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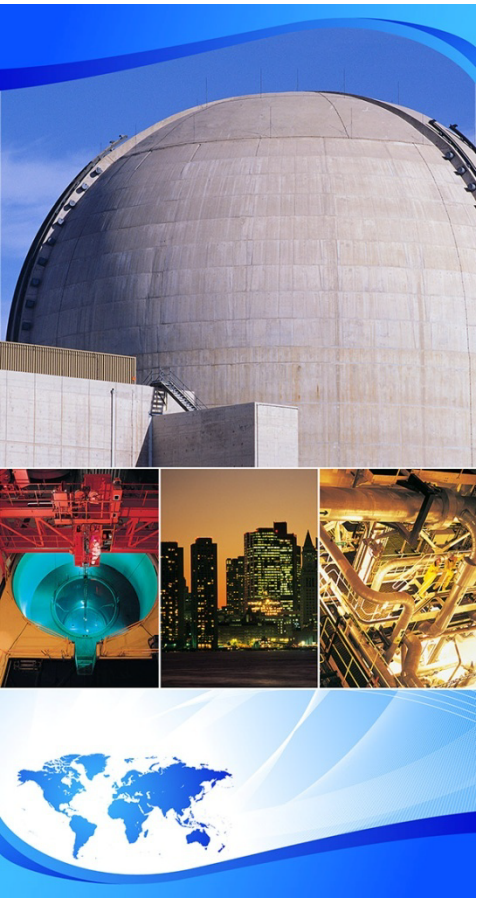

EPRI/NRC-RES FIRE PRA METHODOLOGY

Introduction and Overview: the Scope and Structure of Electrical Analysis Module

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A Collaboration of U.S. NRC Office of Nuclear Regulatory Research (RES) & Electric Power Research Institute (EPRI)

What we'll cover in the next four days
An overview…

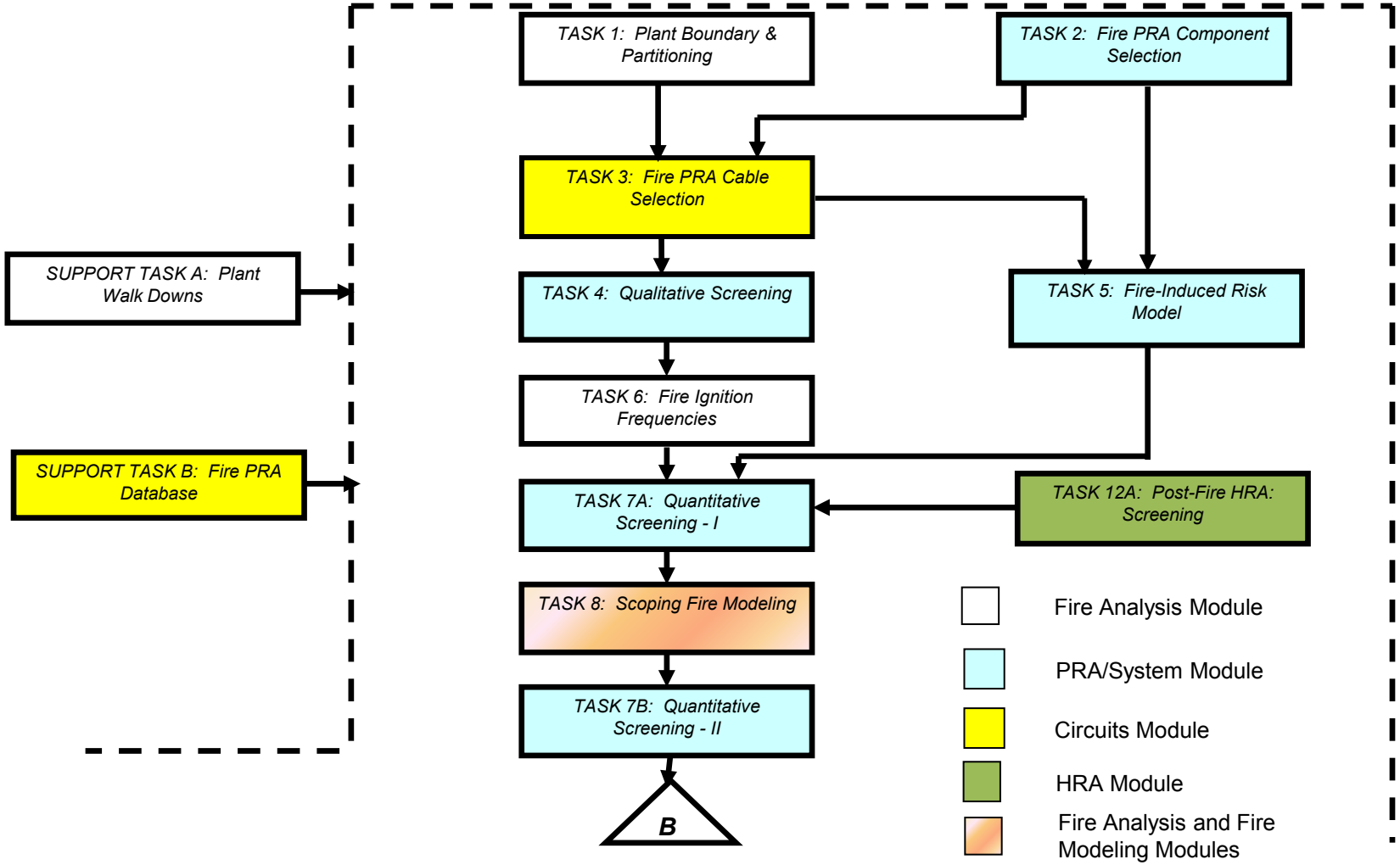
- The purpose of this presentation is to provide an Overview of the Module 2 – Electrical Analysis
  - Scope of this module relative to the overall methodology
    - Which tasks fall under the scope of this module
  - General structure of the each technical task in the documentation
  - Quick introduction to each task covered by this module:
    - Objectives of each task
    - Task input/output
    - Task interfaces

