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Advancing the Science of Safety

# The Evolution of Performance Based/Risk Informed Analytical Tools During the NFPA 805 Transition

**Session W-24**
**A Look at Experience Implementing Risk-Informed, Performance-Based Fire Protection Programs**

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## Motivation

Session:
A Look at Experience Implementing Risk-Informed, Performance-Based Fire Protection Programs

- The evolution of analytical tools provides perspective on the challenges and successes of implementing risk informed/performance based (RI/PB) fire protection programs
- Analytical Tools
  - Computer programs, methods, data, etc.
- Used to develop the analyses supporting RI/PB fire protection programs
  - Required NRC and Industry consensus



## Scope and Objectives

Objective

- Describe the evolution of analytical tools during the NFPA 805 transition process focusing on:
  - The development of the NFPA 805 transition analyses
  - Interactions between the industry and NRC

Scope

- Timeline
  - Pre-transition, Pre LAR submittal, LAR Review/RAI, Post SE
- Evolution of analytical tools
- Research activities supporting analytical tools
- Successes and challenges
- Questions

## Analytical Tools (Examples)

Analytical tools include:

- Computer programs
  - CAFTA, FRANX, CFAST, FDS, MAAP, etc.
- Methods/Guidance
  - NUREG/CR-6850, NEI 00-01, NUREG-1824, NUREG-1921, etc.
- Industry data
  - Fire events data, experimental data
- Frequently asked questions (FAQs)

Mostly developed by:

- NRC/RES, EPRI, Joint Reports
- Fire PRA and NFPA 805 Task Force



## Analytical Tools

Conservative or Realistic?

- The key is to ensure conservatisms do not mask realistic insights
- Starting point of an analysis is always conservative
  - Easier to prepare/Develop
  - Easier to maintain
  - Easier to review
- Detailed analysis increasing realism can't be avoided for specific plant locations
  - Detailed methods have been developed in parallel with the transition process
  - Some are still in process



## Research Activities

Research topics over the last decade:

- Human reliability including main control room abandonment
- Fire ignition frequencies/Fire events data
- Modeling cable fires and cable heating
- Electrical cabinet heat release rates
- Fire modeling verification and validation
- Circuit failure mode probabilities
- Fire modeling guidance
- Incipient detection
- Others (e.g., high energy arcing faults, obstructed fire plume flows, etc.)

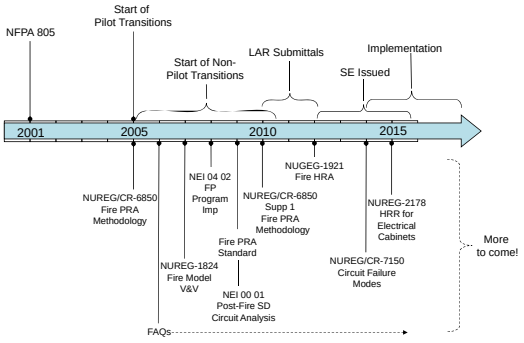


Figure only include a sampling of key documents associated with analytical methods. Other documents governing NFPA 805 transition and FP programs such as Regulatory Guides etc., are not included.

## Future Research

2016 2017 …

Selected approaches and available tools supporting Fire PRAs need further development

- Improvements should focus in achieving realism
  - Example: Ignition and fire growth in electrical cabinets
- In general,
  - Risk results are currently at "working levels" (i.e., meet performance criteria for a given application)
    VS
  - Risk results that provide a better representation of fire events data and plant operating experience
- Current fire risk results may not represent real risk profiles as the residual conservatisms leads to fire dominating plant risk at nearly every plant and may lead to undue focus and resource allocations
- It is appropriate to re-baseline our understanding fire PRA results in order to focus future research, e.g., update EPRI "skyline chart", etc.



## Communication

Developing analytical tools in support of RI/PB programs require routine communications

- Consensus methods needed to support regulatory and operational needs
- Routine interactions through task force meetings, EPRI-NRC/RES MOU, etc.
  - Identifying research needs
  - Developing methods
  - Reviewing recommended approaches/new research
- Increased communication between groups in order to develop products that can be readily implemented and avoid rework

## Challenges and Successes

### Challenges

- The process generated large amount of research resulting in new technologies
- Analytical tools helped to identify risk reduction strategies, plant modifications or procedure changes
- Analytical tools helped resolve a number of variations from deterministic requirements
- PB/RI fire protection programs maintain a larger number of calculations and documents
- FRPA realism improving, but still work to do

### Successes

- The process generated large amount of research resulting in new technologies
- Analytical tools helped to identify risk reduction strategies, plant modifications or procedure changes
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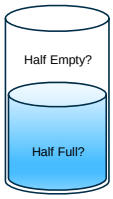




## QUESTIONS?

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