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Regulatory Implications of Advanced Technologies for Advanced Reactors

With the increased interest and activities in development of commercial advanced reactors and their fuels, the U.S. Nuclear Regulatory Commission (NRC) is assessing potential use of advanced technologies to minimize risk and uncertainties related to reactors operations and maintenance, within its flexible regulatory framework. To aid this assessment, the NRC staff is engaged in several research activities to expand their understanding of the key technical and regulatory considerations of use of advanced modeling and simulation and digital twins for condition monitoring of reactor structures and components. The outcome of these activities is intended to ensure staff readiness to review near-term licensing/certification actions, support pre-application engagements, and inform guidance development, as needed. The paper will highlight opportunities afforded by digital twins enabling technology, such as qualification requirements for mechanical systems and components, verification and validation and uncertainty quantification for advanced modeling and simulation, explainability and trustworthiness for artificial intelligence/machine learning (AI/ML). Further, the paper will underscore the use of advanced technologies to enable effective integration of safety, security, and safeguards (3S) to further inform NRC supporting activities to risk-inform and better equip the agency's readiness and posture to address applicants' and licensees' regulatory needs.

This paper will also provide an overview of the various research activities and a summary of the recently completed reports.

Country OR International Organization

U.S. Nuclear Regulatory Commission, United States

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YES

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