

April 10, 1997

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LICENSEE: Commonwealth Edison Company (ComEd)  
FACILITIES: Quad Cities Nuclear Power Station, Units 1 and 2  
SUBJECT: SUMMARY OF MEETING CONCERNING THE QUAD CITIES IPEEE

On March 31, 1997, the staff met with ComEd to discuss the Individual Plant Examination of External Events (IPEEE) report submitted by Quad Cities on February 17, 1997. This report had identified internal fire vulnerabilities that indicated an IPEEE core damage frequency (CDF) of 5E-03. A list of attendees is provided as Enclosure 1.

The objective of the meeting was for ComEd to discuss with the staff the potential vulnerabilities and corrective actions identified in the fire protection and post-fire safe shutdown programs and procedures for Quad Cities, Units 1 and 2, during preparation of the IPEEE. Implications for Dresden Station, Units 2 and 3, were also discussed. A copy of the licensee's presentation is included as Enclosure 2.

The licensee provided clarification of their evaluation including the methodology, risk reduction task force, event tree analysis and their action plan schedule. Clarification was also provided for the Interim Alternate Shutdown Method (IASM) which has been implemented at Unit 1. ComEd provided a brief summary of the fire IPEEE similarities and differences between Quad Cities and Dresden Stations.

Based upon the results of the meeting, ComEd was requested to submit two letters to the NRC: 1) provide the rationale and basis as to why its acceptable to wait until November 1997 before coming to resolution of the IPEEE concerns at Quad Cities, and 2) explain why Dresden fire protection vulnerabilities differ from Quad Cities. The staff will complete a more extensive review of Quad Cities IPEEE by proceeding with a Level 2 evaluation.

ORIGINAL SIGNED BY:

Robert M. Pulsifer, Project Manager  
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Division of Reactor Projects - III/IV  
Office of Nuclear Reactor Regulation

110043

Docket Nos. 50-254 and 50-265

Enclosures: 1. List of Attendees  
2. Licensee's Presentation

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UNITED STATES  
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

April 10, 1997

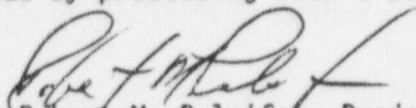
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LIST OF ATTENDEES  
ON QUAD CITIES IPEEE  
MARCH 31, 1997

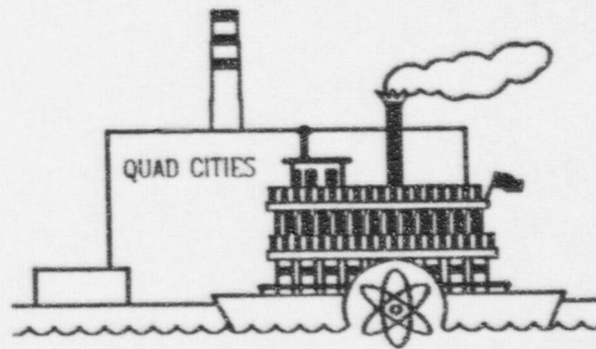
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# Quad Cities Station

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## Individual Plant Examination of External Events



# Quad Cities Fire IPEEE Introduction

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- Quad Cities Response
- What was learned
- Actions taken
  - Immediate Actions
    - Formed Fire Protection Risk Reduction Task Force
    - Administratively Restricted SSD LCO's
    - Developed an Interim Alternate Shutdown Method (IASM)
    - Action Plan for Long-Term Improvements
  - Long-term Permanent Improvements
    - Established Risk Reduction Goals
- Response to Specific Questions



# Quad Cities Fire IPEEE Presentation Overview

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- Methodology
- Event Tree Analysis
  - Example sequence
  - List of top sequences
  - Safe shutdown failure probability
- Risk Reduction Task Force
  - IASM
  - Action Plan
- Reactor Water Clean-up (RWCU) Issue
- Dresden

