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Plenary 2, Session 3
NRC Regulatory Overview

2011 NEI Fire Protection Information Forum

Alexander Klein, P.E., Chief
Fire Protection Branch
Division of Risk Assessment
Office of Nuclear Reactor Regulation

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Topics

- Past
- Present
- Future

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Past

- Uncertainty with risk-informed approaches
  - plants adopting NFPA 805
  - NRC review resources for NFPA 805
- Uncertainty regarding deterministic approaches
  - resolution of circuits
  - resolution of operator manual actions

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Present (1)

- Two pilots have adopted NFPA 805
- Additional plants are submitting on a staggered approach approved by the Commission and a schedule agreed to by the licensees
- NRC has allocated resources to support the review of the NFPA 805 applications

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Present (2)

- Continue to improve data, methods and models
- Available tools are sufficient for submitting NFPA 805 LARs
- The NEI task force methods panels are conducting technical reviews of ‘unreviewed methods
- The NRC staff continues to interact with stakeholders

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Present (3)

- NRC has recently reviewed and approved a number of operator manual action exemptions in accordance with the information in RIS 2006-10
- Licensees are working to close out circuits issues by November 2012
- Enforcement discretion ends for deterministic fire protection issues in November 2012

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Future

- Fire protection issues have been dispositioned
- Normal, routine processes have been established for maintaining and inspecting fire protection programs
- Continued research and improvements in methods

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NRC Perspective on Fire PRA Activities

2011 NEI Fire Protection Information Forum
Plenary 4 – Session 9

Donnie Harrison
Chief, PRA Licensing Branch
Division of Risk Assessment
Office of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission

Current Fire PRA Methodology Guidance

- Fire PRA Methodology for Nuclear Power Facilities NUREG/CR-6850 (EPRI TR 1011989)
  - Published September 2005
- Fire PRA Methods Enhancements NUREG/CR-6850, Supplement 1 (EPRI TR 1019259)
  - Incorporates Fire PRA frequently asked questions (FAQs)
  - Published September 2010
- Fire PRA Unreviewed Analysis Methods (UAM) Panel
  - Evaluating new Fire PRA methods identified as unreviewed analysis methods by peer reviews

"Flexibilities" in NUREG/CR-6850 (EPRI TR 1011989)

- The framework was intended to allow for flexibility with progressive screening/modeling refinements
- Examples:
  - Cabinet fires - analyst can examine cabinet contents and place the fire where the combustibles are actually located (instead of 1 ft from top)
  - Cabinet fires - analyst can examine cabinet contents and cut off fire growth profiles based on total fuel load fuel (instead of burning till extinguished)
- Further refinements achievable by more detailed fire modeling

Fire PRA UAM Panel

- NRC goal is for there to be no surprises in application submittals/reviews using new Fire PRA methods
  - NRC awareness of new Fire PRA methods (prior to application)
  - Industry awareness of NRC issues with new Fire PRA methods (so they can be addressed as part of application)
- General observation is that the Panel is working as an independent review of proposed new Fire PRA methods
- Panels are taking longer than originally expected
  - Panel may terminate a method review if it is determined that there is not enough information/technical basis at this time to support acceptance of the method (and documenting issues)

Expectations for Applications Using New Fire PRA Methods

- For near-term applications, new Fire PRA methods (self-identified or via Peer Review) should be submitted to the Fire PRA UAM Panel as soon as identified
  - Similar to PRA Standards activities, may obviate the need for detailed staff review of the technical bases of these methods – focus becomes application and already identified issues
- For longer-term applications, other paths for new Fire PRA methods may include
  - Submitting a topical report for NRC review/approval
  - EPRI/RES MOU activities

Expectations for Applications Using New Fire PRA Methods (continued)

- If licensee uses a new Fire PRA method, but Fire PRA UAM Panel has not completed review (or NRC has identified issues with the use of the method), application needs to address situation, for example:
  - Sensitivity studies using an established method
  - Revise Fire PRA existing flexibilities within established method
  - Revise Fire PRA using more detailed fire modeling
  - Propose plant modification that eliminates need for new method

Conclusions

- Fire PRA UAM Panel appears to be providing an independent assessment of proposed new Fire PRA Methods
  - Supports licensee in developing applications
  - Supports staff in reviewing applications
- License applications need to identify and address the use of new Fire PRA Methods
- NRC will continue to participate on the Fire PRA UAM Panel

Paul W. Lain, P.E.

NFPA 805 Program Manager

Fire Protection Branch

Division of Risk Assessment

Office of Nuclear Reactor Regulation

New Triennial Inspection Procedure & NFPA 805 License Amendments

2011 NEI Fire Protection Information Forum

Plenary Five, Session 9

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Topics

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1. New Triennial Fire Protection Inspection Procedure (IP71111.05XT)

2. Status of the NFPA 805 License Amendment Request (LAR) Reviews

Background

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Development of IP71111.05XT: "Fire Protection – NFPA 805 (Triennial)"

IP71111.05XT

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- Protection of Safe-Shutdown Capabilities
- Active & Passive Fire Protection
- Protection from Fire Suppression Activity Damage
- Shutdown from Primary Control Station
- Circuits Analysis
- Communications & Emergency Lighting
- Cold Shutdown Repairs (If required)
- Compensatory Measures
- Radiological Release
- Non Power Operations
- Monitoring Program
- Plant Change Evaluation

NFPA 805 LAR Status

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- **Pilot Plants LARs**
  - **HNP approved June 2010**
  - **ONS approved December 2010**
- **Non-Pilots LAR Submittals**
  - **SRMSECY-11-0033**
    - **Resources**
    - **Staggered Approach**
  - **SRMSECY-11-0061**
    - **Public Meetings**
    - **Commitment Letters**

7-10-10-2 Schedule

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- 7 LARs in FY11
  - DC Cook – Submitted
  - Duane Arnold - Submitted
  - Callaway - Submitted
  - Kewaunee – September 29, 2011
  - VC Summer – September 30, 2011
  - Fort Calhoun – September 30, 2011
  - Waterford - November 30, 2011

7-10-10-2 Schedule (cont.)

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- 10 LARs in FY12
  - Browns Ferry, Brunswick, Cooper, Turkey Point, Nine Mile Point, Beaver Valley, Prairie Island, Farley, ANO Unit 1, & ANO Unit 2
- 10 LARs in FY13
  - Palisades, Ginna, St. Lucie, San Onofre, McGuire, Diablo Canyon, Point Beach, Catawba, Robinson, & Calvert Cliffs
- 2 LARs in FY14
  - Crystal River & Davis Besse

LAR Reviews

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- Staff Goal: Continue to Gain LAR Review Efficiencies
- Process Improvements
  - LAR Acceptance Reviews
  - Licensee SharePoint Portals

In Summary

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- IP71111.05XT is in effect and in use.
- Continue with LAR reviews and identify process improvements.

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Plenary Six
Fire Protection Research and Development
2011 NEI FPIF Plenary 6

Gabriel Taylor

NRC/RES

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NRC – RES Collaborative Partners

- EPRI – Electric Power Research Institute
  - Memorandum of Understanding (MOU)
- NIST – National Institute of Standards and Technology
- SNL – Sandia National Laboratories
- BNL – Brookhaven National Laboratories
- Public
  - Stakeholder review and comment of RES products

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Overview of today's presentations

- Session 1: Research Overview – Update on Current and Future Research Projects
  - Dave Stroup, NRC/RES
  - Rick Wachowiak, EPRI
- Session 2: Electrical and System Engineering Issues
  - Gabe Taylor, NRC/RES
  - Bob Daley , NRC/RIII
  - Dan Funk, Edan Engineering
- Session 3: Fire Modeling Developments
  - Francisco Joglar, SAIC

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Overview of today's presentations (2)

- Session 4: Cable Tray Fire Testing
  - Dave Stroup, NRC/RES
- Session 5: Fire HRA
  - Stuart Lewis, EPRI
- Session 6: International Fire Research – Fire Events Database and HEAF
  - Nick Melly, NRC/RES
- Session 7: Training and Participants Feedback
  - Rick Wachowiak, EPRI
  - Dave Stroup, NRC/RES

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NRC Fire Research Overview: Current and Future Research Projects

David W. Stroup, P.E.

