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Adaptiveness of the US NRC Regulatory Framework to Review Risk-Informed SMR Designs

The new generation of Small Modular Reactors (SMRs) have proposed safety strategies whose reliance on PSA (Probabilistic Safety Assessment), and consequently use of risk insights, have significantly varied. For instance, the Licensing Modernization Project (LMP) endorsed by the NRC using its Regulatory Guide 1.233, "Guidance for a Technology-Inclusive, Risk-Informed, and Performance-Based Methodology to Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals for Non-Light-Water Reactors," relies on PSA to classify systems, define the licensing basis events, and determine the adequacy of defense-in-depth of the design. Other approaches such as those proposed in ANSI/ANS-30.3-2022, "Light Water Reactor Risk-Informed, Performance-Based Design,"has a lower reliance on PSA, however, relies heavily on computed event frequencies to select key safety strategy attributes. Other proposed approaches use defense-in-depth as its foundation to ensure safety and use PSA to identify vulnerabilities and close any safety gaps. NRC has already reviewed some SMR designs and has begun reviewing several other SMR designs and/or the associated safety strategies. These SMR designers have developed innovative approaches to use risk-informed and performance-based methods in a variety of safety strategies. Applicants have attempted to develop these safety strategies to comport with the US NRC regulatory framework while at the same time meet with key components of other international frameworks such as the IAEA framework. US NRC has been adaptive to accommodate innovative approaches by leveraging risk insights. US NRC continues to optimize regulatory licensing and construction oversight pathways using lessons learned during its reviews. The proposed paper will summarize numerous ways in which the U.S. NRC has used risk insights, where appropriate, to innovate and adapt its review approach.

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