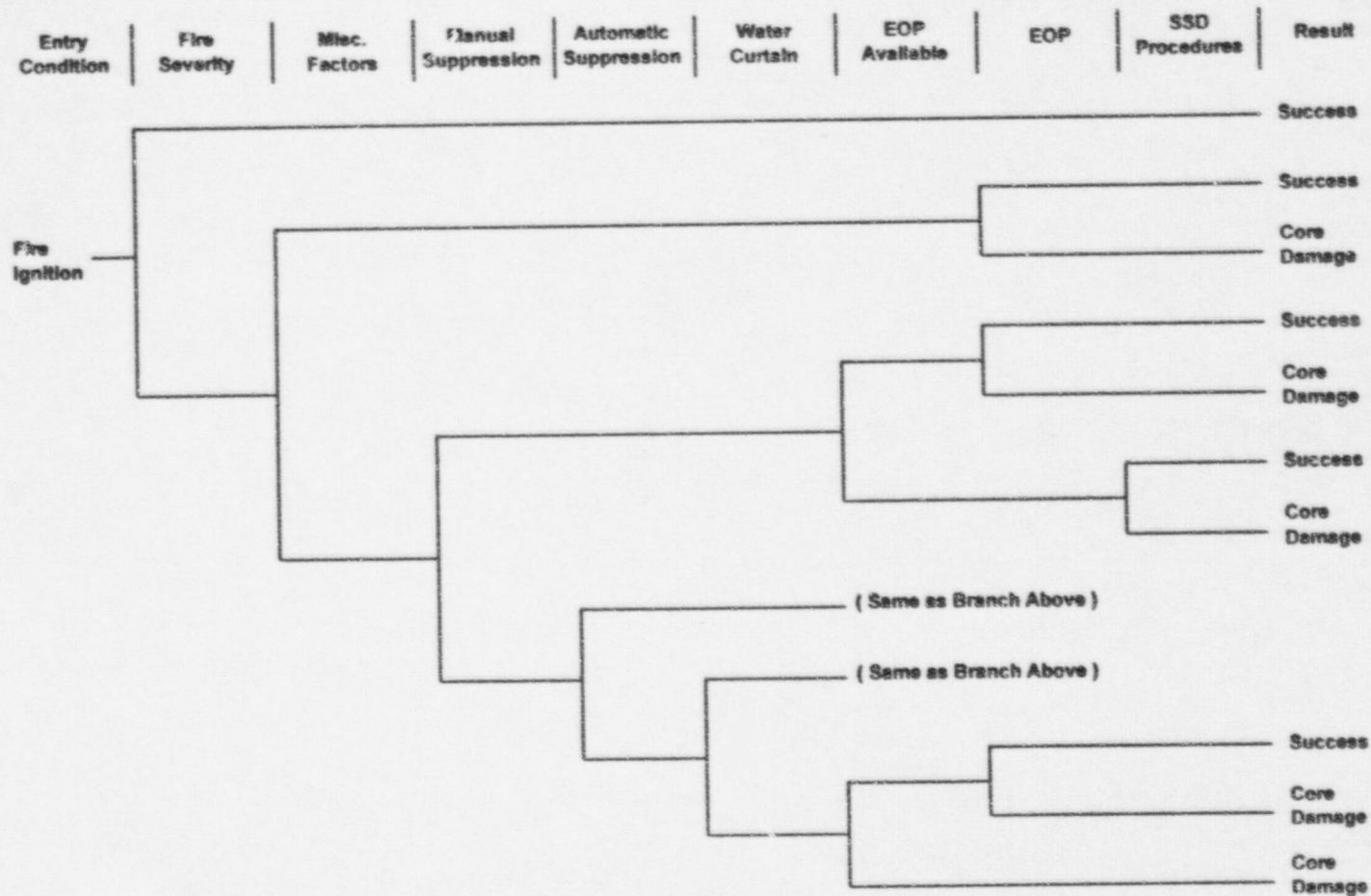


# Quad Cities Fire IPEEE Methodology

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- FIVE Screening Methodology
- EPRI's Fire PRA Implementation Guide
- Attributes of the detailed evaluation:
  - Rigorous Evaluation of Human Actions
  - Fire Severity; i.e., Smoldering and Self-extinguishing Fires
  - Quantified Barrier Reliability and Unavailability
  - Fixed Ignition Source Screening
  - Manual Suppression
  - Fire Propagation Between Targets vs. Worst Case (i.e., Nearest) Target
  - Heat Loss Factor
  - Control Room Analysis