Training Objectives

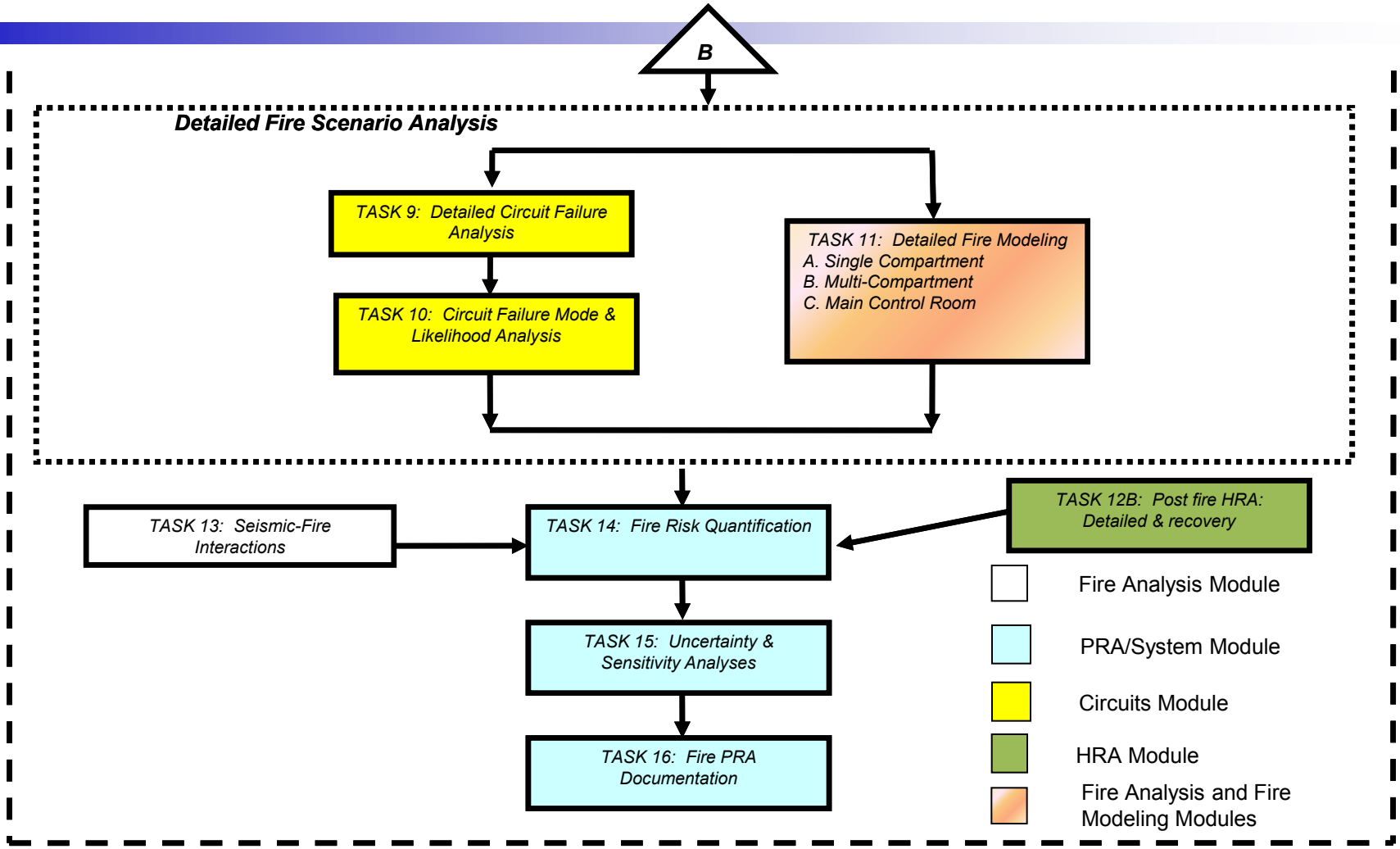
- Our intent:
  - To deliver practical implementation training
  - To illustrate and demonstrate key aspects of the procedures

