

The maturity of Fire PRA

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Evolution

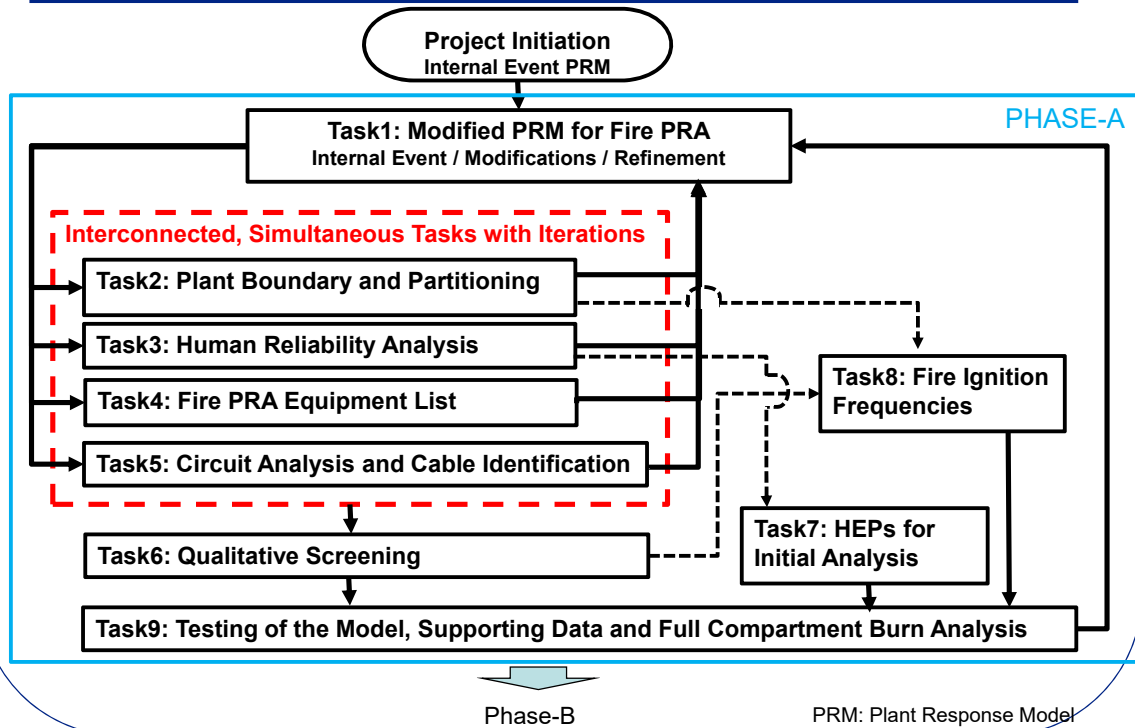
- **Late 70s, UCLA team develops the rudimentary methodology**
 - It is applied to the Zion/Indian Point PRAs
 - Fire is found to be among the dominant risk contributors
 - As a result, a plant modification is implemented at Indian Point
- **2004, 10 CFR 50.48(c) adopts NFPA Std 805**
- **2005, NUREG/CR-6850**
 - Many utilities switch to 10 CFR 50.48(c)
- **Tremendous progress since the 70s**
- **Currently: NRRC develops a fire PRA Guide**
 - NUREG/CR-6850 is the starting point
 - Subsequent developments are included

Maturity and Realism

- **FPRAs for power operations are used by the NRC and industry to make risk-informed decisions**
 - This use indicates that FPRA is credible and realistic enough for decision making
 - FPRA is mature enough to provide useful input

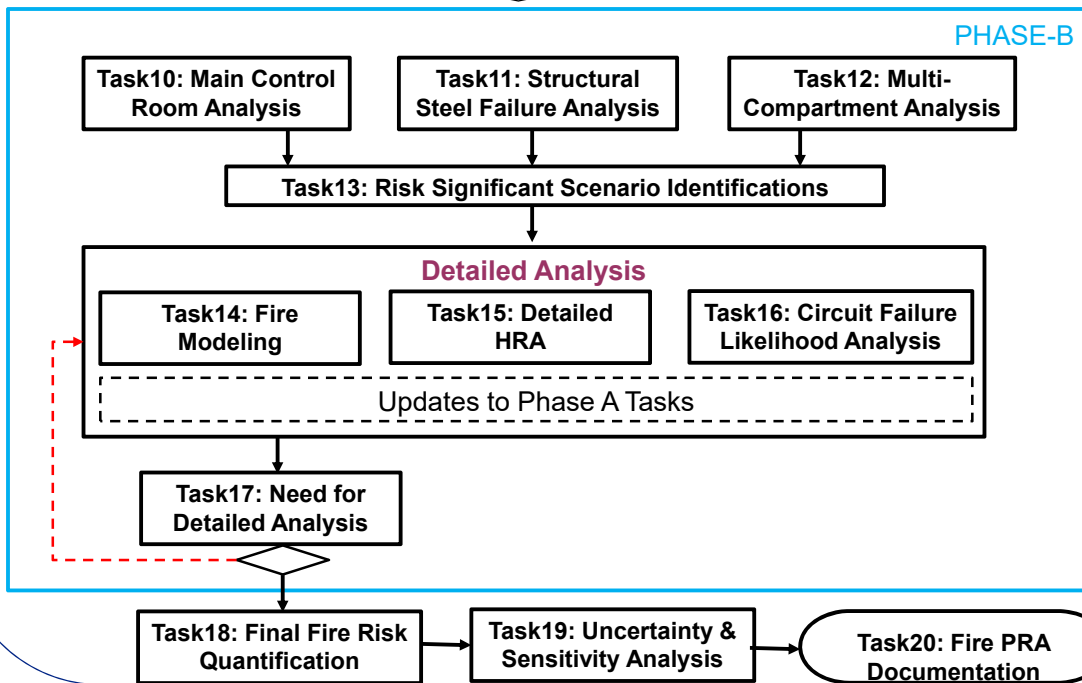
- **I agree with Siu, Coyne, and Melly (2011)**
 - The concept of maturity addresses the relative state of development of a technical discipline.
 - Fire PRA is in an intermediate-to-late stage of maturity (albeit less mature than internal events PRA)

NRRC Guide: Overview of Fire PRA Methodology Phase A



NRRC Guide: Overview of Fire PRA Methodology Phase B

Phase-A



Technical Updates of NUREG/CR-6850

- **Circuit Failure Mode Likelihood Analysis (Task-16)**
 - ✓ Includes the insights from NUREG/CR-7150 (JACQUE-FIRE)
 - Circuit Failure Modes
 - Duration Time of Hot Short
 - Probability of Hot Short
 - ✓ USNRC endorsed NUREG/CR-7150 in 2017. The methods in NUREG/CR-7150 supersede those in NUREG/CR-6850.
- **Human Reliability Analysis**
 - ✓ Include insights from NUREG-1921 (Fire HRA Guidelines)
 - Identification of HFE (Task-3) and Initial HEPs (Task-7)
 - Detailed HEPs (Task-15) - Narrative approach of NRRR HRA Guide is referenced
- **Detailed Fire Modeling**
 - ✓ Use NUREG-2178 for the HRR of electric cabinets (RACHELL-FIRE)
 - ✓ Modeling of Incipient fire detection
- **Structural steel failure is newly added based on the concerns raised in ASME/ANS Fire PRA standard**

Questions

- **Is the current state of the art in FPRA too detailed and resource intensive?**
- **Are there commensurate benefits?**
- **Could the guidance be simplified without losing the benefits?**

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