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Grantee: University of Illinois at Urbana - Champaign

Title of Grant: Advancing Uncertainty Analysis Processes in Risk-Informed Regulatory Framework to Support Simulation Approaches for Aging Plants and Advanced Reactors

Period of Performance: 2/16/2021-2/15/2024 (FY20 Notice of Funding Opportunity NOFO)

Executive Summary

This proposal develops a systematic and scientifically justifiable methodology to facilitate the validation of simulation models, under the Risk-Informed Regulatory (RIR) framework, for aging plants as well as advanced reactors. The project advances the uncertainty analysis processes in the RIR framework and the use of epistemic uncertainty as a quantitative metric of validity of the simulation models, especially when empirical validation is challenging. An advanced importance ranking approach will be developed to identify the critical sources of epistemic uncertainty at multiple levels of analysis, including those associated with underlying simulation models and their supporting phenomena data, based on their contribution to the uncertainty of the plant risk estimate. These advancements will be incorporated into the regulatory guidance to effectively support the use of simulation models in the RIR applications and generate risk-informed guidance as to whether the PRA model needs to be refined and how.

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Presentations and Publications

The list of publications was submitted with the final report after grant expiration.

- *Beal, J., Reihani, S., Sakurahara, T., & Mohaghegh, Z. "A Methodology for Coupling Physical Models and Explicit Maintenance Models for Piping Failure Analysis," Under Review for Reliability Engineering and System Safety.*

- *Beal, J., Reihani, S., Sakurahara, T., Bui, H., & Mohaghegh, Z. "Probabilistic Validation of Maintenance-Physics Coupling in the Absence of Maintenance Performance Data; Application for Nuclear Power Plant Piping Reliability Analysis." Manuscript under internal review. To be submitted to Annals of Nuclear Energy in September 2024.*

Patents

N/A