ELECTRIC POWER RESEARCH INSTITUTE

Fire PRA Methods Development – Plan and Status

Ken Canavan
Director, Plant Technology

PRA Leadership Meeting
July 2010

Fire PRA Methods Development

- EPRI performs research in the area of fire risk
  - Methods development through Fire PRA Matrix
  - Fire PRA and Fire Modeling Training
  - Fire Modeling
  - Fire Hazards Analysis
  - Fire Events Database
  - Fire Testing

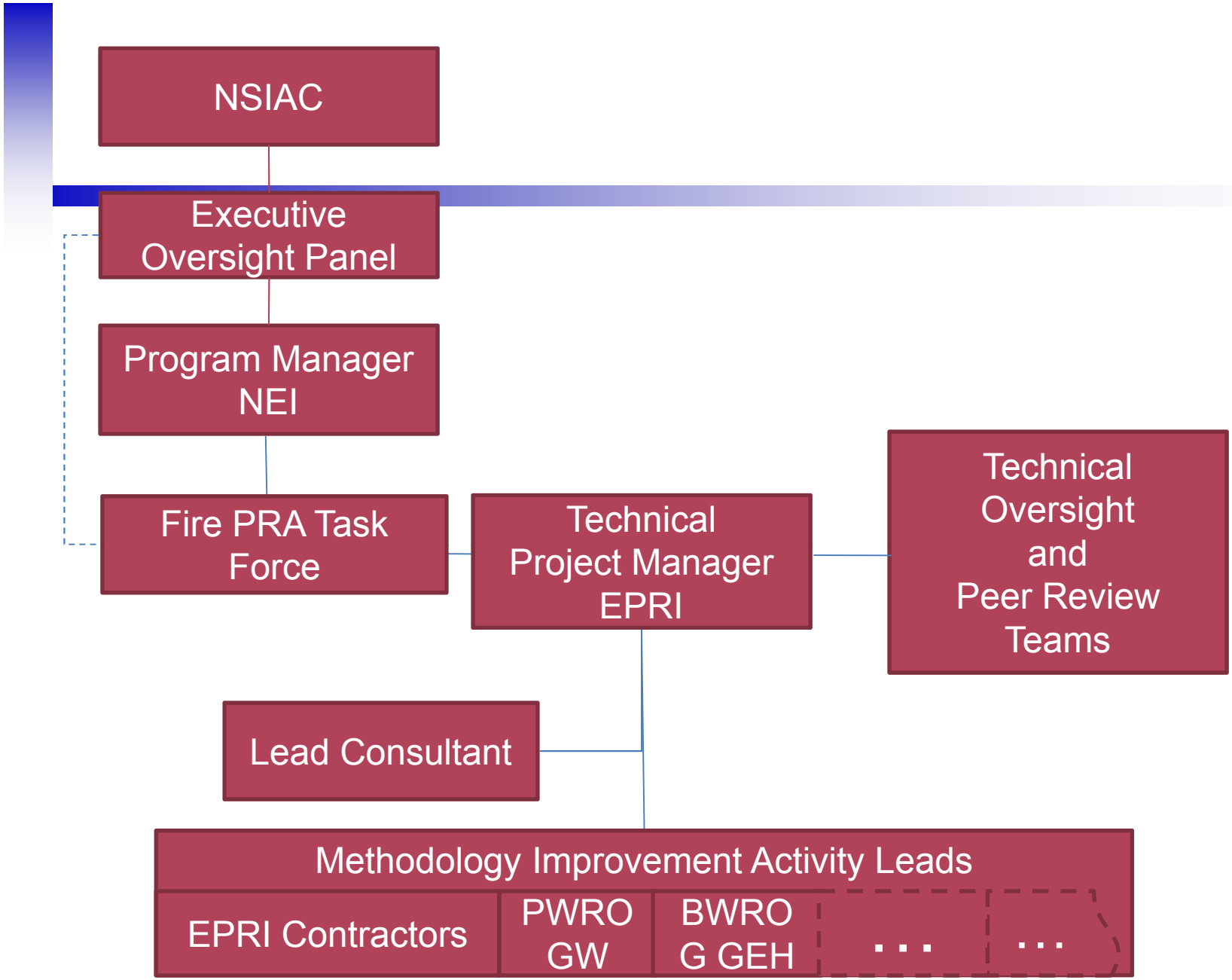
© 2010 Electric Power Research Institute, Inc. All rights reserved.

Fire PRA Action Matrix

Fire PRA Action Matrix

- Owned by the Fire PRA Task Force
- Provides listing of key issues
- Setup to facilitate closure
- For each issue
  - Owners (EPRI, PWROG, BWROG)
  - Schedules
  - Products

© 2010 Electric Power Research Institute, Inc. All rights reserved.