# Quad Cities Fire IPEEE Event Tree Analysis



# Quad Cities Fire IPEEE

## Top Sequence

Rank	Seq. Freq.	Percent	Event Freq.	Failed Events
1	5.06E-04	9.41%	1.34E-03	RFP 1A Oil Fire
			1.00E+00	Fire Severity
			1.00E+00	Manual Suppression Fail
			1.00E+00	Auto Suppression Fail
			9.41E-01	Water Curtain Pass (Single Unit Fire)
			1.00E+00	Damage Severe, EOPs Fail
				Equipment Assumed Damaged:
				• Offsite Power
				• Diesel Generators
				• All Injection Sources
			4.03E-01	SSD Procedures Fail



# Quad Cities Fire IPEEE

## Top Sequences

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- **Top 5 Sequences:**

Rank	Seq. Freq.	Percent	Description
1	5.06E-04	9.4%	RFP 1A Oil Fire - Man. Supp. Fail, WC Pass, EOPs Unavail., SSDPs Fail
2	5.06E-04	9.4%	RFP 1B Oil Fire (remainder same as sequence 1)
3	5.06E-04	9.4%	RFP 1C Oil Fire (remainder same as sequence 1)
4	3.95E-04	7.3%	Air Compressors Electrical/Oil Fire (remainder same as sequence 1)
5	2.99E-04	5.6%	Turbine Generator Oil Fire - Man. Supp. Fail, EOPs Unavail., SSDPs Fail

- **Top 5 Sequences Contribute ~ 40% to the Total Fire CDF**
- **Top 16 Sequences Contribute ~ 60% to the Total Fire CDF**
- **Remaining ~200 Sequences Each Contribute < 1%**
  
- **Total Fire CDF is 5E-03/ry**

# Quad Cities Fire IPEEE

## SSD Procedure Failure Probability

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- Equipment Unavailability
  - Based on historical data
  - Relies on opposite unit equipment
  - Equipment not available for much of a refueling outage
  - Approximately 0.30
- Human Error Probability
  - Based upon complexity of SSD procedures - large number of manual actions
  - Approximately 0.10

# **Quad Cities Fire IPEEE Risk Reduction Task Force**

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- Purpose
- Objectives
- Interim Alternate Shutdown Method (IASM)
- Fire Protection Risk Reduction Action Plan