- We expect and want significant participant interaction
  - Class size should allow for *questions and discussion*
  - We will take questions about the *methodology*
  - We *cannot* answer questions about a *specific application*
  - *We* will moderate discussions, and *we* will judge when the course must move on

Recall the overall fire PRA structure
Module 2 covers the "yellow" tasks



Recall the overall fire PRA structure (2)
Module 2 covers the "yellow" tasks



Each technical task has a common structure as presented in the guidance document

1. Purpose
2. Scope
3. Background information: General approach and assumptions
4. Interfaces: Input/output to other tasks, plant and other information needed, walk-downs
5. Procedure: Step-by-step instructions for conduct of the technical task
6. References

Appendices: Technical bases, data, examples, special models or instructions, tools or databases

Scope of Module 2: Electrical Analysis

- This module covers those parts of the method specifically related to the identification and tracing of cables, and the analysis of electrical circuit failure modes and likelihood

- Tasks covered are:
  - Task 3: Cable Selection (and Routing)
  - Task 9: Detailed Circuit Analysis
  - Task 10: Failure Mode Likelihood Analysis
  - Support Task B: FPRA Database

Task 3: Cable Selection (1 of 2)

- Objectives:
  - *Identify/select* cables whose fire-induced failure could adversely affect the operation of selected equipment (from Task 2)
  - *Locate* selected cables

- Cables may include Power, Control/Indication, and Instrumentation

Task 3: Cable Selection (2 of 2)

- Cable routing can be a major commitment of FPRA resources
  - Depends a *lot* on status of existing plant cable information
    - Scope, quality, vintage, method of documentation
  - Tracing cables is a time consuming activity
  - Intent is to allow for "work smart" approaches
    - Iteration to identify and route more cables as needed to support FPRA
- Allowances are made for making "conservative" assumptions about a cable's routing if unknown
  - e.g., exclusionary approach

Task 9: Detailed Circuit Failure Analysis (1 of 2)

- Objectives:
  - To identify circuit responses (failure modes) to fire-induced cable failures
  - To screen out cables that do not impact the ability of a component to complete its credited function
- This is not about failure mode *likelihoods* (that is task 10)
- This is about defining the effects that cable failure can (or cannot have) on selected equipment
  - e.g., what cables can, or cannot, cause spurious actuations?

Task 9: Detailed Circuit Failure Analysis (2 of 2)

- Fundamentally a deterministic analysis of cable failure modes and effects

- Module will cover:
  - Those failure modes that are, and are not, considered plausible for various cable/circuit configurations and applications
  - Underlying assumptions of the analysis
  - Role of existing analyses (e.g., Appendix R SSD analysis)
  - Steps of the analysis

Task 10: Circuit Failure Modes Likelihood (1 of 2)

- Objective: To establish first order estimates of the conditional probability, given failure of a specific cable, that the circuit will respond in a specific way

- This one is about the likelihood that certain equipment failure modes will be observed given fire-induced cable failure
  - Will the equipment spuriously actuate, or
  - Will it be a loss of function failure?
  - What is the relative likelihood of each failure mode of interest?

Task 10: Circuit Failure Mode Likelihood (2 of 2)

- This is a probabilistic analysis
- Based largely on existing data including
  - The EPRI/NEI cable tests including the NRC/RES collaboration
  - The EPRI expert panel
- Module will include
  - Existing knowledge base
  - Underlying assumptions
  - Key factors in the analysis
  - Analysis approach and methods

Any questions before we move on?