September 11 - 15, 2011

2011 NEI FPIF – Plenary 6, Session 1

Charleston Marriott

Charleston, South Carolina

Office of Nuclear Regulatory Research

Fire Research Branch

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Overview of RES Activities

- Provide a High-Level Overview of NRC RES Fire Research Activities
- Separate Presentations on Major Projects
  - Electrical Circuit Testing and Follow-up Activities
  - Fire Modeling
  - Cable Tray Fire Testing
  - Fire HRA
  - Fire Events Data Base & HEAF
  - Training Programs

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Goals of NRC RES Activities

- Respond to NRC's User Office Needs
- Continue to Advance the Science and Understanding
  - Improve the State-of-the-Art
  - Expand the Knowledge Base
- Reduce Uncertainty
  - Continue to refine/improve
    - Methods
    - Data

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Current Projects

- Incipient Detection Systems
- Low Power Shutdown Fire PRA
- Electrical Cabinet HRR
- Smoke Damage to Electrical Circuits/Components
  - Literature Review
  - Digital Instrument and Control

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Current Projects (continued)

- Effectiveness of Gaseous Fire Extinguishing Agents
- Compensatory Measures
- NUREG/CR-6850 Updates
- Impact of Cable Coatings and Covers

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Current Projects
Non-Reactor Area

- Transportation Package Seal Performance in Beyond Design Basis Thermal Conditions
- Fuel Cycle Facility SDP Tool Development

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Fire Induced Electrical Circuit Failures

2011 NEI FPIF – Plenary 6, Session 2

Kerite-FR, PIRT, Expert Elicitation, IEEE Standard

Gabe Taylor, NRC-RES
Bob Daley, NRC-RIII
Dan Funk, Edan Engineering

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Kerite-FR Thermal Fragility Testing

- Problem Statement
  - Kerite-FR is chemically a thermo-set (TS) material
  - Thermo-set materials threshold ~330ºC
  - Low temperature failures for Kerite-FR
    - Severe Accident Qualification Testing 153-171ºC
    - SCE&G Kaowool Testing 183-329ºC
  - FAQ 08-0053

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Kerite Cables Tested

- Supplied by EPRI through NRC-RES/EPRI Memorandum of Understanding (MOU)
- Several Types and Configurations Tested
  - 2/C 10 AWG FR-III/FR & 12 AWG FR/FR
  - 3/C 6 AWG HTK/FR
  - 4/C 10 AWG FR-III/FR
  - 5/C 12 AWG FR/FR
  - 7/C 12 AWG FR/FR
  - 9/C 14 AWG FR/FR
  - 10/C 12 AWG FR/FR & 14 AWG FRII/FR
  - 12/C 12 AWG FR-III/FR
  - 15/C 12 AWG FR/FR

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Kerite FR Failure Modes

- Early Failures Kerite-FR
  - Early degradation (247-317ºC)
    - Liquid material
    - Insulation cracking
  - Cable Failure (277-311ºC)
- Recovery (317ºC upwards)
- Outright cable failure >370ºC
- Kerite-FR-II, FR-III, & HT >330°C

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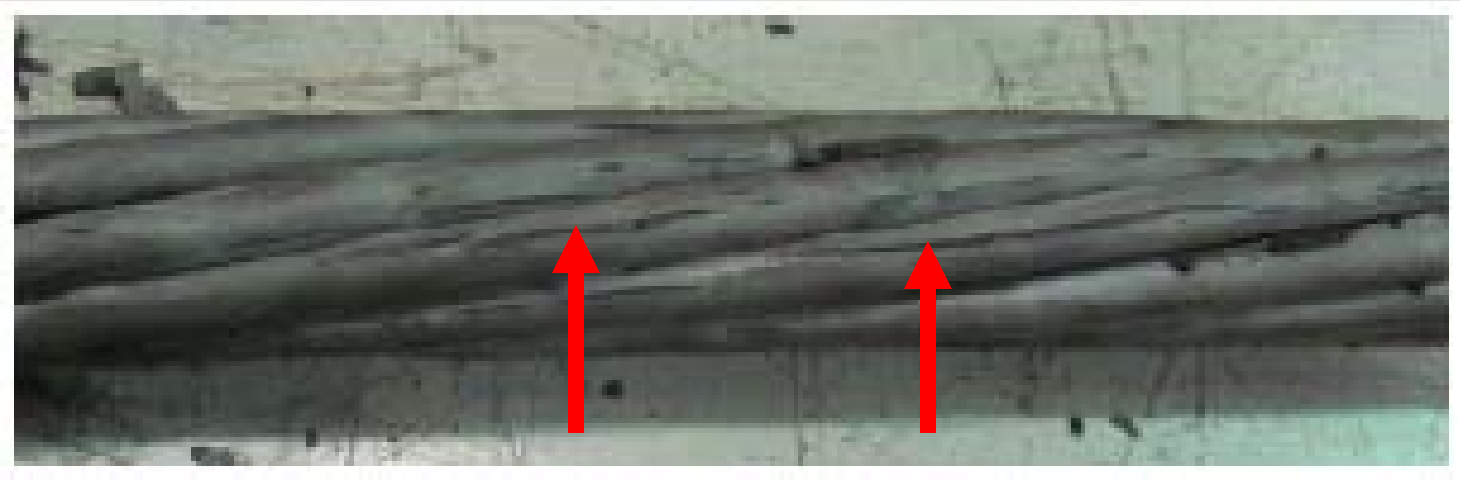
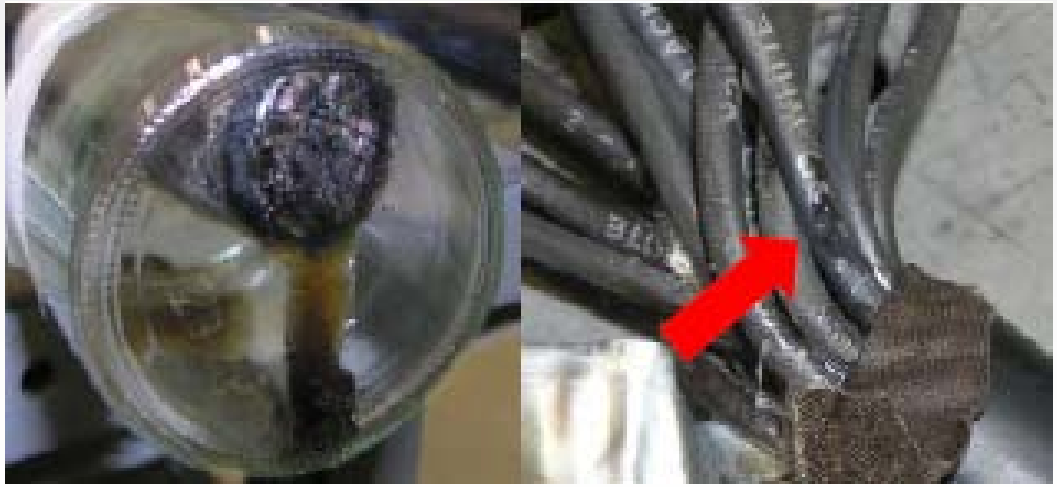
Insulation Cracks & Liquid





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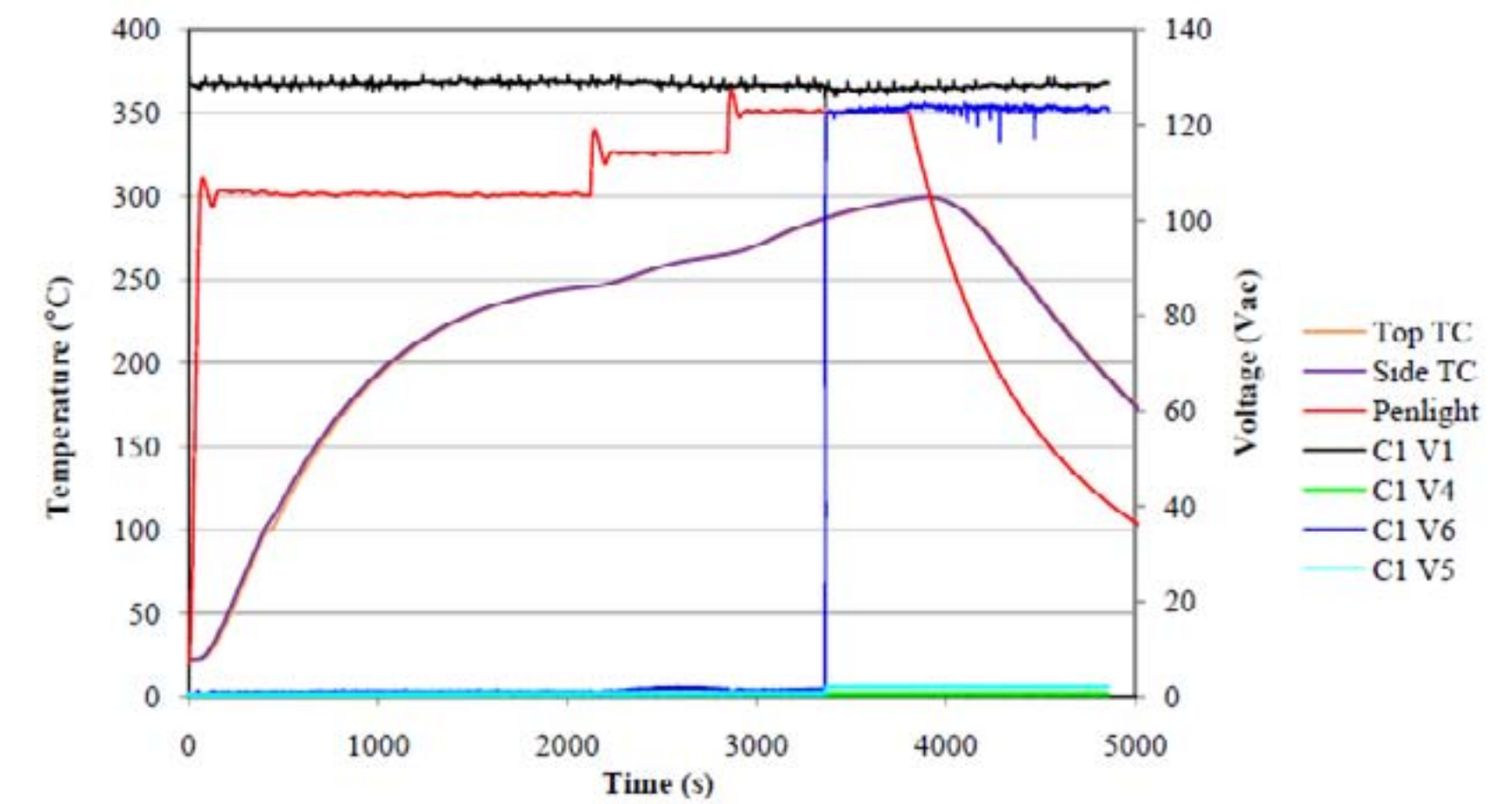
Early Degradation Failure Temperature Range 247-317ºC



