EPRI Risk & Safety Management Program

Research Priorities

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RSM Research Priorities Derive from EPRI Mission

EPRI Mission

Advancing safe, reliable, affordable and environmentally responsible electricity for society through global collaboration, thought leadership and science & technology innovation

Risk & Safety Management Strategic Vision

Provide practical technology to help nuclear power plants to achieve safe, reliable operation

Achieving the Risk & Safety Management Vision

Risk & Safety Management Strategic Vision

Provide practical technology to help nuclear power plants to achieve safe, reliable operation

RSM Program Mission:

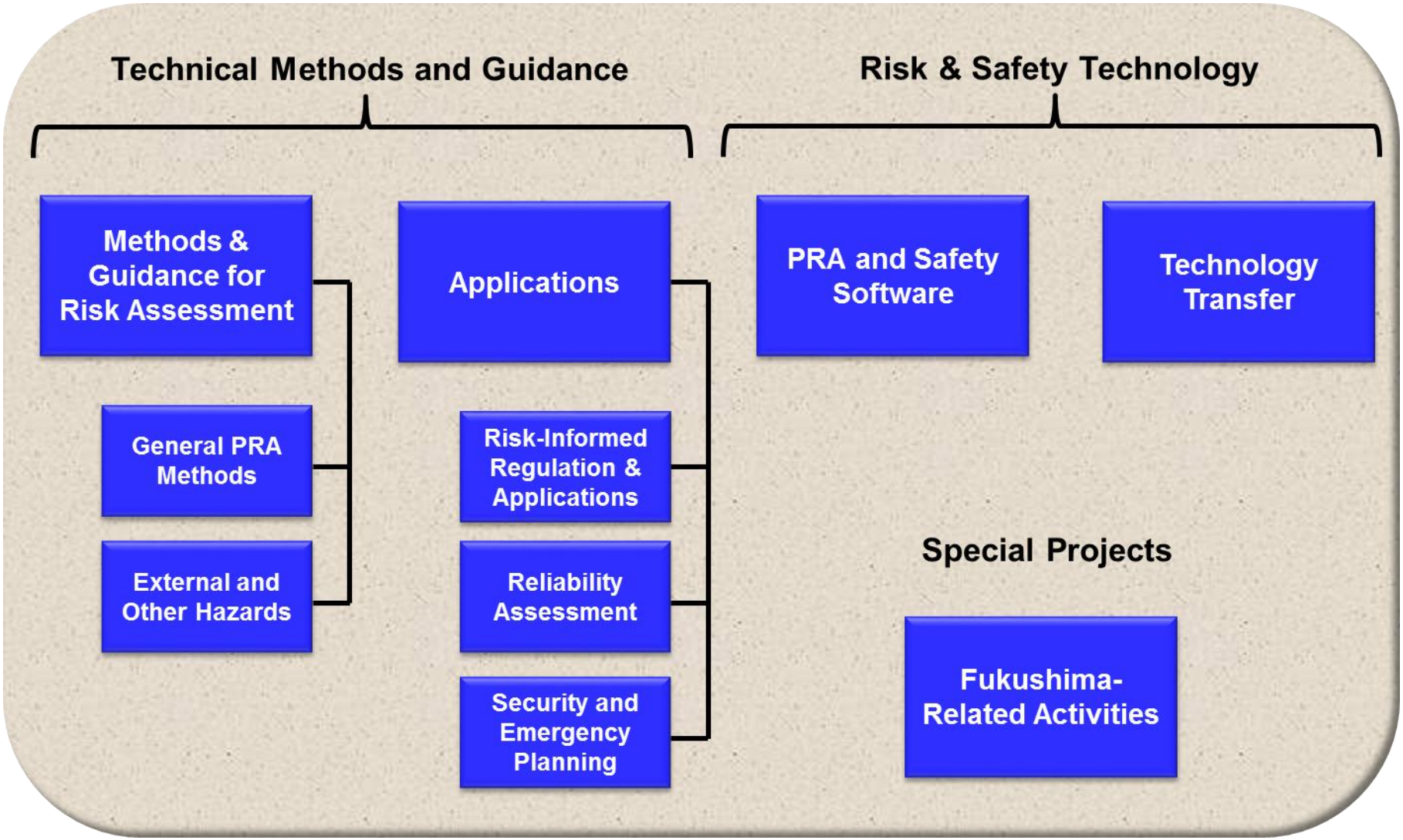
To equip members to implement a risk-informed framework to support