© 2010 Electric Power Research Institute, Inc. All rights reserved.

ELECTRIC POWER RESEARCH INSTITUTE

Organization of NEI Fire PRA Task Force

- NSIAC (all CNOs)
- Executive Oversight / Steering Committee
  - Paul Davidson (VP, Ops Support, PSEG)
  - Danny Pace (VP Engineering, First Energy)
- Biff Bradley – NEI Project Manager
- Ken Canavan – EPRI Technical Lead

© 2010 Electric Power Research Institute, Inc. All rights reserved.

Organization of NEI Fire PRA Task Force

- Technical Oversight and Peer Panel
  - Rob Cavedo (Constellation)
  - Dave Miskiewicz (Progress)
  - Kiang Zee (ERIN Engineering)
  - Bob Bertucio (Scientech)
  - Paul Amico (SAIC)
  - Clarence Worrell (PWROG)*
  - Dennis Henneke (BWROG)*

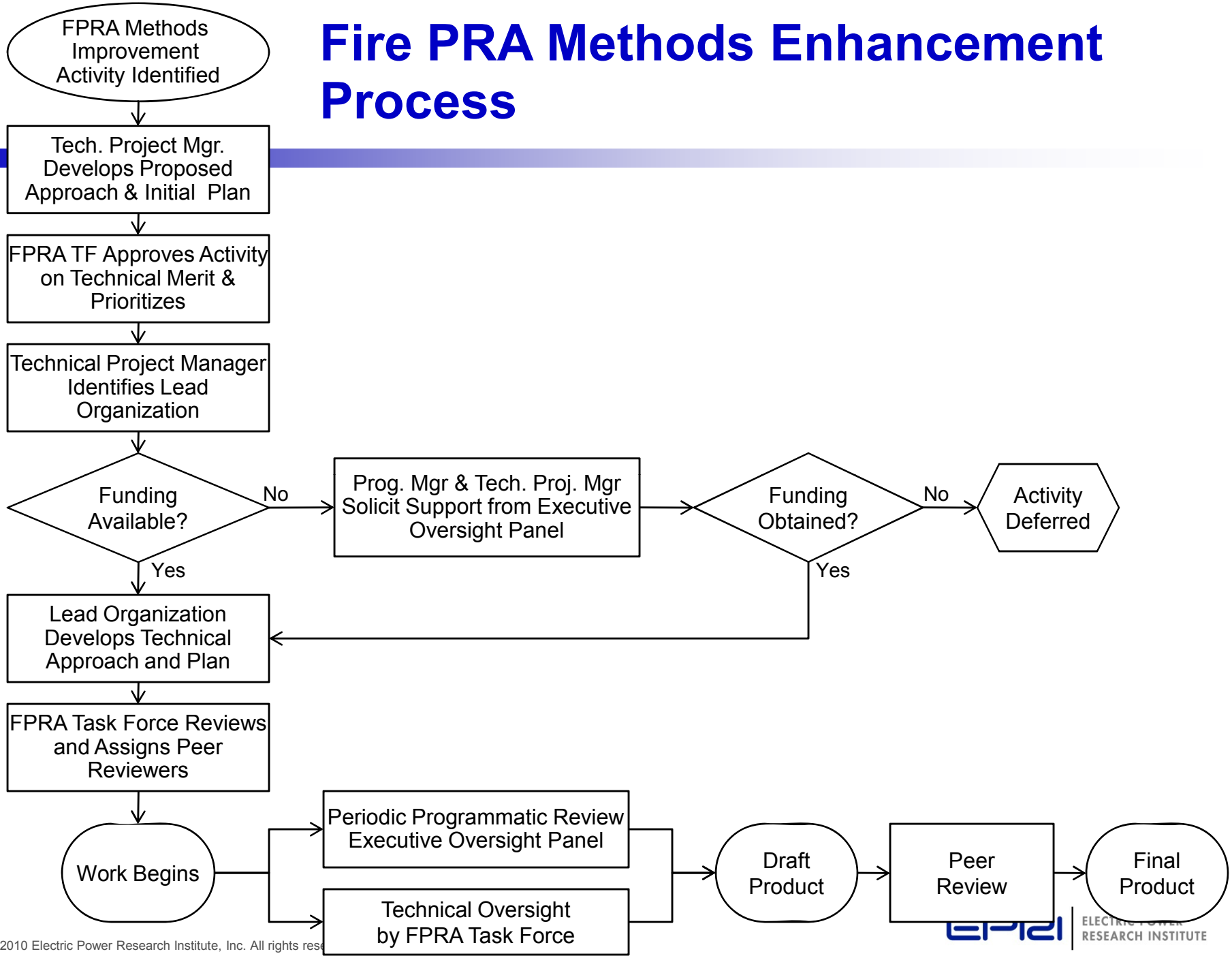
© 2010 Electric Power Research Institute, Inc. All rights reserved.