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KERITE-FR Report

- NUREG/CR-7102, “KERITE Analysis in Thermal Environment of FIRE (KATE-FIRE)”
- Pre-publications version of report will be put into public ADAMS and 805 task force will be notified of its accession number
- NRC final publications as NUREG/CR-7102 expected in Fall 2011

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Electrical Circuit Phenomena Identification and Ranking Table (PIRT) - Overview

Gabriel Taylor, NRC/RES

Bob Daley, NRC/RIII

Dan Funk, Edan Engineering

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PIRT Primary Objectives

- Identify phenomena and influencing parameters that would lead to fire-induced electrical circuit faults
- Rank the phenomena and influencing parameters
- Assess current level of knowledge for each identified phenomena and influencing parameter

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PIRT Secondary Objective

- Review technical basis and deliberate on longstanding fire protection circuit issues
  - MHIF, CTs, proper polarity (ac/dc), etc.
- Any consensus on issues will be documented in NUREG/CR as panels expert judgment and NOT regulatory guidance

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NRC PIRT Perspective

Bob Daley, NRC/RIII

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PIRT Composition

NRC

- Gabe Taylor – RES
- Harry Barrett – NRR
- Bob Daley – RIII
- Steve Nowlen - SNL

EPRI

- Dan Funk – EDAN
- Tom Gorman – PPL
- Andy Ratchford – RDS
- Dave Crane - Pyrolico

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Perspectives

- PIRT strengths
- Can't un-know what you know!
  - With the good comes the bad (or vice versa depending upon your viewpoint)
- Regulations and technical basis
- The rule is flexible to regulate

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Ah-Hah! Moments

- MSOs. Yeah, they can happen!
- Insulation type (TP or TS)
  - No discernible effect on spurious operations
- Jacket Type (TP or TS)
  - No effect

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Ah-Hah! Moments

- Flame impingement
  - Produced a higher percentage than a plume or HGL
- Bundled cable arrangement
  - Higher percentage
- Conductor size
  - No effect on fault modes

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AC/DC Sequential Hot Shorts

- Power Cabling
  - Configuration makes this not plausible for:
    - Three phase AC
    - DC Compound Motor
- Control Cabling
  - Always fair game

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Instrumentation Cabling

- PIRT Discussion
  - Leakage current
  - High or Low outputs will eventually be seen
  - Control Room indications may not be easy to diagnose
  - Conclusion: More Research needed

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Industry PIRT Perspective

Dan Funk, Edan Engineering

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Data Consolidation Project

Gabriel Taylor, NRC-RES

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Data Consolidation Project

- Analyze data from
  - EPRI/NEI, CAROLFIRE, DESIREE-FIRE
- Provide simplistic statistics to aid PIRT in ranking various phenomena and parameters
  - Hot short, spurious actuation, fuse clear
  - Duration
  - Inter-cable vs intra-cable shorting

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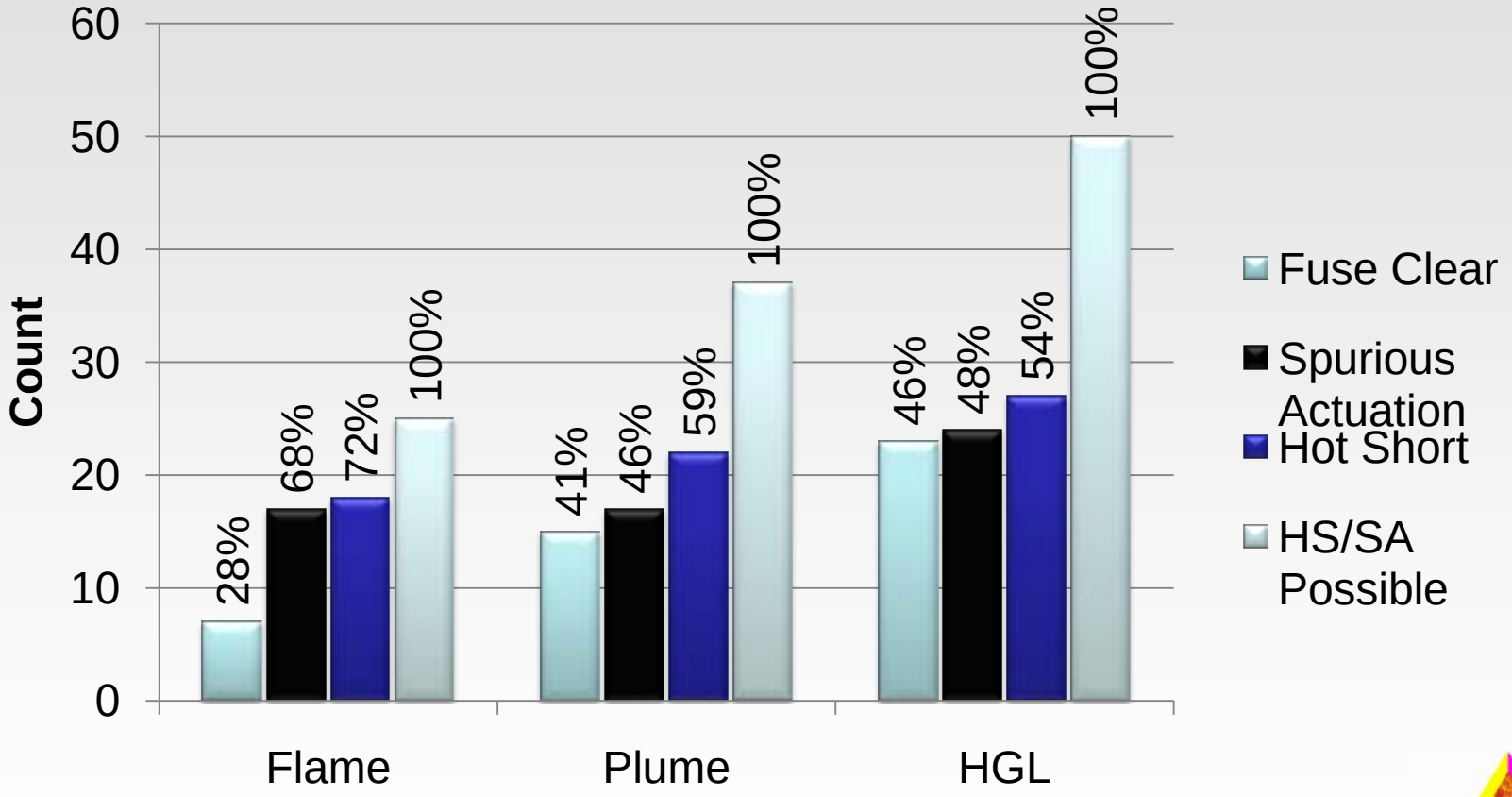
Exposure Conditions – ac tests