- Identifying cost-effective ways to improve ***safe operations***, *while also*
- Enhancing ***operational flexibility***

Mission achieved through

- Developing and improving ***technical methods*** and ***analysis tools***
- Providing ***guidance*** for effective use of methods and tools

Organization of RSM Research Areas

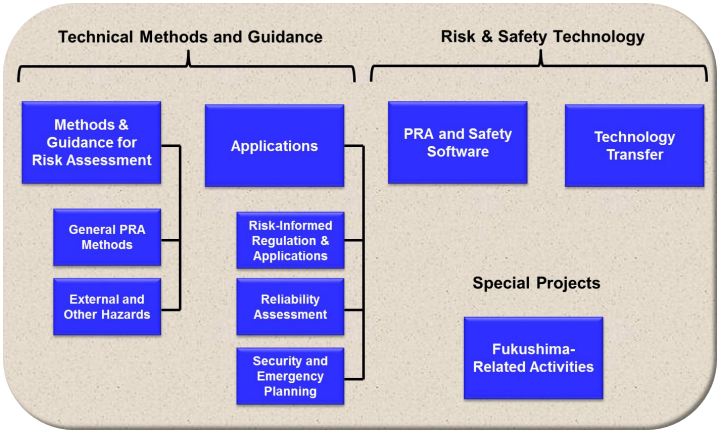


Objectives for Long-Term Research in RSM

- Enhance ability to understand risks for more effective decision-making
- Enhance risk analysis process to
  - Provide greater efficiency for timely probabilistic risk assessments (PRAs) and applications
  - Facilitate ability to extract meaningful risk insights

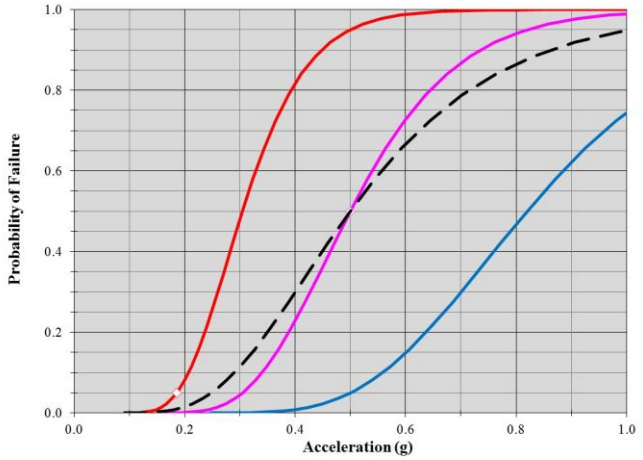
Examples of relevant research priorities

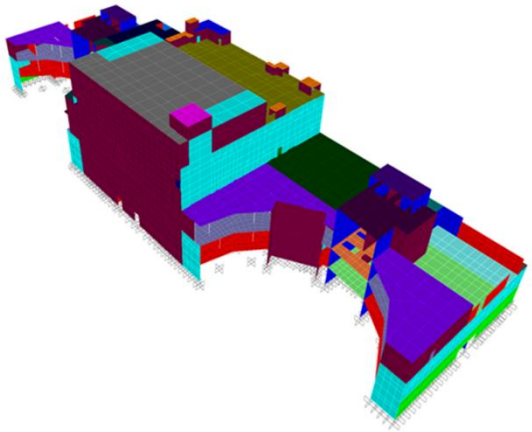
- Improvements in ***seismic fragility analysis***
- Methods and guidance for risk assessment of ***external flooding***
- Advances in ***human reliability analysis***
- Advanced ***PRA software platform***

