

External Hazards Assessments for Nuclear Reactor Siting by the United States Nuclear Regulatory Commission: 50 years of Challenges, Innovative Approaches, and Preparing for What Comes Next

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The U.S. Nuclear Regulatory Commission (NRC) ensures safe operation of nuclear reactors and the civilian use of nuclear materials with the mission of protecting people and the environment. The NRC staff contributes to this mission by performing technical reviews over a wide variety of external hazards, including meteorology, hydrology, seismology, geology, and volcanology. Scientific and engineering methods employed in the assessment of external hazards have evolved substantially since the establishment of the NRC nearly 50 years ago. By ensuring adequate protection of public health and safety from the civilian use of nuclear power, the NRC ensures the resilience of the domestic nuclear reactor fleet to continue to reliably provide power. The NRC staff performs safety reviews to ensure regulatory compliance with existing regulations and is responsible for guidance in response to emerging needs and legislative requirements. Consistent with the Commission's 1995 policy statement on the use of probabilistic methods, the NRC staff promotes the use of advanced analysis tools that include high-speed computer modeling, the adoption of the Senior Seismic Hazard Analysis Committee (SSHAC) process to assess seismic hazards, and the implementation of the hierarchical hazard assessment (HHA) process for the evaluation of hydrologic hazards. The NRC staff develops and updates guidance documents as the state of practice embraces new analysis methods. This includes incorporating lessons learned from national and global operating experience such as the 2011 accident at Fukushima Dai-ichi in Japan and considering new hazard information by implementing NRC's process for the ongoing assessment of hazard information. The development and deployment of an ever-expanding variety of nuclear reactor designs presents regulatory challenges and opportunities. As a modern regulator, the NRC is enhancing current methods and processes to address the unique facets of these new reactor designs. The NRC staff implements innovative approaches to hazard analysis through risk-informed regulation and a graded approach to site characterization. The NRC continues to evolve and adapt with emerging computational advances that can be used in addition to the technical tools in current use.