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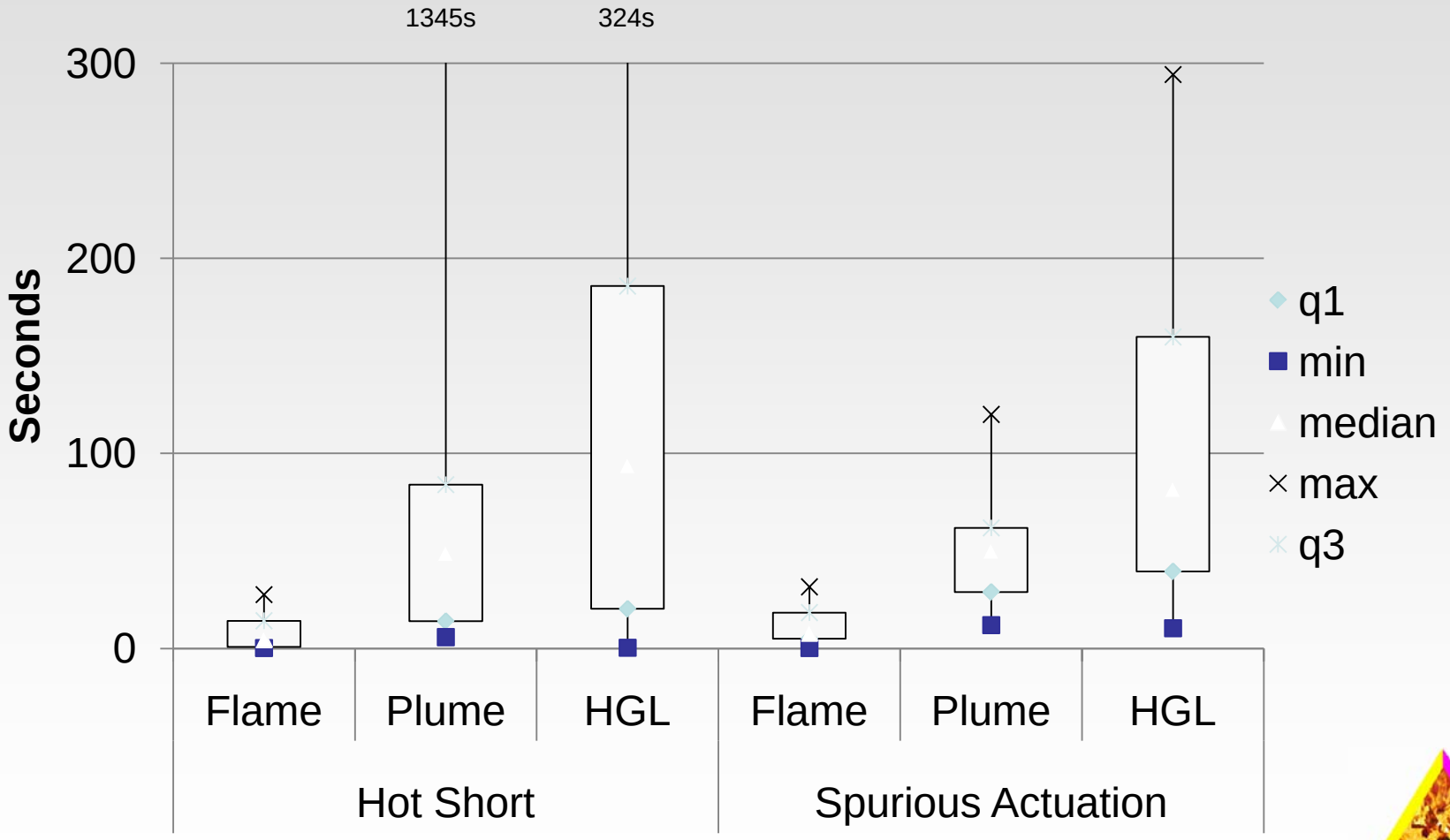
Exposure Conditions – ac tests Duration



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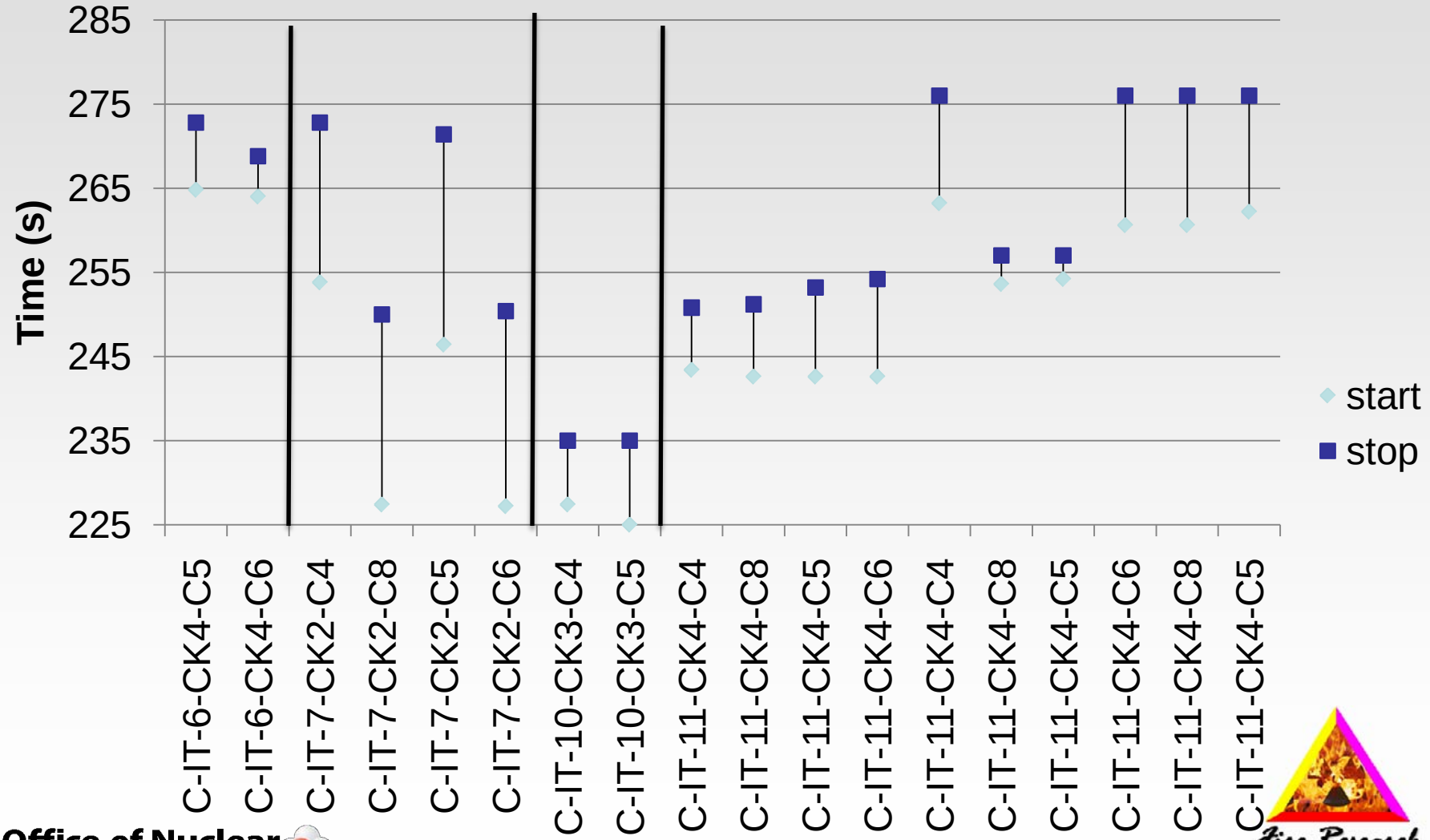
Concurrence



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We have results – now what?

- Follow-on Expert Elicitation for PRA values
- Develop research plan for areas that need further research
- Revise NUREG/CR-6850, RG(s) or issue generic communications (if needed)

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PRA Expert Elicitation

Gabe Taylor

NRC-RES

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Expert Panel Objective & Tasks

- Develop best-estimate conditional probabilities for circuit failure modes
- 8 member team (4 NRC / 4 EPRI)
- Use information from PIRT panel to prioritize what phenomena to rank
- Develop best-estimate probabilities

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Expert Panel Schedule (Tentative)

- 1st working meeting early in 2012
- Meeting wrap-up early summer 2012
- Report estimate: Fall/Winter 2012

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Proposed IEEE test standard for cable fire rating

Gabriel Taylor, NRC/RES

Office of Nuclear Regulatory Research

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New IEEE test standard

- Purpose : develop a fire-rated cable test standard acceptable to NRC
- Objective: fire testing standard to determine cable fire-endurance rating
- Deterministic and performance-based criteria

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New IEEE test standard (2)

- IEEE draft standard P1844
- PAR submitted summer 2011
- 3-5 years for final
- Insulated Conductor Committee (ICC) meetings 2x per year
  - Next is Denver October 23-26, 2011

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Standard Outline

- Similar to UL2196
  - ASTM E-119
  - Hose Stream
- Acceptance Criteria based on cable function
  - Power, Instrumentation, Control

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NRC Cable Tray Fire Testing Program

David W. Stroup, P.E.

September 11 - 15, 2011

2011 NEI FPIF – Plenary 6 Session 4

Charleston Marriott

Charleston, South Carolina

Office of Nuclear Regulatory Research

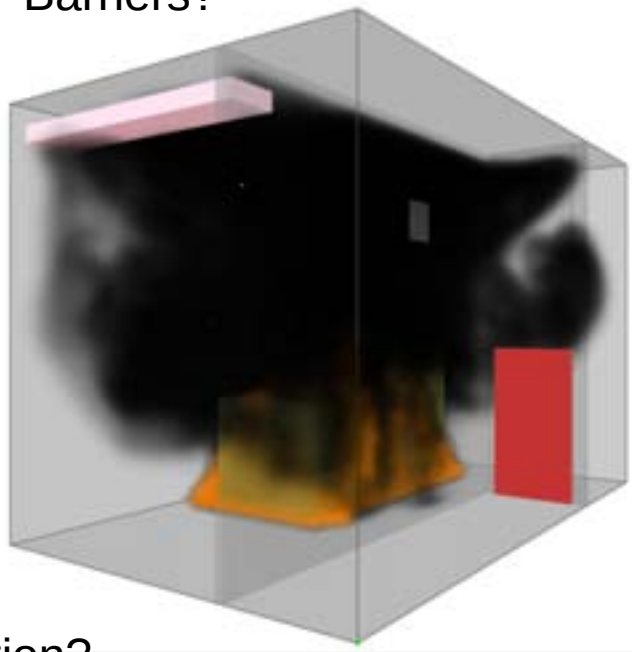
Fire Research Branch

What's the Problem?