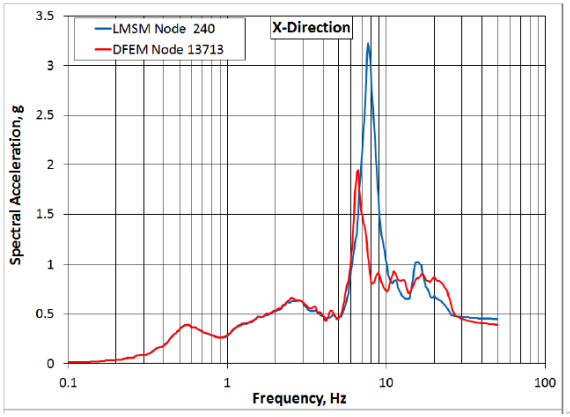


Improvements in Seismic Fragility Analysis

- Fragility analysis captures likelihood of failure as a function of earthquake intensity
- Research underway to
  - Improve ability to model structural response
  - Apply experiential data to inform fragility analysis
  - Develop new approach to fragility assessment







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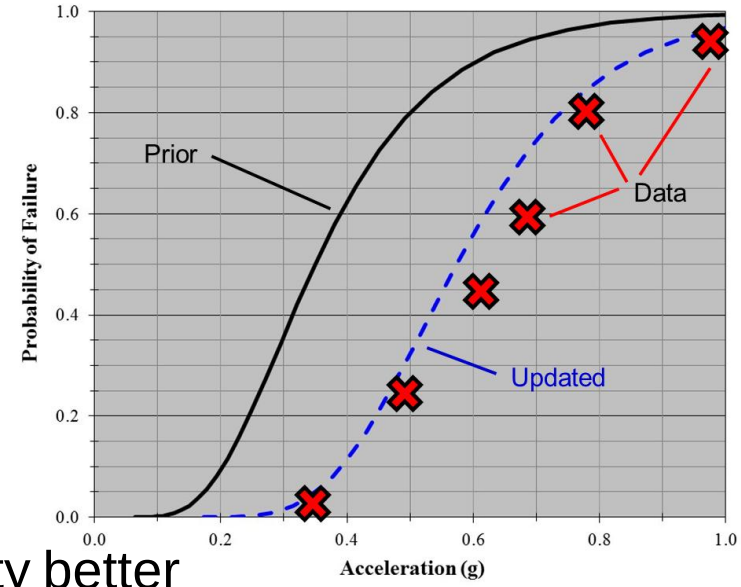
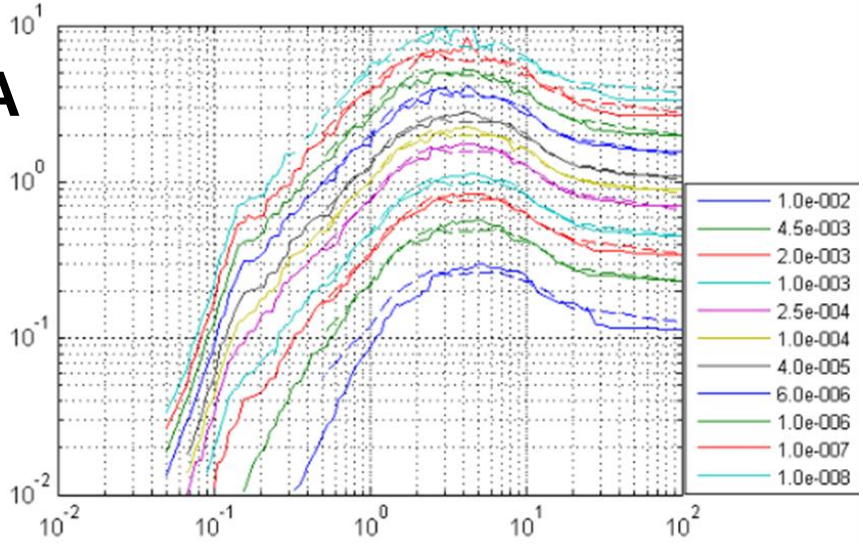
Using Data to Inform Fragility Assessment



