



# FNP NFPA 805 LAR Submittal

## Overview

March 19-21, 2013

**Circuit Analysis**

# Summary

- Circuit Analysis Process and Controls
- Analyst Qualifications
- Governing Analysis Criteria
- NSCA vs. PRA
- Analysis Methodology
- Circuit Analysis Database
- Associated Circuits

# Process and Controls

- Circuit Analysis Process
  - Performed IAW approved procedure
  - Strict and formal analysis conventions
  - Emphasis on consistency and standardization
  - Integrated PRA and NSCA requirements
- Controls
  - Rigidly defined Function States
  - Independent verification for each analysis
  - Detailed documentation in database (FDM/ARCPPlus)

# Analyst Qualifications

- All analysts formally qualified to SNC & Contractor QUAL CARD for independent work
- Internalized industry lessons learned on training, qualifications, and oversight
- Procedure and database established to force consistency
- Maintained awareness of dual use – PRA and NSCA

# Governing Criteria

- NEI 00-01, Rev.1
  - Initial Work to Rev.1
  - Gap analysis performed to Rev. 2 (per Generic RAI 10 and RG 1.205)
- NEI 00-01, Rev. 2
  - Later work
  - Integrated emerging PIRT issues
  - No credit taken for off-scheme exclusions
- NUREG/CR-6850
  - Included Open circuits

*Note: Integrated requirements for conservative, but universal criteria between PRA and NSCA*

# NSCA vs. PRA

- Implementing Concepts
  - 95% of circuit analysis criteria for PRA and NSCA are the same
    - Establish single dataset for criteria to assure dual use and better interface between NSCA and PRA
    - Provide procedure and database flexibility to accommodate the 5% difference
  - Long-term configuration control extremely difficult if redundant data sets are maintained
  - Differences primarily handled through:
    - Use of Function States
    - Interlock identification and documentation

# Analysis Methodology

- All circuit analysis drive by FUNCTION STATES
- Function States
  - Component + Initial State + Desired State
  - Permits maximum flexibility to accommodate PRA and NSCA differences (primarily auto signals)
  - Minimize false failures up front
  - Efficient and less error prone
  - Consistent with NUREG/CR-6850 methods for Tasks 3 & 9

# Analysis Methodology, cont...

- Work package development to facilitate process
- Single, controlled database (FDM)
- Process and techniques based on NRC/EPRI training modules
- Major Steps

## Prerequisites satisfied

- Function state established
- Plant specific rules and conventions
- General classification
- Resolve questions



# Analysis Methodology, cont...

- Major Steps

- Work Package Development

- Drawings
    - Supplemental information

- Cable Selection

- All scheme cables dispositioned
    - Fault codes applied to all cables
    - Basis documented for excluded cables
    - Selection of required cables with “hot probe” method
    - Cables generally excluded based only on design features at this stage (NUREG/CR-6850 concept)

# Analysis Methodology, cont...

- Major Steps

- Power Supply Identification

- All Power Supplies identified
    - Required and not-required determined based on Function State requirements
    - Sensitive to alternate PS lineups and how they are credited

- Dependencies & Interlocks

- All circuit interlocks formally dispositioned
    - Equipment dependencies established or off-scheme cables directly incorporated
    - Differentiate auto functions so NSCA and PRA can apply as credited by Basic Event

# Analysis Methodology, cont...

- Major Steps
  - Documentation
    - Controlled database, with individual analysis originate and check sign-offs
    - Reference drawing
    - Final calculation for circuit analysis and PRA Notebook

# Circuit Analysis Database

Circuit Analysis

Circuit Analysis - View

Select System:  
N2C23SV0020ET:CLOSED:OPEN

Select Function Code:  
N2C23SV0020ET:CLOSED:OPEN

Function Code  
N2C23SV0020ET:CLOSED:OPEN

Equipment ID  
N2C23SV0020ET

Primary Component  
MAIN TURBINE EMERGENCY TRIP SOLENOID VALVE 20ET

System  
C23

Component Type  
SV

Normal Position  
CLOSED

Failed Electrical Position  
OPEN

Failed Air Position  
N/A

Analyzed By  
ZOHAB SAJJAD

Reviewed By  
ALLEN G THOMAS

Revision  
7/20/2010

7/26/2010

References:

Drawn By  
D2002171

Description  
MAIN TURBINE EH FLUID SYSTEM

R  
20

Doc Type  
P & ID

Drawn By  
D202722

Description  
TURB. AUX. AUTO STOP TRIPS & EMERG TRIP

R  
17

Doc Type  
Elementary Dia

Drawn By  
D202722

Description  
TURB. AUX. AUTO STOP TRIPS & EMERG TRIP

R  
1

Doc Type  
Elementary Dia

Drawn By  
D204742

Description  
125V DC DIST. PNLS

R  
18

Doc Type  
Wiring Diagram

Power Supplies:

Power Supply ID	Description	Ckt Bkr #	Required
Q1R21L0001A	120V VITAL AC INSTRUMENTATION PANEL 1A	Q1R21L0001ABK	<input checked="" type="checkbox"/>
Q1R21L0001B	120V VITAL AC INSTRUMENTATION PANEL 1B	Q1R21L0001BBK	<input checked="" type="checkbox"/>
Q1R21L0001C	120V VITAL AC INSTRUMENTATION PANEL 1C	Q1R21L0001CBK	<input checked="" type="checkbox"/>
Q2R41L0001D	125V DC DISTRIBUTION PANEL 2D	Q1R41L0001DBK	<input checked="" type="checkbox"/>

Interlocks:

Contacts	Component	Description	Interlock R
1D 63-2/AST	N2N33PS583D	MAIN TURBINE AUTO STOP OIL TRIP SWITCH	<input checked="" type="checkbox"/>
1E 63-2/AST	N2N33PS583E	MAIN TURBINE AUTO STOP OIL TRIP SWITCH	<input checked="" type="checkbox"/>
1F 63-2/AST	N2N33PS583F	MAIN TURBINE AUTO STOP OIL TRIP SWITCH	<input checked="" type="checkbox"/>

Cables:

Cable ID	Function	Comments	Fault Consequence	Required
2UYT0001E	C		LOC-FTO	<input checked="" type="checkbox"/>
2UYTBA02E	C		LOC-FTO	<input checked="" type="checkbox"/>
2UYTBB01B	C		NR-FAULT CAN NOT CAUSE VALVE TO FAIL TO OPEN	<input checked="" type="checkbox"/>
2UYTBB02B	C		NR-FAULT CAN NOT CAUSE VALVE TO FAIL TO OPEN	<input checked="" type="checkbox"/>
2VBL1D19A	P		NR-FAULT CAN NOT CAUSE VALVE TO FAIL TO OPEN	<input checked="" type="checkbox"/>

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Modification View

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# Associated Circuits

- Electrical Coordination
  - Consolidated calculation
  - Addresses NSCA & PRA
- Common Enclosure
  - Addresses secondary fire concerns
  - Addresses loss of DC control power to Switchgear
- CPT Open Circuits
  - Followed PIRT recommendations
- MHIF Analysis
  - Followed NEI 00-01, Appendix B method

# Questions ?