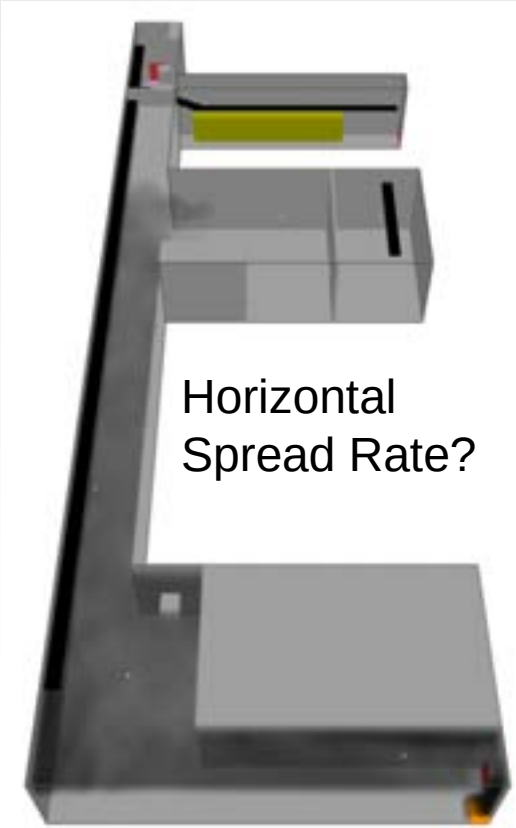
Answer: Very little useful information on cables for fire modeling

Tray to Tray Spread?

Effectiveness of Fire Barriers?

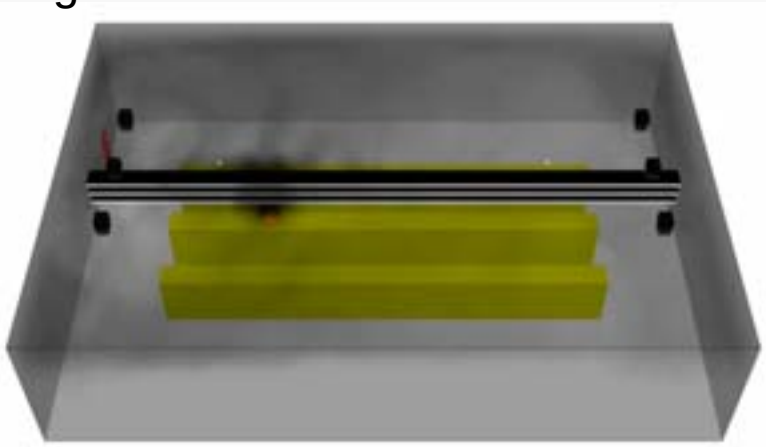


Vertical Spread Rate?

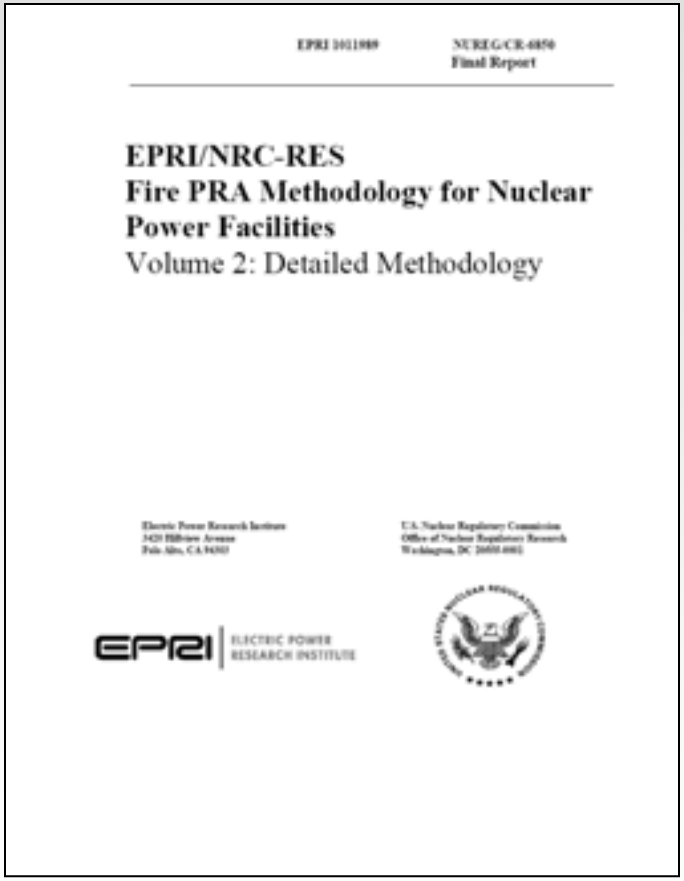


Horizontal Spread Rate?

Ignition?



Current Guidance for Modeling Cables



EPRI 1011989 NUREG/CR-6850
Final Report

EPRI/NRC-RES
Fire PRA Methodology for Nuclear Power Facilities
Volume 2: Detailed Methodology

Electric Power Research Institute
3420 Hillview Avenue
Palo Alto, CA 94303

U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Washington, DC 20555-0001

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Problems going from "bench" to full-scale

Table R-1
Bench Scale HRR Values Under a Heat Flux of 60 kW/m^2, q_{bs} [R-4]

Material	Bench Scale HRR [kW/m^2]
XPE/FRXPE	475
XPE/Neoprene	354
XPE/Neoprene	302
XPE/XPE	178
PE/PVC	395
PE/PVC	359
PE/PVC	312
PE/PVC	589
PE, Nylon/PVC, Nylon	231
PE, Nylon/PVC, Nylon	218

Which HRR to Use?

Micro-Calorimeter

5 mg sample

Standard Test Method for Measuring Flammability Properties of Plastics and Other Solid Materials Using Microscale Combustion Calorimetry
ASTM D 7309

Cone Calorimeter

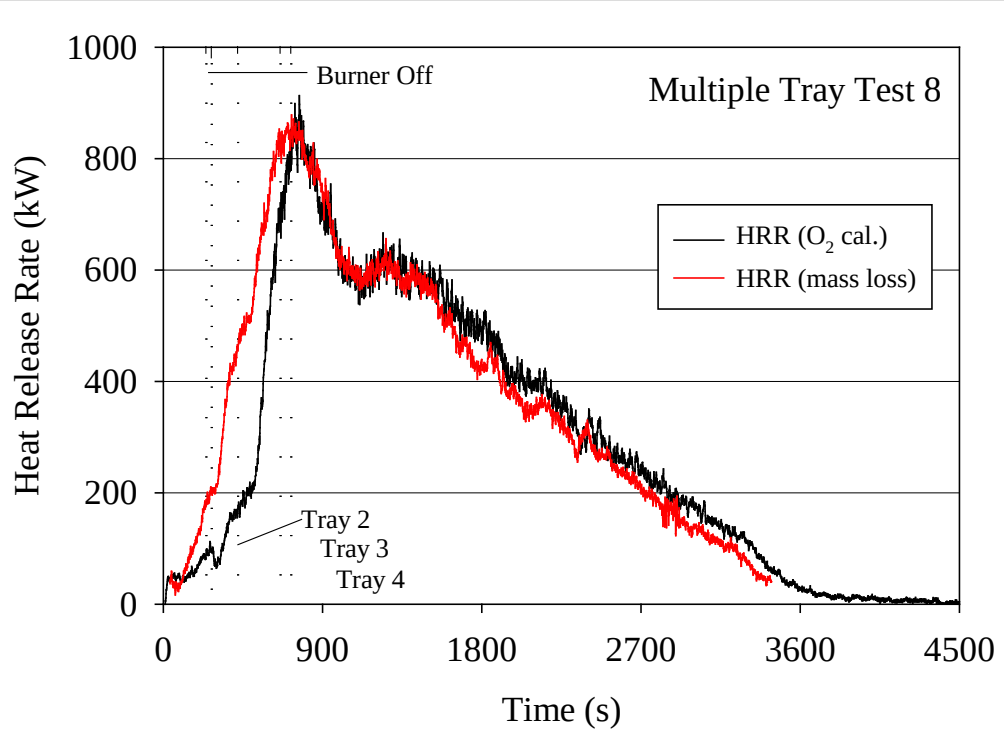
10 cm x 10 cm sample

Standard Test Method for Using a Cone Calorimeter to Determine Fire-Test-Response Characteristics of Insulating Materials Contained in Electrical or Optical Fiber Cables
ASTM D 7309