- Examining earthquake experience database for representative equipment
  - Augmenting or reformulating methods for seismic capacities
  - Assessing whether alternate approaches exist to characterize fragility better
  - Initial results from pilot study: consistent increases in assessed median capacity
- Mining data from extensive qualification testing
- New testing of components for sensitivity to high-frequency motions

Scenario Earthquake Approach to Fragility Analysis



- **New approach for seismic PRA**
- **Concept**
  - Use large number of earthquake time histories to characterize probabilistic ground motion
  - Eliminate reliance on uniform hazard spectra to connect hazard to fragility analysis
- **Objective**
  - Decrease uncertainty in seismic motions imputed to buildings and equipment
  - Understand potential conservatisms in current seismic PRA methods

Promising technical approach – if complexity can be reduced

External Flooding Research

Examples of research priorities

- ✓ Improvements in ***seismic fragility analysis***
- Methods and guidance for risk assessment of ***external flooding***
- Advances in ***human reliability analysis***
- Advanced ***PRA software platform***

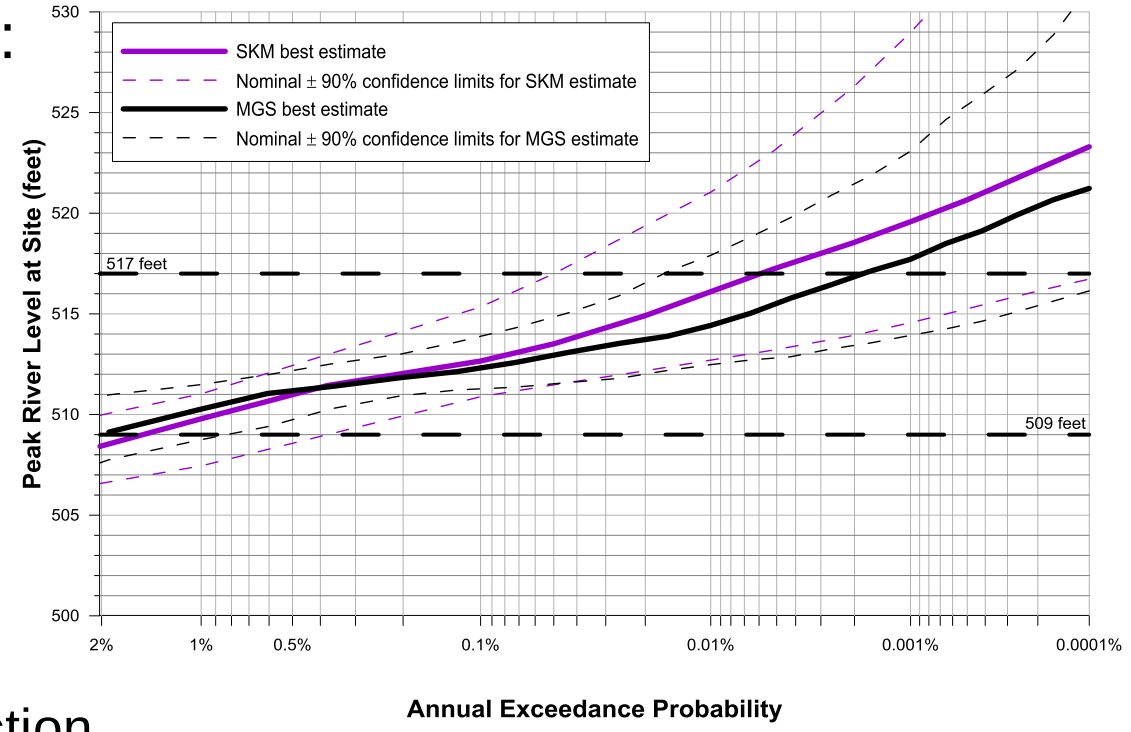
Overall research focus

- Better characterization of probabilistic flood hazard
- Improved understanding of potential impacts on plant (inundation, debris, dynamic forces)
- PRA modeling of plant response