Fire PRA Task Force Conduct

- Regularly Scheduled Interaction
  - Monthly Meetings
  - Bi-weekly calls
- Purpose to provide status of Action Matrix activities
- Followed by Executive Briefing

© 2010 Electric Power Research Institute, Inc. All rights reserved.

Fire PRA Methods Enhancement Process



© 2010 Electric Power Research Institute, Inc. All rights res

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Fire Matrix Activities
Medium and High Priorities

- Revision of the Fire Events Database (FEDB)
- Peak heat release data review and analysis, testing plan if warranted
- Oil Fires

- Transient Fire HRR
- Credit for Incipient Detection
- Control Room Modeling and Treatment in the Fire PRA
- Control versus suppression of fire events
- Fire growth and propagation investigation and conclusions from data
- Results Comparison
- Additional Peer Review Guidance

© 2010 Electric Power Research Institute, Inc. All rights reserved.

Fire Events Database Project Status

© 2010 Electric Power Research Institute, Inc. All rights reserved.

Overview of Fire Events Database (FEDB) Project

- Purpose: Provide more current fire event related data for Fire PRA applications:
  - realistic fire frequencies,
  - treatment of detection & suppression effectiveness
  - add credibility by reducing “undetermined” data
  - potential periodic update as new data is available
- Cooperative effort lead by EPRI with NRC RES under Memorandum of Understanding (MOU)
- Update data through 2009, and beyond as available
- Principal data sources: Plant condition reports and related records, supplemented as available by LERs & ENs, NEIL & EPIX reports, and plant specific data collected for FPRAs

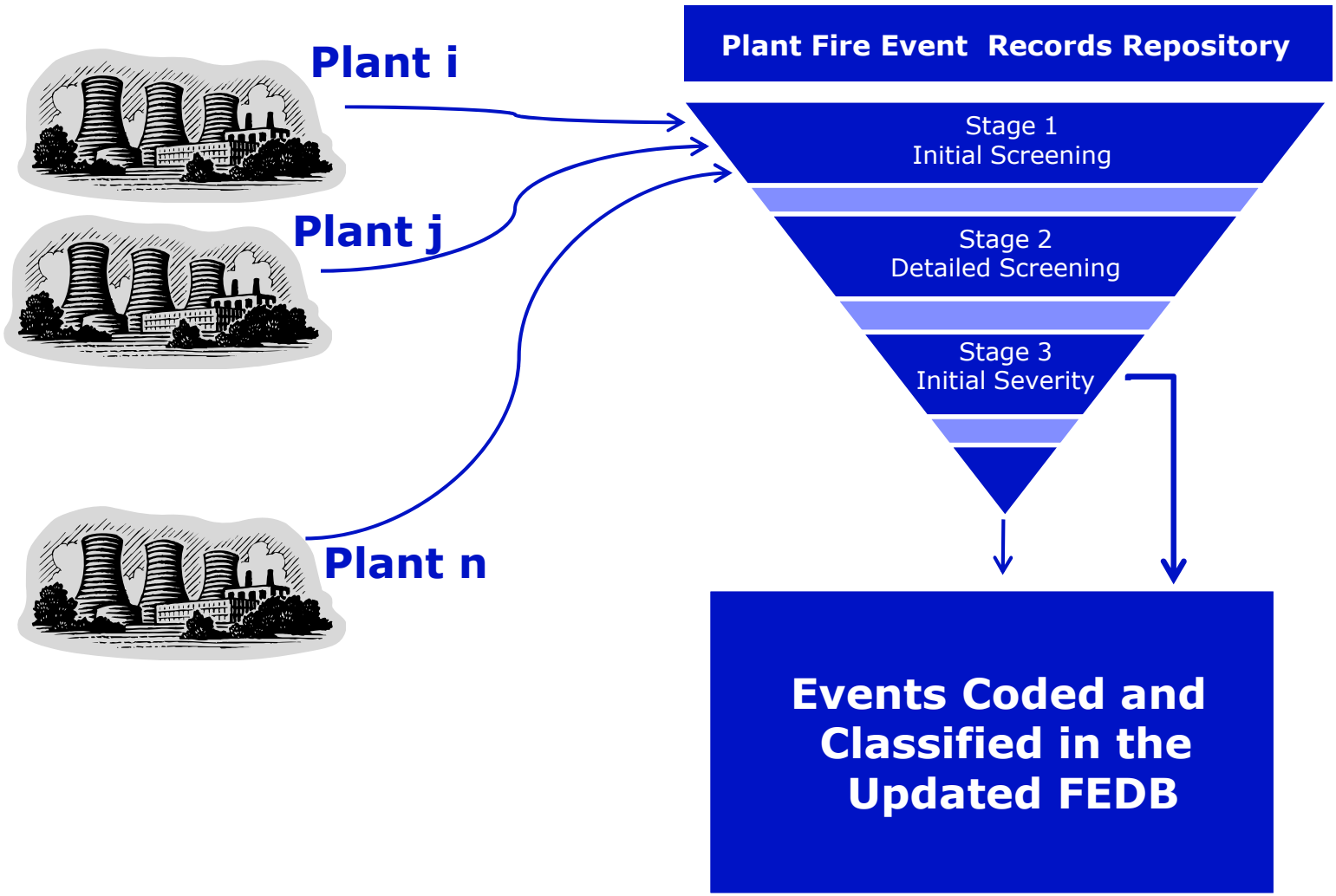
© 2010 Electric Power Research Institute, Inc. All rights reserved.