Panel Calorimeter

120 cm x 45 cm sample

No Applicable Standard



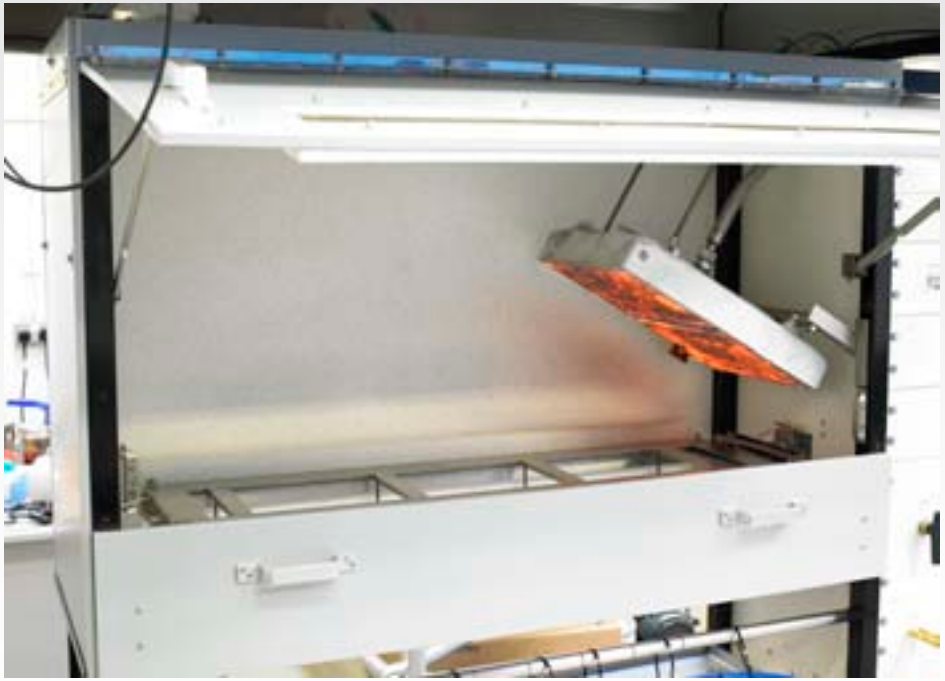
Thermoplastic Cable

CHRISTIFIRE I - Results

- NUREG/CR-7010, Vol. 1 – Late Fall
- Results Consistent with NUREG/CR-6850
- Heat Release Rate per Unit Area
  - Thermoset: 100 kW/m^2 to 200 kW/m^2
  - Thermoplastic: 200 kW/m^2 to 300 kW/m^2
- FLASH-CAT Model for Predicting Heat Release Rate

CHRISTIFIRE – Phase 2

- Flooring Radiant Panel Test
- Critical Radiant Heat Flux

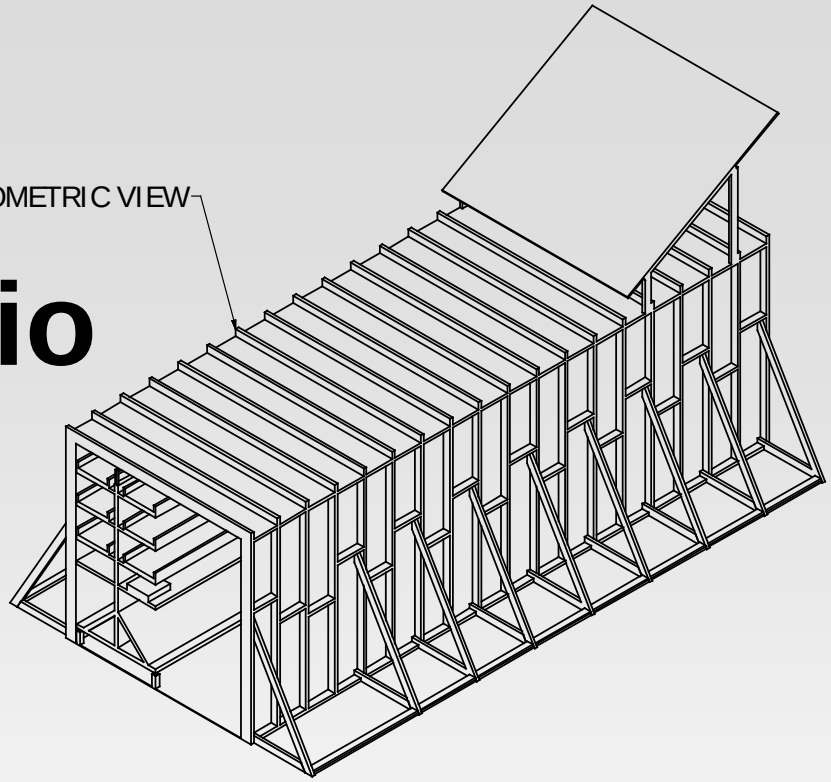


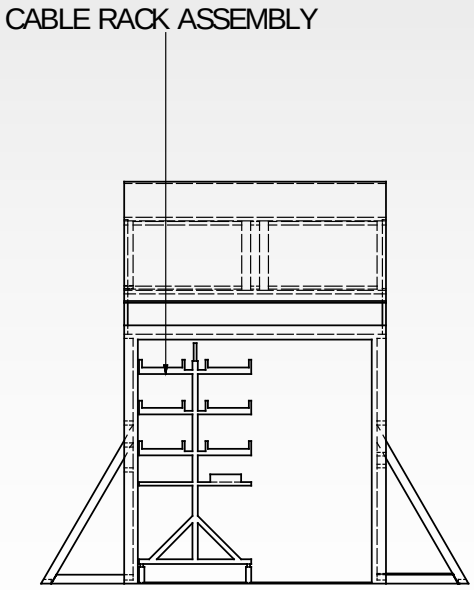

4/0
3/0
2/0

CHRISTIFIRE – Phase 2

- Full Scale Tests
- Complex Configurations
  - Vertical Trays
  - Transitions
  - Enclosure Effects
- Schedule
  - Start of Testing: September/October 2011
  - Draft Report: February 2012

Test Scenario





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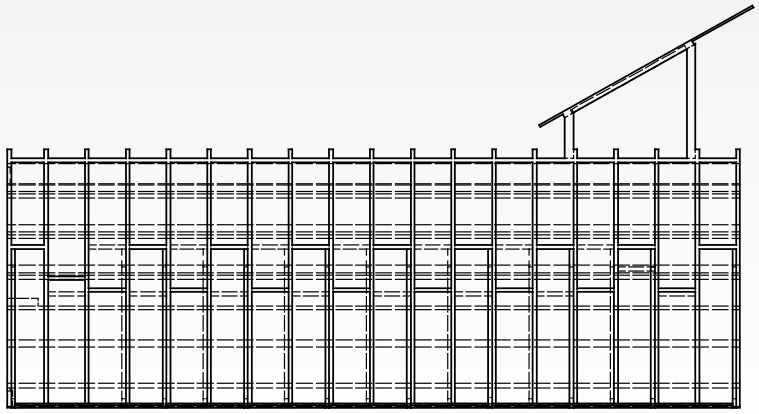

LEFT SIDE

CHRISTIFIRE
Future Phases

- Additional Configurations
- Cable Coatings
- Tray Covers

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Nicholas Melly
Fire Protection Engineer
September 12-15, 2011
NEI Forum, Charlestown SC

Plenary 6 Session 6: International Fire Research – Fire Events Data Base & High Energy Arcing Faults

Office of Nuclear Regulatory Research

Fire Research Branch

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Fire Events Database: Scope

- Updated Fire Events Database Project (FEDB)
- Metrics Methodology Report
- OECD Fire Incident Records Exchange Project

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Updated Fire Events Database Project (FEDB) -EPRI/NRC

This database project will become the principal source of fire incident operational data for use in fire PRAs

- Need for improved database identified by NFPA 805 FAQ program
  - FAQ 48 -update of current fire events database 2001-2009
  - address fire ignition frequency
- Will serve more general fire PRA needs of both NRC and industry

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Updated Fire Events Database Project (FEDB)

- Joint project by RES and EPRI
  - RES and EPRI collaborated on data fields and criteria for severity classification
  - EPRI taking the lead in collecting data and populating database, with RES in an audit role (2 audits completed)

- Sandia National Labs and Idaho National Labs under contract to RES for additional support

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Updated Fire Events Database Project (FEDB): Current Work

- NRC/EPRI Collaboration on the development of a set of common exclusionary cases
- Ongoing discussions as to the relevance and use of the older data (1968-1990) as well as the completeness observed for the 1991-2000 timeframe
- Continued NRC audit(s), Next Audit expected in November 2011

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Metrics Methodology Report

- Commission directed: SRM M080717, GAO Report 08-747
  - periodically updated
- High consequence plant fires, LER level
  - Average of ~9 severe fires a year, No statistically significant trend in the past 20 years of events
- Triennial & Annual/Quarterly Fire Protection Inspection Findings
- Long-term Compensatory Measure Tracking
  - Assess the effectiveness of the ongoing improvements to the fire protection regulatory framework using recent plant data to establish a baseline

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Metrics Methodology Report

- Results incorporated into the Open Government High Value Datasets Program
  - ADAMS Accession Number ML110871330
  - http://www.nrc.gov/public-involve/open.html#datasets
  - Data.gov- Open Government initiative
  - Fire Events Data from Licensee Event Reports
  - Findings from Fire Inspections

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OECD Fire Incident Records Exchange Project

- Participation of 12 Member Countries
  - Canada
  - Czech Republic
  - Finland
  - France
  - Germany
  - Japan
  - Korea
  - Netherlands
  - Spain
  - Sweden
  - Switzerland
  - US
- Reporting threshold equivalent to LER level fires
- Many member country licensee's directly reporting the specific details of each fire scenario
  - Extremely specific and informative accounts of each fire scenario

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OECD Fire Incident Records Exchange Project

- Establishes a Framework for multi-national co-operation
- feedback of experience gained in connection with fire events
- Open lines of communication between members countries.