External Flooding Research (continued)

Recent and near-term activities

- Completed pilot studies:
  - Flooding of river site
  - Intense precipitation
- In progress:
  - Dam failure rates and mechanisms
  - Coastal flooding from storm surge
  - Human response to implement flood protection



Human Reliability Analysis

Examples of research priorities

- ✓ Improvements in ***seismic fragility analysis***
- ✓ Methods and guidance for risk assessment of ***external flooding***
- • Advances in ***human reliability analysis***
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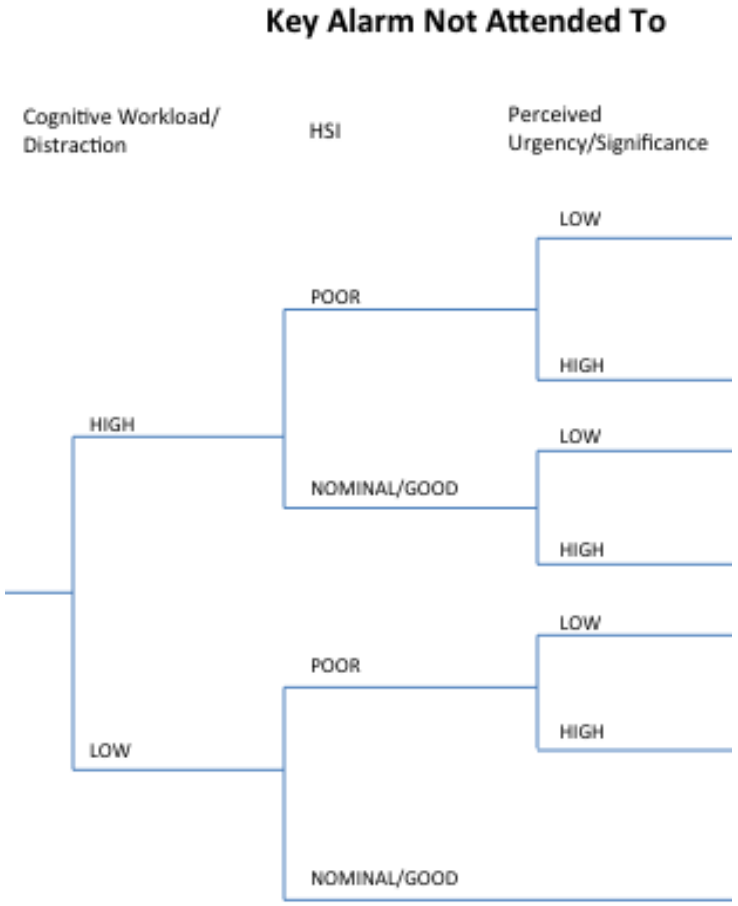
- Practical methods with strong basis from psychological literature
- Adapting/extending methods for
  - External hazards, starting with seismic and external flooding
  - Assessment of actions not covered by explicit procedures ("recovery")
  - Use of portable/flexible capabilities (e.g., FLEX in US)
  - Assessment of actions after onset of core damage (severe-accident management)



