



U.S. NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

U.S. NRC PRA Research Activities

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Outline

- Research Goals
- PRA Methods, Models and Tools
 - Reactor Oversight Tools
 - Human Reliability
 - Digital I&C PRA
 - Fire Research
- Emerging Focus Areas
- Recent Publications

Overall Goals

- Support the reactor oversight and operating experience programs
- Improving the effectiveness and efficiency of risk-informed regulation
- Support continuous advancement in PRA state-of-the-art and state-of-practice
- Expand PRA infrastructure to encompass new reactor concepts and designs



PRA Methods, Models, and Tools

- Standardized Plant Analysis Risk (SPAR) Model Development and Maintenance
 - 78 Level 1 Internal Event Models for Operating Plants
 - 3 “New” Reactor Models (AP1000, ABWR, US APWR)
 - Focus areas in the coming year:
 - External event and NFPA 805 fire models
 - Support system initiating events
 - Improved success criteria
 - Resolution of ASME Peer Review Findings and Observations
- SAPHIRE Version 8 (PRA Analysis Computer Code)
 - Anticipating increased inspector use
 - Enhanced integrated modeling features
 - Improving analysis time



PRA Methods, Models, and Tools

- Human Reliability Analysis
 - SRM M061020: Propose a single model for the agency to use or guidance on which model(s) should to be used in specific circumstances
 - “Hybrid” model user guide and technical basis report under development
 - Reports should be available for public comment later this year
 - SRM M090204B: Work with US stakeholders on the HRA benchmark and data activities HRA Benchmark
 - HRA Benchmark
 - Study US crew performance in their home simulator
 - Focus on HRA methods used in US (ATHEANA, SPAR-H, CBDT)
 - HRA Quantitative and Qualitative Data



PRA Methods, Models, and Tools

- Digital I&C PRA
 - Currently working on selection and development of two candidate QSRMs to apply in proof-of-concept studies
 - Bayesian Belief Network method
 - Statistical testing method
 - Future research activities
 - Reliability parameters
 - Common cause failures
 - Fault tolerant features
 - Dynamic interactions
 - Human reliability analysis

Fire Research

- Fire PRA and HRA
 - NFPA-805 Support
 - NRC/EPRI Training (2 classes/year)
 - NUREG/CR-6850, Supplement 1 (addresses FAQs arising from pilot reviews)
 - NUREG-1921, “Fire HRA” – final publication expected this summer
 - NUREG/CP-0194 “Methods for Applying Fire Risk Analysis to Fire Scenarios” (July 2010)
- Fire Modeling
 - NUREG-1934, “Nuclear Power Plant Fire Modeling Application Guide” being revised (will be available for public comment in April 2011)

Fire Research (cont)

- Fire and Electrical Systems Circuit Analysis
 - DC Electrical Shorting in Response to Exposure Fire (DESIREE-FIRE) – final report expected later this year
 - Electrical Circuit Phenomena PIRT in progress
- Fire Testing
 - Spent fuel shipping cask testing (NIST)
 - Cable Heat Release, Ignition, and Spread in Cable Tray Installations of Fires (CHRISTI-FIRE) – Phase 1 Draft Report completed (NUREG/CR-7010)



Emerging Focus Areas

- Formulate plans for Level 3 PRA project (NUREG-1150 update) (SRM M100218)
- Develop guidance for expert judgment in regulatory decision-making (COMGEA-11-001)
- Clarify “defense-in-depth” to ensure consistent implementation (SRM SECY 11-0014)
- Evaluate options for more holistic risk-informed, performance-based regulatory approach (February 11, 2011 Tasking Memo)
- Risk-Informing small modular reactor reviews (COMGEA-10-001/COMGBJ-10-004)



Recent NRC Publications

- Technical Reports
 - NUREG/CR-6850, EPRI 1019259, Supplement 1, “Fire Probabilistic Risk Assessment Methods Enhancements”
 - NUREG/CR-7010, “Cable Heat Release, Ignition, and Spread in Tray Installations During Fire (CHRISTIFIRE), Volume 1: Horizontal Trays” Draft Report
 - NUREG-1953, “Confirmatory Thermal-Hydraulic Analysis to Support Specific Success Criteria in the Standardized Plant Analysis Risk Models—Surry and Peach Bottom” Draft Report



Recent NRC Publications (cont)

- Regulatory Guidance
 - DG-1247 Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants (ML100480890)
 - DG-1226 An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis (ML091200100) (RG 1.174, Rev 2)
 - DG-1227 An Approach for Plant-Specific, Risk-Informed Decision-making: Technical Specifications (ML091200294) (RG 1.177, Rev 1)
- Generic Notices
 - Information Notice (IN) 2010-18: Generic Issue (GI) 199, “Implications Of Updated Probabilistic Seismic Hazard Estimates In Central And Eastern United States On Existing Plants”
 - IN 2011-005, “Tohoku-Taiheiyou-Oki Earthquake Effects on Japanese Nuclear Power Plants”