

External Flooding Probabilistic Risk Assessment Analysis Identification of Plant Vulnerabilities

Background

All nuclear power plants must consider and evaluate external flooding risks such as flash flooding from rain, river flooding, dam failure, hurricane and tsunamis. These events challenge off-site power, threaten many on-site plant mitigation components, challenge the integrity of plant structures and limit plant access. Plants must understand the impact of these events in order to fully comprehend and prepare for these plant risks. Existing plant mitigation procedures may not be adequate to deal with these types of events.

Why Westinghouse?

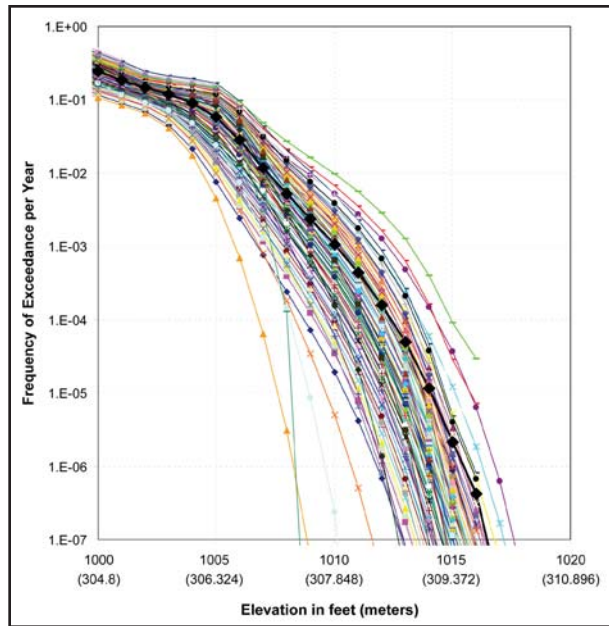
Westinghouse developed external flooding procedural guidance and alternative strategies for the mitigation of reactor coolant system and used fuel pool challenges caused by severe floods. Plants have implemented specific Westinghouse strategies that provide margin during an actual plant challenge, demonstrating that Westinghouse leads the industry in external flooding probabilistic risk assessment (PRA) experience. Westinghouse uses lessons learned from this potentially complex analysis to deliver timely solutions to market and to help its customers meet U.S. Nuclear Regulatory Commission requirements in a cost-effective manner.



Aerial view of nuclear reactor during 2011 Missouri River flood

Description

As shown by the Fukushima event and more recently by the flooding along the Mississippi and Missouri rivers in the United States, external flooding risks can pose a very real and significant challenge to plant safety during both power operations and shutdown conditions. Strategies to cope with such events can be developed based upon a full understanding of the risk contributors and associated insights for the event.



Frequency of exceedance for flood elevations

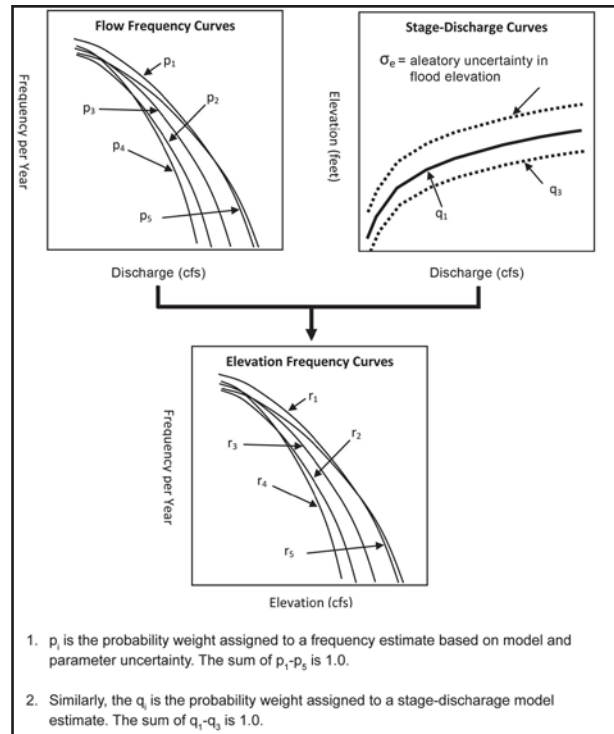
Benefits

Westinghouse can:

- Analyze plant risk due to external flooding events from a PRA and design-basis perspective.
- Develop a variety of plant procedures necessary to cope with external flooding events.
- Develop plant modifications, evaluate the risk-effectiveness of temporary measures and establish mitigation strategies for dealing with such events.

Experience

- Westinghouse developed external flooding hazard curves for use in external flooding risk assessments and supported PRA models and plant response strategies. Analyses included simplified external flood models in support of a U.S. Nuclear Regulatory Commission External Flood Significance Determination Process.
- Westinghouse performed PRA model development, risk assessment and technical analysis of system



Analysis steps to estimate flood exceedance curves

capabilities and resource requirements for external flood mitigation strategies.

- Westinghouse developed maximum precipitation frequencies for use in bounding precipitation-induced flooding assessments.
- A member of the Westinghouse PRA staff is chairman of the recently resurrected American Nuclear Society team to upgrade the U.S. industry standard ANS-2.8, Determining Design Basis Flooding at Power Reactor Sites.
- Westinghouse provides assessment of extended power uprate impact on external flooding risks.
- Westinghouse has performed several extended power uprates over the last two years