Advanced PRA Software

Examples of research priorities

- ✓ Improvements in ***seismic fragility analysis***
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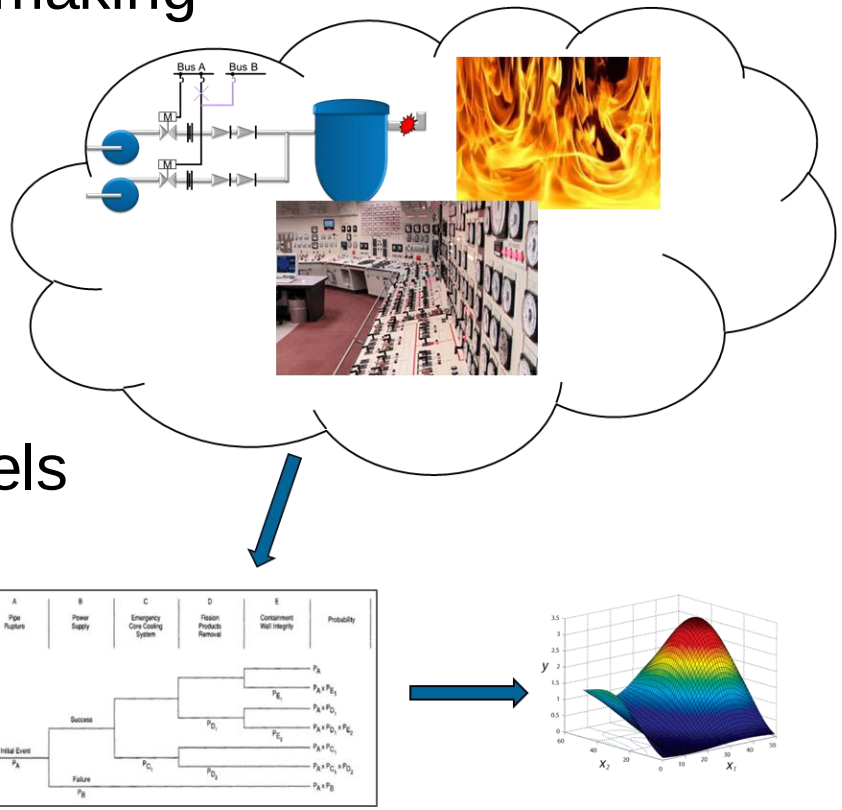
Phoenix: Meeting needs for

- Supporting increasing regulatory application of PRA
- Effective risk-informed decision-making
- Extending plant operating life
- New plants

Key Features of *Phoenix*

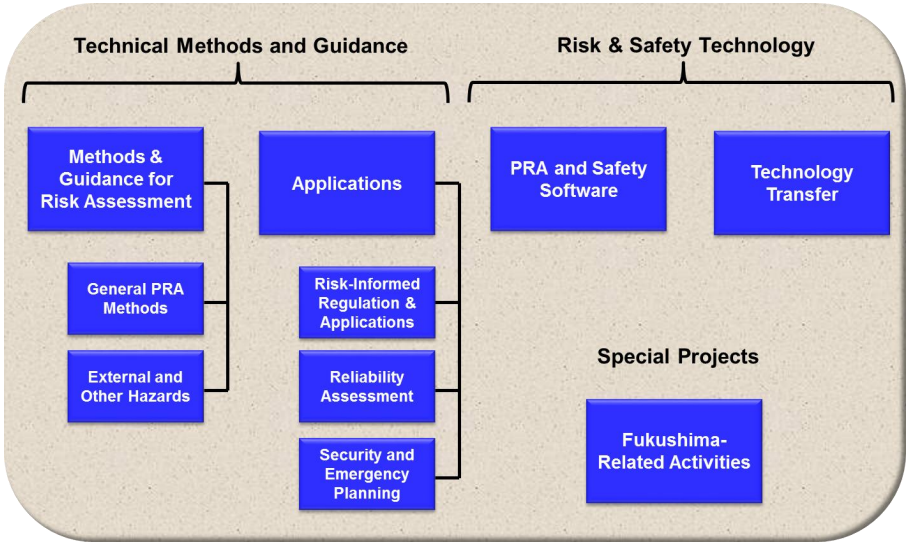
- More efficient ways to construct and evaluate risk models
- Better ways to visualize results



Summary

EPRI Risk & Safety research priorities address

- ✓Common cause failures due to external and internal events
- ✓Technologies to prevent/mitigate severe accidents
- ✓Severe accident analysis
- ✓Emergency preparedness and response
- ✓Post-accident recovery



Together…Shaping the Future of Electricity