



# FNP LAR AUDIT PRESENTATION

March 19, 2013

**Session 9 – Fire PRA**

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# Agenda

- Unique Team Efforts in FNP Fire PRA
- Peer Review of FNP FPRA
- Results of FNP Fire PRA
- FNP Fire PRA Model Development
- Use of Electrical Cabinet Factors
- FRE Process

# FNP Fire PRA

- Farley Fire PRA was developed based on the state-of-the-art methodologies available in 2010 ~ 2012 time frame which include four non-NUREG/CR-6850 methods approved by the EPRI Methods

## Review Panel:

- Frequencies for cable fires initiated by welding and cutting
- Alignment factor for pump oil fires
- Clarification for transient fires
- Electrical cabinet fire treatment (Electrical cabinet

factor)

# Unique Team Efforts in FNP

## Fire PRA

- More than 9 focused reviews (each was about a week long) of all technical aspects of Farley fire PRA to make the Farley fire PRA model as realistic as possible
- Participants to the focused reviews were from all related technical areas:
  - PRA logic modeling (Internal events and Fire)
  - Fire modeling
  - Fire Protection/SSA/NSCA
  - Circuit analysis
  - Operations and Design

# Peer Review of FNP FPRA

- A RG 1.200, Rev. 2, Peer Review against the ASME PRA Supporting Requirements.
- The review was conducted by the WOG in October 2011 and issued under LTR-RAM-II-12-007.
- The conclusion of the review was that the FNP methodologies being used were appropriate and sufficient to satisfy the ASME/ANS PRA Standard RA-Sa-2009
- All 31 finding level F&Os have been addressed in the LAR, Attachment V

# Results of FNP Fire PRA

	CDF	LERF
Unit 1	5.24E-05/yr	1.26E-06/yr
Unit 2	5.85E-05/yr	2.39E-06/yr

from FNP NFPA 805 LAR Attachment W

# FNP Fire PRA Development

- **Task 1) Plant Partitioning**
  - PAUs – Fire Protection Program Fire Areas
  - Administrative Partitions used for data management – fire zones
- **Task 2) Equipment Selection**
  - All PRA model basic events reviewed
  - MSO components
  - All NSCA component failure modes are modeled or dispositioned
  - Cue Instruments for credited human actions

# FNP Fire PRA Development

- Task 3 and 9) Cable Selection/Analysis
  - Used ‘equipment functional states’ approach
  - Consistent with guidance in NEI 00-01
  - Identify Off Scheme Circuits
  - Breaker Coordination addressed
  - Analysis is entered into ARC FDM Database Software
  - Consistent with industry practice



# FNP Fire PRA Development

- **Task 5) Fire-Induced Risk Model**
  - Based on FNP Internal PRA model, Rev. 9 (peer reviewed March 2010)
  - Added logic structure for Fire PRA
    - Accounts all applicable MSO Scenarios and SSD equipments
    - Additional HVAC systems
    - HEP cues – instruments
- **Task 6) Fire Ignition Frequency**
  - Used supplement 1 (FAQ-08-0048) IGFs (with sensitivity)
  - Plant specific ignition frequency via Bayesian update

# FNP Fire PRA Development

- Task 8 and 11) Scoping and Detailed Fire Modeling
  - Generic Treatment Fire Modeling analysis results used to define zone of influence
  - HGL evaluation used to address impact on generic zone of influence, defines NSP for a ZOI scenario to lead to full zone damage
  - Multi-Compartment Analysis
  - Control Room Abandonment evaluation