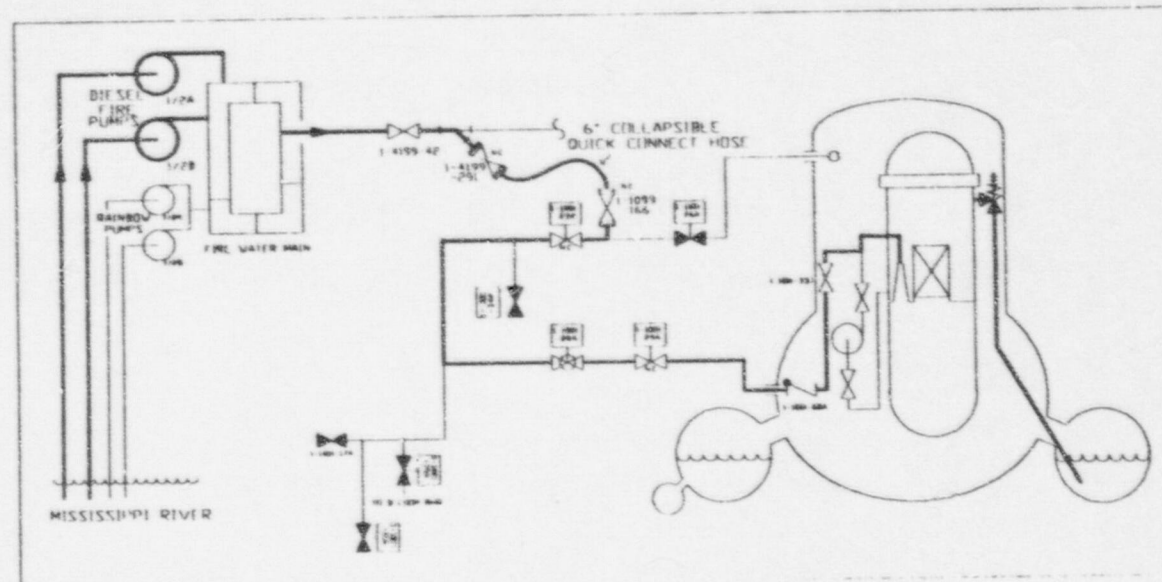


# **Quad Cities Fire IPEEE IASM**

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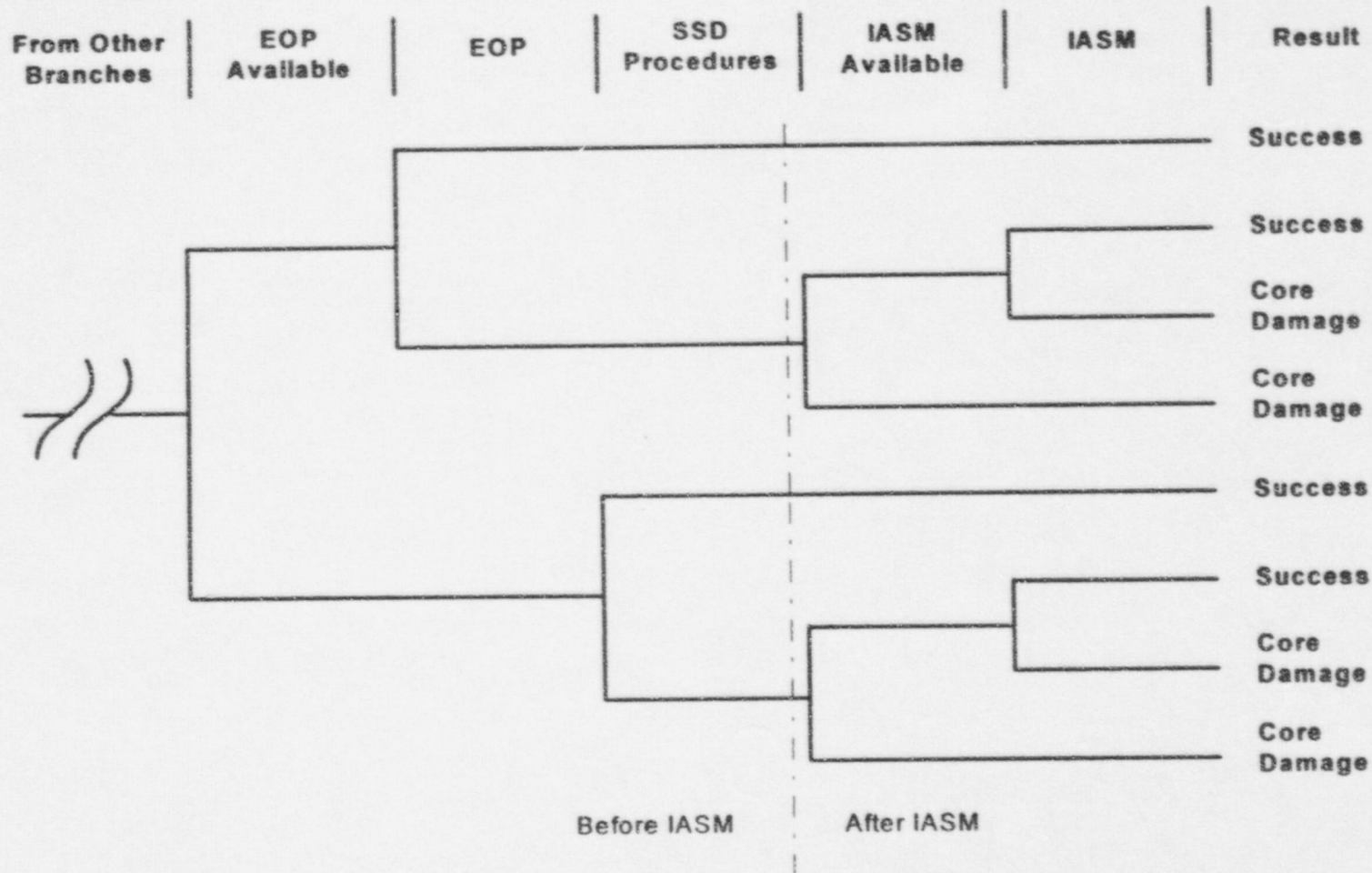
- Method of Injection into the Vessel
- Independent Power Source
- Independent Water Source
- Same or Shared Unit Equipment