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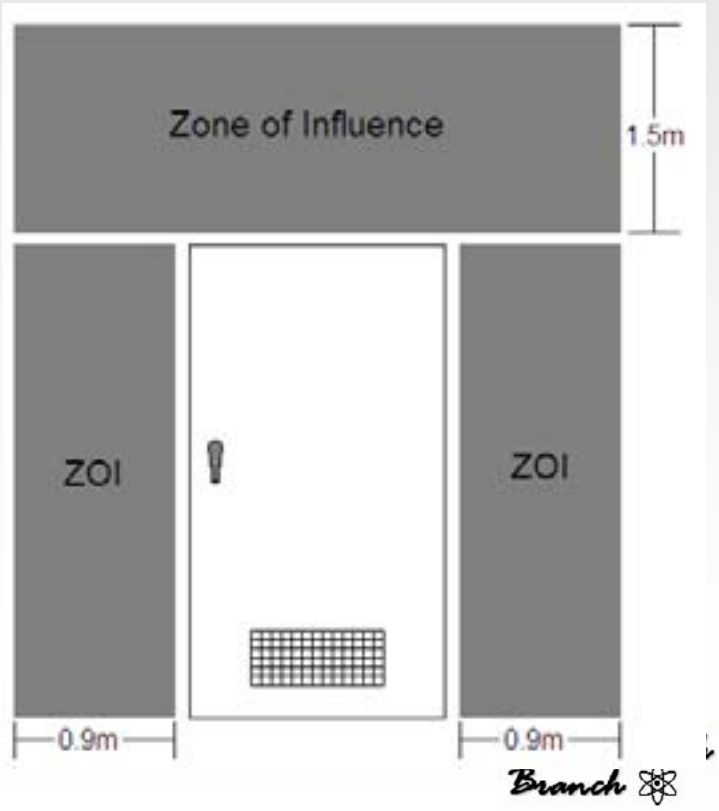
High Energy Arching Faults (HEAF)

- NUREG/CR-6850, Appendix M (2005)
- Method based on one well documented fire event at San Onofre in 2001 to define zone of influence (ZOI)
- Components within ZOI are assumed to fail or ignite
- This becomes the input to fire PRA model



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Committee on the Safety of Nuclear Installations (CSNI) HEAF

- CSNI fire events database project identified need for separate High Energy Arcing Faults HEAF
- Between 2007 – 2011
- Objectives included
  - Define HEAF
  - Share events, Op. Exp., research, & mitigation strategies
  - Characterize physical and chemical phenomena
  - Develop simple model
  - Publish technical report

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NRC HEAF Experimental Testing Proposal

- NRC-RES sponsored with SNL
- In-kind contributions
- technical expertise or monetary contributions via NEA.
- EPRI and U.S. Utility Participation support is indispensible; much like past successful programs such as DESIREE–FIRE

- Needed Components
  - Switch Gear: Breakers and Cabinets
  - Motor Control Center: Breakers and Cabinets
  - Load Center: Distribution Connections and Cabinets
  - Bus bars & bus ducts: Iso-phase and Non-segregated
  - Transformer Bushings

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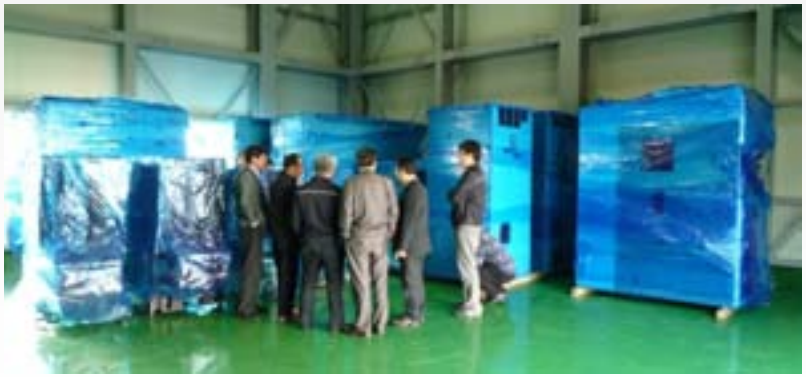
Donated Components Through OECD Contribution



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HEAF Testing - Scope of Work

- Develop draft test plan & peer review
- Setup and perform testing
- Analyze data
- Develop realistic risk/damage model
- Report results

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Conclusions

- HEAF events are expected to occur in the nuclear and non-nuclear fields.
- Data from experimental testing will assist in developing better tools to model the risk in fire PRAs.
- Motive for experimental program is supported by CSNI/IAGE HEAF TG work.
- Partnership through the OECD/NEA international umbrella as well as EPRI will be an indispensible part of a successful HEAF testing program.

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Training and Participant Feedback

David W. Stroup, P.E.

September 11 - 15, 2011

2011 NEI FPIF – Plenary 6 Session 7

Charleston Marriott

Charleston, South Carolina

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Overview of NRC/RES & EPRI Training Activities

- Providing Specialized Training is essential to successful implementation of the methodologies
- Two Major Areas of Focus
  - Fire PRA NUREG/CR-6850 (EPRI 1011989)
  - Fire Modeling NUREG-1934 (EPRI 1023259)

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Fire PRA Methodology Training

- NUREG/CR-6850 (EPRI 1011989)
- Joint Training between NRC-RES & EPRI
- EPRI hosting this year
  - Week 1 August 1 to 5 San Diego, CA
  - Week 2 Nov, 14 to 18 Jacksonville, FL
- Information/Registration www.epri.com
- Next year NRC will host
  - Two Weeks, Washington, DC Area

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EPRI/NRC Fire PRA Course

- Five Separate Modules
  - Fire PRA
  - Electrical Analysis
  - Fire Analysis
  - Fire HRA
  - Advanced Fire Modeling (New)
- Includes Latest FAQs
- First Day Introduction (Last Time??)

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DVD Based Training

- "Self Study" Tool:
  - Methods for Applying Risk Analysis to Fire Scenarios (MARIAFIRES-2008)
  - NUREG/CP-0194 (EPRI 1020621)
  - Published July 2010
- Based upon the 2008 Training Sessions
- Working on MARIAFIRES-2010

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MARIAFIRES - 2010

- Based upon the 2010 Training Sessions
- Replace Introduction Sessions
  - PRA
  - Fire Analysis
  - Electrical
  - HRA
- Add New Module - HRA

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Fire Modeling

- NUREG-1934 (EPRI 1023259) Fire Modeling Application Guide
  - Draft for Comment
  - Used as “textbook” for 6860 Training
- NUREG-1824 (EPRI 1011999) Verification and Validation (V&V)
  - Initial Issue: May 2007
  - Future Expansion

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Changes to Inspection Procedure 71111.05T Fire Protection Triennial Inspection

2011 NEI FPIF Plenary 7, Session 1
Daniel M. Frumkin, Team Leader
Fire Protection Branch
Division of Risk Assessment, NRR

Topics

- IP 71111.05T, Revision Effective January 1, 2011
  - Enclosure 1 – Supporting Documentation
  - Enclosure 3 – Adverse Affect Discussion
- IP 71111.05T, Revision Effective August 1, 2011
  - Combining IP 71111.05T and 71111.05TTP
  - Consideration of Industry Comments in January Revision

IP 71111.05T, Effective January 1, 2011 Supporting Documentation

- Enclosure 1 of IP 71111.05T includes additional supporting documentation:
  - Operator manual action corrective actions
  - Circuit failure configurations and corrective actions
  - List of protected safe shutdown train equipment and routing of components for selected fire areas
- This information should be available to the inspectors.

