

Fire Probabilistic Risk Assessment (PRA)

Background

A Fire PRA is required to implement plant transition to NFPA 805, as well as to meet NRC Regulatory Guide (RG) 1.200 requirements (i.e., technical adequacy of PRA results for risk informed activities). NFPA 805 is a standard developed by the National Fire Protection Association that provides a risk-informed, performance-based alternative to a plant's current fire protection program. NUREG/CR-6850 is the NRC-endorsed guidance for developing a Fire PRA that meets the Fire PRA Standard, ANS 58.23.

Fire Risk Services Team (FRST)

To ensure the development of a high-quality Fire PRA, Westinghouse FRST has expertise in all the required areas, such as:

- First-hand Fire PRA implementation experience at domestic and international facilities, including fire risk assessments for the AP1000 and System 80+ advanced reactor designs
- Substantial PRA experience provided by staff of over 30 PRA engineers
- World-class fire modeling capability with Fauske& Associates (FAI), a subsidiary of Westinghouse
- Fire protection program and licensing experience
- Substantial industry involvement, providing immediate access to lessons-learned as they are developed; participation in NEI Task Forces on
- NFPA 805, Fire PRA, and Fire-Induced Circuit Failures, as well as the ANS Risk-Informed Standards
- Consensus (RISC) Committee

Immediate deployment of personnel with a wide range of expertise and experience levels

Fire PRA Capabilities

Integration of Fire PRA with Level 1 and Level 2

PRA Models

- Westinghouse has been intimately involved in the development of Level 1 and Level 2 PRAs for numerous plants. In the early 1990s, Westinghouse developed the PRA models for many individual plant examination submittals and supported numerous PRA updates and applications.
- Westinghouse has been instrumental in developing the PRA quality review process, as well as coordinating, leading, and supporting various PRA peer reviews. Westinghouse can use this extensive

first-hand knowledge of Levels 1 and 2 PRAs to develop a full-scope Fire PRA and integrate it with the existing Level 1 and 2 PRA models.

- Westinghouse has experienced safe shutdown and fire protection personnel, who have direct experience with plant-specific safe shutdown Nuclear Services/Engineering Services analysis and the NFPA 805 transition process, which is essential for performing several of the NUREG/CR 6850 tasks. These tasks include fire compartment selection and reconciliation of a plant's equipment/basic event mapping list with the safe shutdown equipment list. Westinghouse can support the plant mapping of Fire PRA components to cable locations.

Scoping Fire Modeling, Detailed Fire Modeling, and Circuit Analysis

- Westinghouse and FAI have expertise in fire analysis, including fire behavior and fire modeling. We can perform fire scoping analysis using a range of first-order fire modeling tools (e.g., fire dynamic tools [FDTs] and fire-induced vulnerability evaluation [FIVE]) to calculate the potential for target damage and find the severity factor.
- Westinghouse can perform detailed fire modeling to provide a realistic fire risk assessment in key fire compartments at the plant. Westinghouse and FAI engineers are qualified users of all mainstream zone and computational fluid dynamics fire modeling software (e.g., CFAST, MAGIC, and FDS). In addition, FAI has developed and validated their own multiple compartment fire analysis code, FATE.
- Westinghouse has expertise in performing circuit failure analysis using deterministic means to identify cables/circuit failures that could adversely affect safe shutdown equipment. We

can also perform circuit failure mode likelihood analysis, which is a probabilistic assessment of the likelihood that a cable will experience certain failure modes.

- Westinghouse, by incorporating the first-hand knowledge of your plant's existing PRA with expertise in fire modeling and circuit analysis, we can effectively perform quantitative screening, as well as incorporate results from the detailed fire modeling, circuit analysis, and human reliability analysis into the Fire PRA.

PRA Quantification, Sensitivity Studies, and Documentation

- We have engineers who are experienced in PRA modeling industry software and who can develop a Fire PRA that effectively quantifies plant risk. They can also perform uncertainty analyses and sensitivity studies on key assumptions inherent to the NUREG/CR-6850 Fire PRA development process.
- Westinghouse can document the Fire PRA process and results into a Fire PRA report, which includes an electronic Fire PRA database system.

Plant Walkdowns

- Plant walkdowns provide input for Fire PRA tasks, but they can be time consuming. Westinghouse will use our first-hand Fire PRA walkdown experience and industry lessons-learned to combine walkdowns for several tasks to maximize overall efficiency.