base of operational experience. Much of the safety review will rely on computer code simulations of plant response. Modern trends in computer modeling lead to greater integration of phenomena with complicated coupling. Still it is not evident that even sophisticated modeling will adequately account for all pertinent phenomena and processes. There should be criteria specifying where the staff will require experimental demonstration of predicted plant performance.

We look forward to continuing our exchange with the staff, including review of the coming SECY papers on policy and operational issues.

Sincerely,

/RA/

Said Abdel-Khalik
Chairman

REFERENCES

1. SECY-11-0024, "Use of Risk Insights to Enhance the Safety Focus of Small Modular Reactor Reviews," February 18, 2011 (ML110110688)

2. COMGBJ-10-0004/COMGEA-10-0001, "Use of Risk Insights to Enhance Safety Focus of Small Modular Reactor Reviews," dated August 31, 2010 (ML102510405)

3. SECY-10-0034, "Potential Policy, Licensing, and Key Technical Issues for Small Modular Nuclear Reactor Designs," March 28, 2010 (ML093290245)

4. NUREG-1860, "Feasibility Study for a Risk-Informed and Performance-Based Regulatory Structure for Future Plant Licensing, Volumes 1 and 2," December 2007 (ML073400763)

5. ACRS Letter, Technology-Neutral Framework for Future Plant Licensing, dated April 20, 2007 (ML071100303)

6. ACRS Letter, Draft Commission Paper on Staff Plan Regarding a Risk-Informed and Performance-Based Revision to 10 CFR Part 50, dated May 16, 2007 (ML071360076)

7. ACRS Letter, Development of a Technology-Neutral Regulatory Framework, dated September 26, 2007 (ML072530598)

8. Next Generation Nuclear Plant Licensing Strategy - A Report to Congress, dated August 2008 (ML110620503)

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