# Quad Cities Fire IPEEE IASM-Simplified Diagram



- Diesel Fire Pumps
- Backup Diesel Pumps
- Residual Heat Removal System
- Batteries for relief valves
- Calculations
  - Hydraulic
  - Core
  - PRA
- Operator Training

# Quad Cities Fire IPEEE Post IASM Sequences





# Quad Cities Fire IPEEE Post IASM Sequences

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- **Unit 1 Total Fire CDF Now 9E-04/ry**

- **Top 5 Sequences:**

Rank	Seq. Freq.	Percent	Description
1	1.55E-04	16.9%	Turbine Generator Oil Fire - Man. Supp. Fail, EOPs Unavail., SSDPs Fail, IASM Fails
2	8.06E-05	8.8%	Air Compressors Electrical/Oil Fire - Man. Supp. Fail, WC Pass, EOPs Unavail., SSDPs Fail, IASM Fails
3	5.54E-05	6.0%	Computer Room Cable Self-Ignition - Man. Supp. Fail, EOPs Unavail., SSDPs Fail
4	4.45E-05	4.9%	Torus / DW DP Compressor 1A Fire - Man. Supp. Fail, Auto Supp. Fail, EOPs Unavail., SSDPs Fail
5	4.45E-05	4.9%	Torus / DW DP Compressor 1B Fire - (same as sequence 4)

- **Top 5 Sequences Contribute ~ 41 % of the Total Fire CDF**
- **Top 23 Sequences Contribute ~ 81% of the Total Fire CDF**
- **Remaining ~200 Sequences Contribute < 1% Each**