Current Status of FEDB Project

- Beta testing revised data fields and severity classifications complete in cooperation with NRC under MOU
  - Agreement on details reached
  - Documentation in preparation
- Updated FEDB software operational; by INL
- New data collection project (post 2000 events) initiated

© 2010 Electric Power Research Institute, Inc. All rights reserved.

Fire Event Data Collection Process



© 2010 Electric Power Research Institute, Inc. All rights reserved.

ELECTRIC POWER RESEARCH INSTITUTE

Current Status of Fire Event Data Collection, Coding, & Classification

- Initiated '00-'09 data collection from plants; keyword search data arriving
- Coding and classification guidance and related infrastructure nearing completion

Schedule

Initiate data acquisition from plants	June 2010
Update FEDB data fields, coding, and fire severity determination guidance	September 2010
Revise draft interim TR 1019198	November 2010
Fire event collection, review, and capture in FEDB	January 2011
Fire event coding and severity determination	May 2011
Updated FEDB software and data release for use	August 2011

© 2010 Electric Power Research Institute, Inc. All rights reserved.

Heat Release Rates
Project Status

© 2010 Electric Power Research Institute, Inc. All rights reserved.

Re-Evaluation of Heat Release Rates in Vertical Cabinet Fires

- Purpose of study:
  - Re-evaluate the heat release rates (HRRs) of cabinet fires recommended for use in NUREG/CR-6850 (Table G-1)

- Scope limited to:
  - Vertical cabinets
  - No consideration of external influences, or of fire propagation to other cabinets
  - No consideration of fire duration

© 2010 Electric Power Research Institute, Inc. All rights reserved.

Approach

- Re-evaluation based on fire test data from:
  - NUREG/CR-4527: Tests performed on nuclear power plant cabinets filled with cable
  - VTT experiments: 3 series of tests, all under ventilation-limited conditions
  - IRSN experiments (CARMELA), under ventilation-limited conditions

© 2010 Electric Power Research Institute, Inc. All rights reserved.

Approach

- 3 models created to capture different fire characteristics:
  - Fires initiated in qualified cable: based on NUREG/CR-4527 fire tests
  - Fires in open-door cabinets under “flashover conditions”
  - Fires with flashover, but under ventilation-limited conditions. Based on VTT and IRSN experiments

© 2010 Electric Power Research Institute, Inc. All rights reserved.

Status and Activities

- Formed EPRI Working Group
- Writing Team Developed Draft
  - Discuss draft
  - Obtain additional comments
  - Assignments to provide input
- Revised Draft Issued for Task Force Review (July 14th)
- Peer Review – September
- Publish – November

© 2010 Electric Power Research Institute, Inc. All rights reserved.

Fire PRA Matrix Products

- Being developed by a range of stakeholders including EPRI, the PWROG and the BWROG
- Fire PRA matrix products will be available to all stakeholders
- Are designed to
  - Increase the realism associated with the current generation of fire PRAs
  - Reduce the resources required to develop a fire PRA

© 2010 Electric Power Research Institute, Inc. All rights reserved.

Other Fire Research Activities

- Important fire research is performed beyond the current matrix
- These activities include:
  - Fire Hazard Analysis
  - **Fire Testing**
    - **Fire Effects Testing on DC Circuits (NRC RES Lead)**
    - **Incipient Detection Systems Testing (planning)**
  - **Fire PRA and Fire Modeling Training**
  - **Fire PRA Modeling Research and Guides**
  - **Fire PRA Human Reliability Analysis**

© 2010 Electric Power Research Institute, Inc. All rights reserved.

Together…Shaping the Future of Electricity

© 2010 Electric Power Research Institute, Inc. All rights reserved.

ELECTRIC POWER RESEARCH INSTITUTE