IP 71111.05T, Effective January 1, 2011 Enclosure 3 to IP 71111.05T

- The NRC staff added Enclosure 3 to IP 71111.05T – January 1, 2011
- The enclosure discussed:
  - Fire Protection License Condition
  - Adverse Affect
  - General Design Criteria 3 – Probability and Effect of Fires and Explosions
- Industry stakeholders had concerns over this enclosure and other changes
  - December 17, 2010 letter, J. Butler of NEI to F. Brown of NRC

IP Effective August 1, 2011 Combining IP 71111.05 T and TTP

- Inspection Procedure 71111.05TTP:
  - With this procedure the NRC reduced the scope of the typical triennial inspections by specifically excluding the subject circuit configurations from the inspection.
  - This allowed licensees to focus on the transition, which had the potential to resolve the circuit issues
- IP 71111.05TTP reduced scope for circuits was incorporated into IP 71111.05T
- The scope for transitioning plants continues to be reduced under IP 71111.05T for plant in their first 3 years of transition.

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IP Effective August 1, 2011 Industry Comments and Resolution

- Industry Comments – Dated December 17, 2010
  - Numerous editorial and clarifications
  - Discrepancies related to Regulatory Guide 1.189 and NEI 00-01, Revision 2, in the area of circuit analysis
  - Concerns with Enclosure 3
- NRC staff considered the industry comments, see letter ML110200509, and issued revised IP 71111.05T effective August 1, 2011

Conclusion

- The inspection procedure has been updated for use.
- The NRC staff is aware that industry stakeholders may have concerns with Enclosure 3

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Fire Protection Lessons Learned

2011 NEI FPIF Plenary 7, Session 2
Daniel M. Frumkin, Team Leader
Fire Protection Branch
Division of Risk Assessment, NRR

Why Lessons Learned?

- July 2008 SRM:
  - The Closure Plan should include training to appropriate staff on the important historical lessons learned from the fire protection issue resolution activities since 10 CFR 50 Appendix R was established.

Lessons Learned (1)

1) Performance-Based Regulation is Good

2) Delineate inspector and headquarters responsibilities

3) Comprehensive Implementation Guidance
   - Regulatory Guide 1.120,- drafted in 1976 – Never issued
   - Regulatory Guide 1.189, for fire protection Issued in 2001

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Lessons Learned (2)

4) Don't rely on generic communications for permanent guidance
   - Numerous generic communications, different review than regulatory guides, and the information is spread over different documents

5) Be consistent
   - Pre-1976, between 1976 and 1980, and after 1980 were different to address different points in plant construction and evolving fire protection regulations
   - NFPA 805 provides an opportunity to implement consistency

Lessons Learned (3)

6) Consider outcomes of enforcement discretion
   - 14 years of enforcement discretion for circuits 1998 to 2012

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Conclusion

- NRC staff plans to incorporate these lessons into a Knowledge Management Brochure

- "The only thing we learn from history is that we never learn from history." – F. Hegel

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NRC Fire Protection Knowledge Management & Staff Development

2011 NEI FPIF – Plenary 8, Session 5

Gabriel Taylor

Fire Protection Engineer

Office of Nuclear Regulatory Research

Fire Research Branch

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What is Knowledge Management (KM)?

- KM is a continuous, disciplined and timely process of identifying, collecting and using information to better accomplish the job. (RES KM plan)

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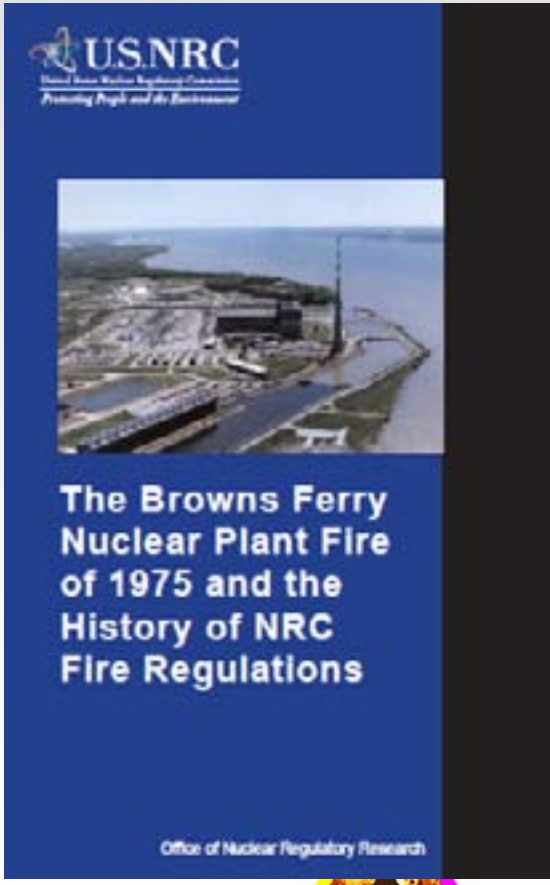
KM within the Agency

- NRC is active in KM across the agency
  - Share point sites, ADAMS, management directions
- Principle product of NRC-RES is knowledge
- FRB has performed several KM activities

Brown Ferry Fire Brochure

- NUREG/BR-0361
- Documents the 1975 Browns Ferry Fire
- Regulatory impacts from the fire
- Collection of historic documents related to the fire, interview videos, congressional hearing, journal articles, presentations, question and answer information and more.



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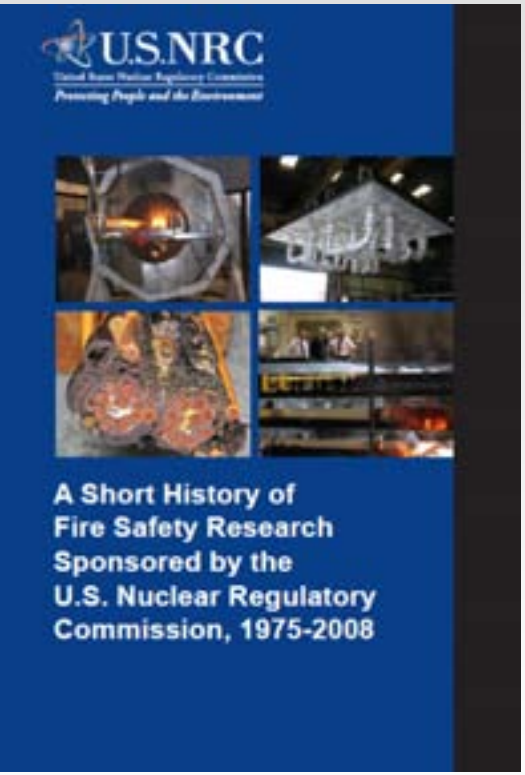
History of Fire Safety Research



- NUREG/BR-0364
- Summarizes research conducted by NRC from it inception through 2008
- Overview of four phases
  - Fire Protection Research Program (1974-87)
  - Risk Method Integration and Evaluation Program (RMIEP 1987-93)
  - Post RMIEP (1993-98)
  - Fire PRA related (1998-present)

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Fire Protection and Fire Research KM

- NUREG/BR-0465
- Previously issued as Fire Research Branch cd handouts at annual Regulatory Information Conference (RIC), now formalized as a NUREG/BR
- Visual basic application to quickly locate technical or regulatory documents

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MARIAFIRES

- NUREG/CP-0194
- Methods for Applying Risk Analysis to Fire Scenarios (MARIAFIRES)-2008
- DVD and report based documentation of NRC-RES/EPRI fire PRA training conducted in 2008
- Work to update with 2010 version of training

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NRC Staff Development

Office of Nuclear Regulatory Research

Fire Research Branch

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NRC Staff Development

- Nuclear Safety Professional Development Program (NSPDP)
- Technical training – TTC Chattanooga
- Qualification program (NRR, Regions)
- Rotational opportunities
- On the job training

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NSPDP Overview

- Two year training and rotational program
- Goal is to function efficiently as a regulator
  - not to become an expert in any one area
- Focus on new hires directly out of school
- Home office base
- Mentors
- Progressive non-competitive grade increases with satisfactory performance

NSPDP - Technical Training

- Reactor training
  - Power plant engineering
  - Reactor technology
  - Component Specific (MOV, breakers, etc.)
- Inspections and communications
  - IMC 609 Appendix F (Fire SDP)
- PRA training
- Training can be diverse
  - create your own path

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Other Technical Training

- NFPA 805 training
- External Training
  - Advanced degrees
    - Part time & Full time
  - Continuing Educations Credits / Conference
  - Fire Modeling
  - Human Factors
  - Dependent on funding and needs

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Qualification Programs

- Ensure employees have knowledge and skills required to perform their duties
- Qualification requires passing an oral board
- 13 qualification tracks based on job type
  - Not including regional inspection qualification tracks (IMC 1245)
  - Study & on the job training activities

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Personal Career Track

- NSPDP – NRR (2005-2007)
  - Watts Bar 1, ACRS, RES
- RES FRB (2007 – present)
  - Witness testing
    - Duke, Progress, Dominion, NRL
  - Managed projects at SNL, BNL, NIST
  - Triennial Fire Protection Inspection (Quad)
  - Course work towards masters degree
  - Working on standards committee ICC
  - International Projects/Travel

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Keys to maintaining young engineers

- Meaningful & important work
- Develop into future experts
- Incorporation as part of the team
- Feedback (positive and negative)
  - Active supervision
- Maintain a healthy work/life balance
- Reward good work
  - Time off, monetary, conferences, training etc.