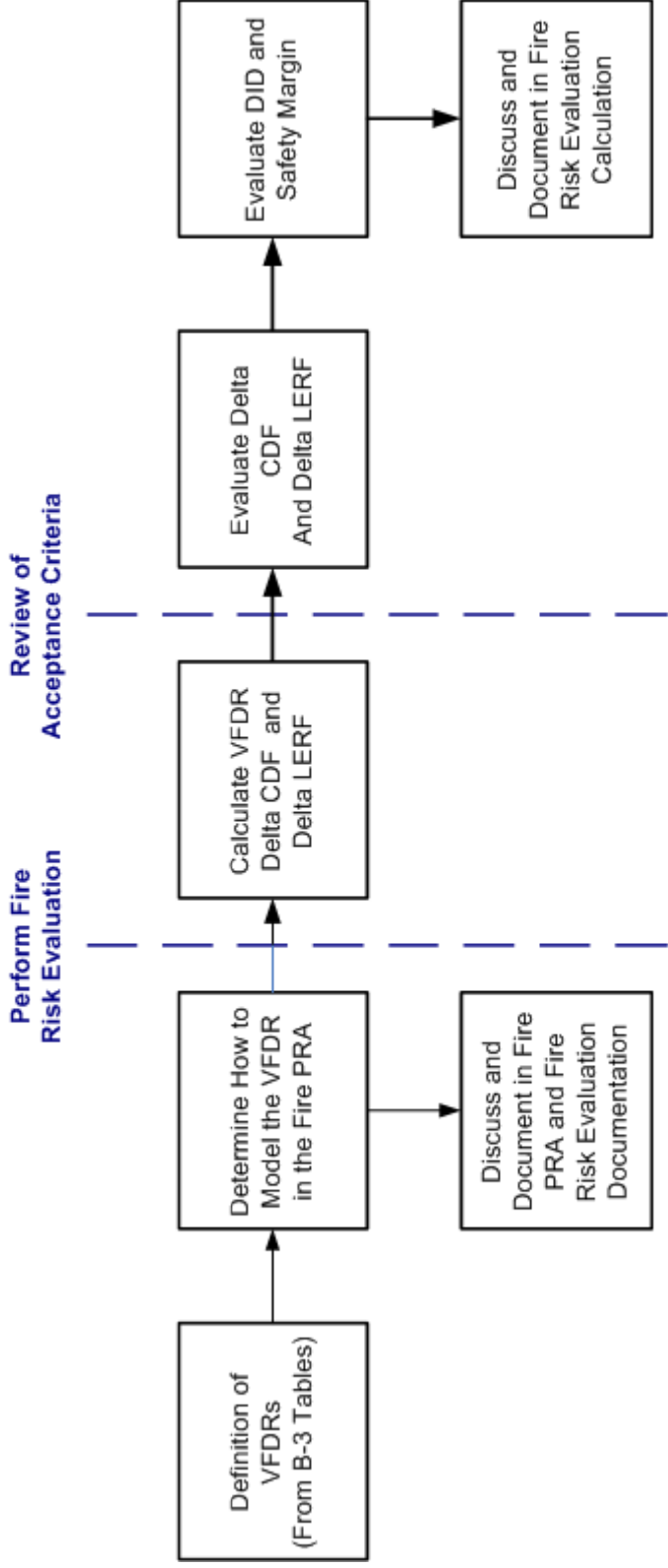
# FNP Fire PRA Development

- **Task 10) Circuit Failure Mode & Likelihood Analysis**
  - In accordance with NUREG/CR-6850
    - Table 10-1 and 10-2
  - CPT credited
- **Task 12) Fire HRA**
  - Based on FNP Internal PRA HRA with EPRI HRA calculator
  - Credited additional EOP/AOP/SOP actions for Fire PRA

# FNP Fire PRA Development

- **Task 13) Seismic-Fire Interactions**
  - Credit previous analyses associated with IPEEE and an assessment of Fire Related Vulnerabilities
- **Task 14) Fire Risk Quantification**
  - Documents results incorporating input from above tasks
- **Task 15) Uncertainty and Sensitivity**
  - Provided qualitative evaluation of uncertainties associated with each NUREG/CR-6850 task
  - Performed various sensitivity analyses and parametric uncertainty analysis using UNCERT<sub>code</sub>

# FNP FRE Process



# FNP Fire Delta Risk

	Delta CDF	Delta LERF
Unit 1	8.80E-06/yr	4.14E-07/yr
Unit 2	8.99E-06/yr	5.98E-07/yr

from FNP NFPA 805 LAR Attachment W

# Results – FNP Plant Risk (/yr)

	Unit 1		Unit 2	
Hazard	CDF	LERF	CDF	LERF
Internal Events	1.06E-05	1.24E-07	7.98E-06	1.20E-07
Seismic	1.08E-05	1.26E-07	1.08E-05	1.62E-07
Other External Risk (IPEEE)	Insignificant	Insignificant	Insignificant	Insignificant
Fire	5.24E-05	1.26E-06	5.85E-05	2.39E-06
<b>TOTAL</b>	<b>7.38E-05</b>	<b>1.51E-06</b>	<b>7.73E-05</b>	<b>2.67E-06</b>

from FNP NFPA 805 LAR Attachment W