Risk-Informed and Performance-Based Regulations for Nuclear Power Plants

The American Nuclear Society (ANS) supports and advocates for Risk-Informed and Performance-Based (RIPB) safety design and licensing approaches because such approaches will assure protection of public health and safety in the most effective, efficient and transparent manner. The RIPB approach is a set of methodologies that work to realize graded safety along with efficient priority setting. It takes advantage of decades of development and improvements in deterministic and probabilistic safety analyses, as well as experience-based insights into equipment and human performance to focus on the appropriate features and activities for oversight, assessment and evaluation. Performance-based regulatory approaches assure the necessary flexibility for designers to maximize inherent benefits of any technology using the latest innovative methods and tools.

The current Nuclear Regulatory Commission (NRC) regulatory framework provides prescriptive requirements for most facets of reactors and their supporting systems. The regulatory framework has proven to be effective in protecting public health and safety, but it is cumbersome and does not take full advantage of technological developments and experience gained from decades of reactor operations.

Nuclear power technology is at a crossroads where it is essential that the safety of advanced reactors be assessed from the perspective of integrated safety outcomes. Lack of integrated decision making often leads to focus on isolated objectives that may not optimize overall outcomes. Innovative reactor designs currently under development require changes to the existing compliance-focused regulatory review based on prescriptive criteria used for existing light-water designs. Such changes can be addressed within current regulations, but the process would be inefficient and most likely cost prohibitive as well as impractical to support the variety of different designs that are being developed. Optimization of outcomes requires weighing appropriately design objectives that may require transparent trade-offs, such as between safety and security needs. For example, protecting critical safety equipment from tampering may make operator action in an accident situation more difficult.

The regulatory practice associated with existing nuclear power plants has been evolving and now includes successful application of some RIPB approaches. However, the imperative for regulatory continuity and stability for the existing plants has restricted the incorporation of more advanced methods. For example, the current Reactor Oversight Process for operating plants is fully RIPB in nature[1]. Previously onerous prescriptive requirements in Technical Specifications[2] and in-service inspection[3] are now risk-informed. It is essential to accelerate the application of modern RIPB approaches to new advanced reactors without adversely affecting the current fleet of operating reactors.

Approaches that appropriately account for risk significance in establishing technical and regulatory requirements increase effectiveness and efficiency. Such approaches also reduce unnecessary regulatory burden by focusing resources on the protection of the health and safety of the public and the environment. A performance-based regulatory approach emphasizes desired and measurable outcomes, rather than prescriptive processes, techniques, or procedures. This approach is consistent with the Nuclear Regulatory Commission's goal of performance-based regulatory actions that "…focus on identifying

performance measures that ensure an adequate safety margin and offer incentives for licensees to improve safety without formal regulatory intervention by the agency."[4]

Accordingly, ANS supports the application of RIPB methods where appropriate for ongoing design and licensing activities. The necessary research and development work is done[5] and there does not appear to be any reason to put off taking beneficial action. In addition, ANS endorses the development of a RIPB advanced reactor licensing framework that enables cost-efficient applications of new technology while ensuring the protection of public health and safety in a transparent and understandable manner.

References

1. NUREG-1649, Rev. 6, "Reactor Oversight Process," July 2016.
2. "Risk Management Technical Specifications" (http://www.nrc.gov/reactors/operating/licensing/techspecs/risk-management-tech-specifications.html).
3. NRC Information Notice 1998-044, December 1998 (http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/1998/in98044.html).
4. "Risk and Performance Concepts in the NRC's Approach to Regulation"(http://www.nrc.gov/about-nrc/regulatory/risk-informed/concept.html).
5. NUREG-2150, "A Proposed Risk Management Regulatory Framework," April 2012.

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