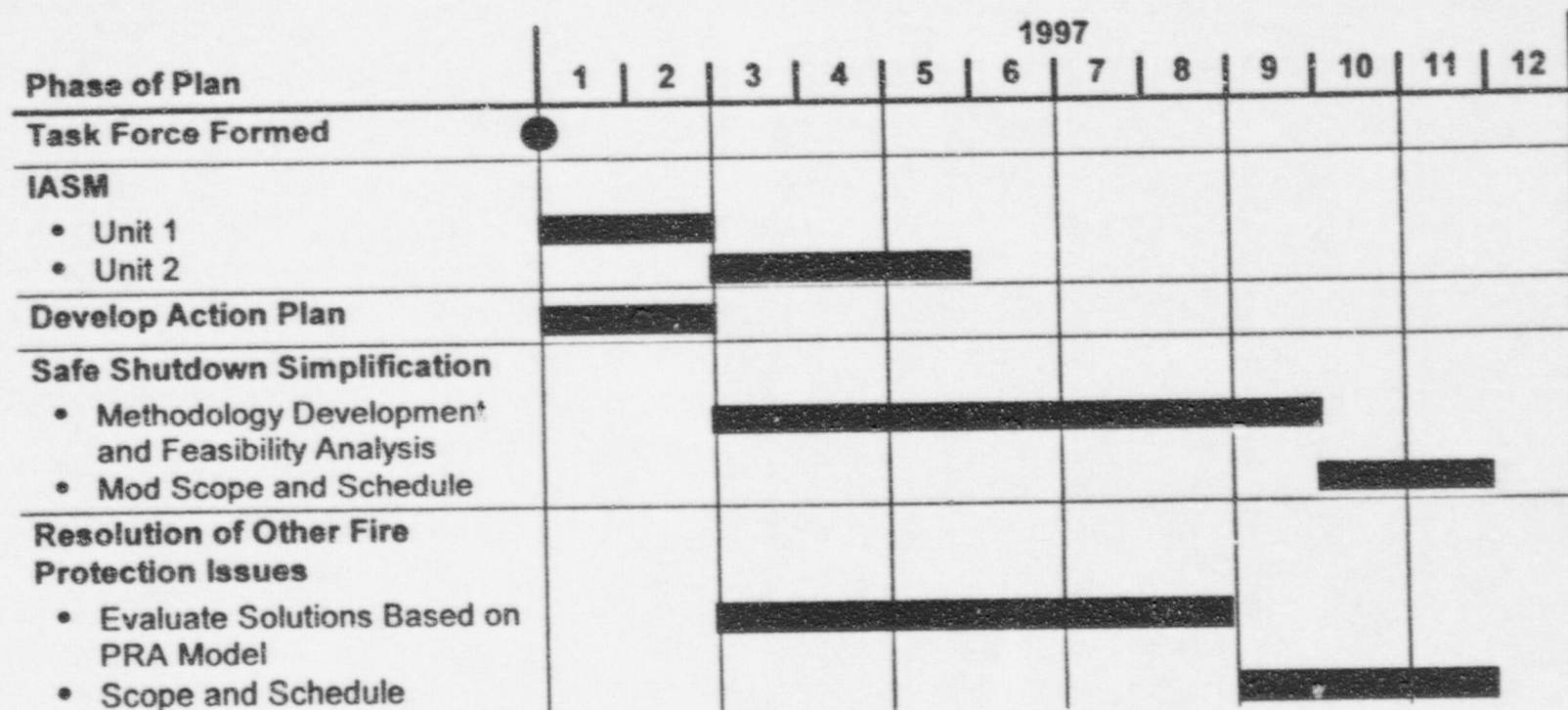
- **Unit 2 Post IASM**

# **Quad Cities Fire IPEEE FP Risk Reduction Action Plan**

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- Task Force
- Approach
  - Simplify Safe Shutdown Methodology
  - Potential Enhancements

# Quad Cities Fire IPEEE Plan Implementation





# **Quad Cities Fire IPEEE RWCU Issue**

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- Identification
- Resolution
- Conformance
- Reporting

# **Dresden Station Fire IPEEE**

## **Dresden / QC Similarities, Differences**

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### **●Similarities and Differences Exist Between QC and Dresden Fire Protection:**

#### **»Similarities**

- Non-IEEE-383 rated cables**
- Load stripping following a significant fire**

#### **»Differences**

- Dresden relies on Isolation Condenser for safe shutdown which has few active components (therefore is less vulnerable to fire damage) and requires simple manual actions.**
- Low reliance on opposite unit equipment for Safe Shutdown**
- Non-combustible Vimasco cable coating in AEER**
- 3M Fire Barrier Cable Wraps in Key Areas**
- Extensive Automatic Suppression Coverage**

**●Based on these significant differences Dresden expects a lower CDF than QC. However, since Dresden has not completed its IPEEE, Dresden is planning for the contingency that vulnerabilities may be identified.**

# **Dresden Station Fire IPEEE**

## **Steps in Response to QC Results**

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- »Reviewed QC IPEEE Issues for applicability to Dresden
- »Walked down specific plant areas to assess impact
- »Reprioritized project tasks
- »Work closely with and learn from QC
- »Develop corrective action(s) if needed, for short term resolution of potential vulnerabilities
- »Develop a plan, as appropriate, to identify and evaluate long-term resolution of vulnerabilities at Dresden



# **Quad Cities Fire IPEEE Conclusion**

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- Performed Detailed Examination
- Established Goals to Resolve Identified Potential Vulnerabilities
- Committed Resources to Accomplish Goals
- NRC Communications

# Quad Cities Fire IPEEE

## NRC Question Cross-Reference

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Question/Issue	Slide(s)
1. Discuss the Task Force action plan, potential solutions, final recommendations, and implementation.	Slides 9, 14, and 15
2. Discuss details of the Interim Alternate Shutdown Method.	Slides 10 and 11
3. Discuss the Reactor Water Cleanup high/low pressure interface issue.	Slide 16
4. Provide details of the top fire induced accident sequences leading to core damage.	Slides 5, 6, 7, 8, 12, and 13
5. Discuss the potential for similar IPEEE results at Dresden.	Slides 17 and 18
6. What parts of the analysis deviated from EPRI's FIVE methodology?	Slide 4