

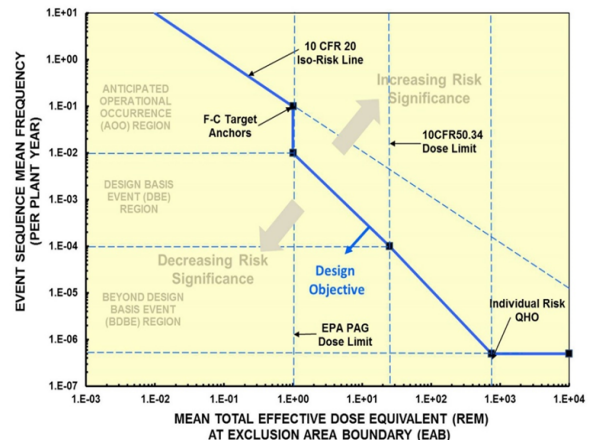
Enhancing Risk-Informed and Performance Based Seismic Safety for Advanced Non-Light Water Reactors

Workshop: September 2-3, 2020, NRC Headquarters

Staff from the Nuclear Regulatory Commission (NRC) and NRC contractors will host a workshop on an enhanced technology-inclusive (TI) and risk-informed and performance based (RIPB) conceptual seismic design approach to achieve desired seismic safety for Advanced Non-Light-Water Reactors (ANLWR). The approach aligns with the Licensing Modernization Project (LMP) framework and may offer an alternative pathway for the design of future ANLWRs. At the workshop, NRC staff and contractors will present perspectives and detailed insights into a proposed seamless integration of seismic probabilistic risk assessment (SPRA) and the LMP framework into the design process; one that leverages the LMP safety criteria and categorization criteria for structures, systems, and components (SSCs) with the performance-based ASCE 43 seismic design criteria. The resulting design process is also integrated with defense-in-depth considerations to produce a risk-balanced seismic design with potential safety and cost benefits, as well as attributes consistent with existing 10 CFR Part 52 and Part 50 licensing processes. This TI-RIPB pathway for ANLWR to design against seismic hazards. Feedback from the ANLWR technical community and stakeholders at the workshop will be used by the NRC in planning future technical activities to further evaluate the feasibility and validity of the proposed TI-RIPB approach.

Benefits of the TI-RIPB Approach to Licensees

- A flexible SSC design process that achieves seismic safety while utilizing proven engineering practice and applicable nuclear design codes and standards
- A design approach integrated with SPRA that explicitly incorporates Licensing Basis Events (LBEs), including seismic failures, non-seismic failures and human errors, while also accounting for defense-in-depth adequacy
- A risk-focused design approach that leads to better understood and more tailored seismic safety margins (including reduced design demands for low-risk SSCs and a more balanced seismic risk profile across the plant), thereby enhancing the commercial viability and competitiveness of ANLWRs



Benefits the TI-RIPB Approach to Regulators

- Provides improved focus on safety and regulatory clarity by explicitly tracking and focusing on seismic risk contributors while reducing unnecessary design conservatism
- Technology inclusive
- No obvious impediments for implementation under both 10 CFR Parts 50 and 52 licensing process
- Prioritizes staff review on the SSCs and LBEs that contribute most to the seismic risk profile of the advanced nuclear plant design

Challenges

- First-of-a-kind approach for nuclear engineering seismic design in that (i) more than one seismic design category would be available for the design of safety-related SSCs, and (ii) the role of each individual SSC in various accident sequences is explicitly accounted for
- Realistic case studies are needed to demonstrate the feasibility and validity of the approach and the applicability of the processes
- May require pilot designs to determine how all aspects can be seamlessly integrated and placed into practice

Future Activities

- Reach consensus among the technical community on principal aspects of the proposed alternative approach
- Forge collaborative effort to identify case studies that can yield the most beneficial and effective insights
- Develop a strategic plan to ensure successful and efficient ANLWR licensing under existing or new regulations
- Identify regulatory enhancements related to the implementation of the proposed TI-RIPB approach

Proposed LMP-ASCE Seismic Design Process

