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Experience Reviewing Risk-Informed Fire Protection Programs

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Topics for Discussion

- Introduction
- NFPA 805 Status
- Significant Observations
- Successes
- Challenges
- Conclusion

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Introduction

My perspectives on Risk-Informed, Performance-Based Fire Protection (RI/PB FPP) are based on over 10 years of developing, implementing, regulating and inspecting NFPA 805 in US

- Prior to NRC, I was the PM for the first NFPA 805 Pilot Plant, Oconee
- Since coming to NRC, I have been involved with all NFPA 805 transitions and many of the inspections

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Why did NRC pursue RI/PB FP?

- Long standing compliance issues
  - Multiple spurious operations (MSOs)
  - Un-approved operator manual actions (OMAs)
  - Unqualified Fire barrier materials (Thermo-Lag, Hemyc)
- Desire to clean up the licensing basis

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Status of NFPA 805 Implementation

- A total of 16 plants out of a total of 28 have been approved (2 pilots, 14 non-pilots)
- Region I – 2 plants, 2 units
- Region II – 7 plants, 14 units
- Region III – 3 plants, 4 units
- Region IV – 4 plants, 4 units

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Status of NFPA 805 Implementation - continued

- Approved NFPA 805 license amendments
  - Included a total of:
    - Approximately 300 modifications
    - Approximately 500 implementation items
    - Almost 3000 recovery actions
  - A total of 231 Appendix R exemptions were addressed in the transition of NFPA 805 plants
    - 61 were transitioned to the NFPA 805 licensing basis
    - 170 were rescinded
  - A total of 111 deviations from regulatory guidance were addressed in the transition of NFPA 805 plants
    - 75 were transitioned to the NFPA 805 licensing basis
    - 36 were deleted all together

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NFPA 805 Status – continued

Breakdown by Vendor

- B&W – 1 plant, 3 units
- CE – 3 plants, 3 units
- GE – 5 plants, 8 units
- Westinghouse – 7 plants, 10 units

Breakdown by Vintage

- Pre–79: 13 plants, 20 units*
- Post–79: 4 plants, 4 units #

* Farley Unit 1 is Pre-79

\# Farley Unit 2 is Post-79

Significant Observations

- **ALL** licensees utilized the Fire Risk Evaluation (FRE) performance-based approach
  - One licensee also utilized the Fire Modeling (FM) performance-based approach
- Fire PRA is an essential, required tool to implement RI/PB FPP

Significant Observations - continued

- There were several NFPA 805 Chapter 3 items that licensees requested approval to deviate from using performance-based methods
  - These were allowed through NRC approval in accordance with 10 CFR 50.48(c)(2)(vii)

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Significant Observations - continued

- Examples of 50.48(c)(2)(vii) approvals:
  - Use of an EPRI method to adjust surveillance frequencies based on performance
  - Unqualified cable above suspended ceilings
  - Treated wood
  - Non-metal and/or buried/embedded conduits
  - Epoxy floor coatings

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Successes

- Modifications implemented with RI/PB FPP have in many cases significantly reduced risk
- The number and complexity of recovery actions has been significantly reduced
- Several plants have transitioned away from the use of Self-Induced Station Blackout (SISBO)
- Implementation of the Frequently Asked Question (FAQ) process has provided both regulatory stability and a transparent process for changing implementation guidance

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Challenges

Implementation of RI/PB FPP has pushed the state-of-the-art in Fire PRA. Significant changes have been made to acceptable methods

- Fire-induced hot short modeling
- Fire ignition frequencies
- Electrical Cabinet HRR
- "Tightly Sealed Cabinets"
- Very Early Warning Fire Detection Systems (VEWFDS)
- Control Room evacuation modeling

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Conclusions

Based on the reasons RI/PB FPP were created, the programs appear to have been a success

- MSOs have been properly addressed
- Recovery Actions have been evaluated, found to be acceptable and in many cases significantly reduced in number
- Fire barriers have been evaluated and found to be acceptable
- Licensees now have a clear licensing basis
- Modifications provided significant safety improvements resulting in reduction in both fire risk and overall plant risk

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Acronyms

- RI/PB FPP – Risk-informed, performance-based Fire Protection Program
- PM – Project Manager
- NFPA – National Fire Protection Association
- MSO – Multiple Spurious Operation
- OMA – Operator Manual Action
- B&W – Babcock & Wilcox
- CE – Combustion Engineering
- GE – General Electric
- FRE – Fire Risk Evaluation performance-based approach
- FM – Fire Modeling performance-based approach
- EPRI – Electric Power Research Institute
- SISBO – Self-Induced Station Blackout
- PRA – Probabilistic Risk Assessment
- FAQ - Frequently Asked Question
- HRR – Heat Release Rate
- VEWFDS – Very Early Warning Fire Detection System

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