
Identifying and Prioritizing Sources of Uncertainty in External Hazard Probabilistic Risk Assessment

PI: Michelle (Shelby) Bensi -
University of Maryland

Program: RC-8: Evaluation of
Physical Phenomena Data
Impact and Improvements

Collaborators:

Katrina Groth - University of Maryland
Zeyun Wu - Virginia Commonwealth University;
Zhegang Ma - Idaho National Laboratory;
Hongbin Zhang - Idaho National Laboratory;
Ray Schneider - Westinghouse Electric Company

ABSTRACT:

Significant sources of uncertainties in external hazard probabilistic risk assessment (XHPRA) are associated with the frequency, severity, and temporal evolution of external hazard events. To reduce hazard uncertainties, there is a research need to evaluate existing knowledge and tools, identify their limitations, and develop a technically sound, risk-informed strategy for identifying and characterizing drivers of hazard uncertainty so that uncertainty reduction activities can be prioritized based on their risk significance, risk reduction benefit, and value. This risk-informed strategy must reflect the importance of uncertainty reduction options relative to the overall results of the XHPRA. As such, it must account for the impacts of hazard events on structures, systems, and components (SSCs) and event progressions as well as the close coupling of the physical aspects of hazard events with plant response and human performance.

The goals of this project are to:

- Identify significant sources of uncertainty in XHPRA, with particular emphasis on how they relate to the frequency, severity and temporal evolution of hazard events
- Assess (individually and collectively) the effects of key sources of uncertainty from the perspective of hazard severity, temporal evolution, physical event impacts, event progression, and interplay between human response and physical event impacts
- Integrate insights related to key sources of uncertainty to develop a risk-informed process for prioritizing measures to reduce hazard uncertainty

In seeking to reach these goals, the objectives of this project are to:

1. Develop a structured process for identifying, evaluating, categorizing, and assessing the impact of uncertainties on XHPRA modeling elements and create a common taxonomy for communicating these uncertainties across hazard groups
2. Investigate the spectrum of uncertainties involved in the physical processes that underlie external hazards and assess the uncertainties associated with estimation of hazard frequencies and parsing of hazard information into the XHPRA
3. Investigate how uncertainties in the physical hazard characteristics and associated hazard timing interfaces with plant processes to prepare for, mitigate, cope, and recover from the external challenge and connect the impact resulting from the interaction of uncertainties in the hazard severity/evolution with human response
4. Assess the combined impact of these uncertainties (and uncertainty reduction efforts) on the development of the external hazard characterization in the XHPRA.