

# A Proposed Periodic Risk-informed Seismic Safety Assessment Process for DOE Nuclear Facilities

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DOE Order 410.1C and specifically DOE Standard 1020-2016 define a periodic process to assess seismic safety for DOE nuclear facilities. The process starts with a periodic seismic hazard assessment and a subsequent probabilistic seismic hazard analysis (PSHA) if needed. Then, a facility condition assessment follows if the PSHA update identifies an increase in seismic hazards when comparing the new hazard with the original seismic design.

Recently, Idaho National Laboratory proposed a risk-informed approach to determine when a PSHA update is needed. The approach starts with a Senior Seismic Hazard Advisory Committee (SSHAC) level 1 or 2 PSHA to assess the seismic hazard. If the assessment results in a new seismic hazard higher than the original design ground motion, the risk-informed analysis would be applied to decide if a SSHAC level 3 PSHA update is needed. The INL risk-informed contents were not implemented at the INL site because seismic hazard did not increase in comparison to the original seismic design for the facilities under study.

We agree with applying the risk-informed approach in the seismic safety assessment for nuclear facilities because a seismic safety assessment for nuclear facilities needs to not only consider the seismic hazard but also the seismic design of safety-related structures, systems and components (SSCs). However, we believe that the risk-informed analysis should not be based on a periodic seismic hazard assessment but on a PSHA update with a relatively higher SSHAC level process. A risk-informed approach can provide safety insights probabilistically by identifying the facility's seismic risk, safety margin and those limit states which dominate seismic risk so that we can answer three fundamental questions, what can go wrong, how likely it is and what is the consequence. A facility SSC upgrade will use the insights provided by the risk analysis. Based on these we propose that the periodic DOE's seismic safety assessment for nuclear facilities starts with a seismic hazard assessment and if the estimated seismic hazard experiences a significant increase determined by a sensitivity analysis to confirm that the change in input data, criteria and assessment methods has potentially resulted in a significant increase in the seismic hazard, a PSHA with a high SSHAC level should be implemented. If the site-specific PSHA determines that the seismic hazard increases, a probabilistic seismic risk assessment should be implemented to understand the seismic risk of the facility and to determine if any SSC upgrade is needed. Conceptual flow charts for the current DOE Standard 1020 -2016 periodic seismic safety assessment process and a proposed risk-informed process outlining the difference between the current and the proposed risk-informed approach will be discussed.