

Fire Protection Initiatives

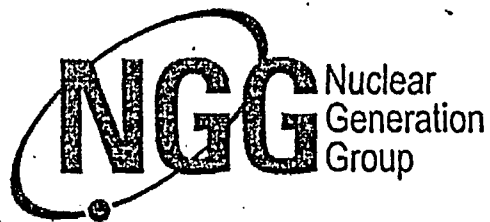
NRC Meeting January 7, 2004

Brunswick (BNP)

Crystal River 3 (CR3)

Harris (HNP)

Robinson (RNP)



Progress Energy

No commitments are made or implied by this presentation.

Information is presented to stimulate dialogue.

Fire Protection Initiatives

Progress Energy Participants

- Fire Protection
 - Paul Gaffney (Corporate Chief Elect/I&C Engineer)
 - Jeff Ertman (Corporate Fire Protection Engineer)
 - Frank Dola CR3 (Operations)
 - Frank Modlin RNP (Safe Shutdown Engineer)
 - Tony Maness HNP (Fire Protection Project Manager)
 - Roger Sims BNP (Fire Protection Program Manager)
 - Alan Morisi HNP (Meggitt Cable Project Lead)
- Regulatory Affairs
 - John Caves HNP (Regulatory Affairs)
 - David Lee (Corporate Regulatory Affairs)
- Additional personnel by phone if line is available

Fire Protection Initiatives

Purpose of Meeting

- Goal of this meeting is to communicate our current fleet plans to the NRC

Fire Protection Goals

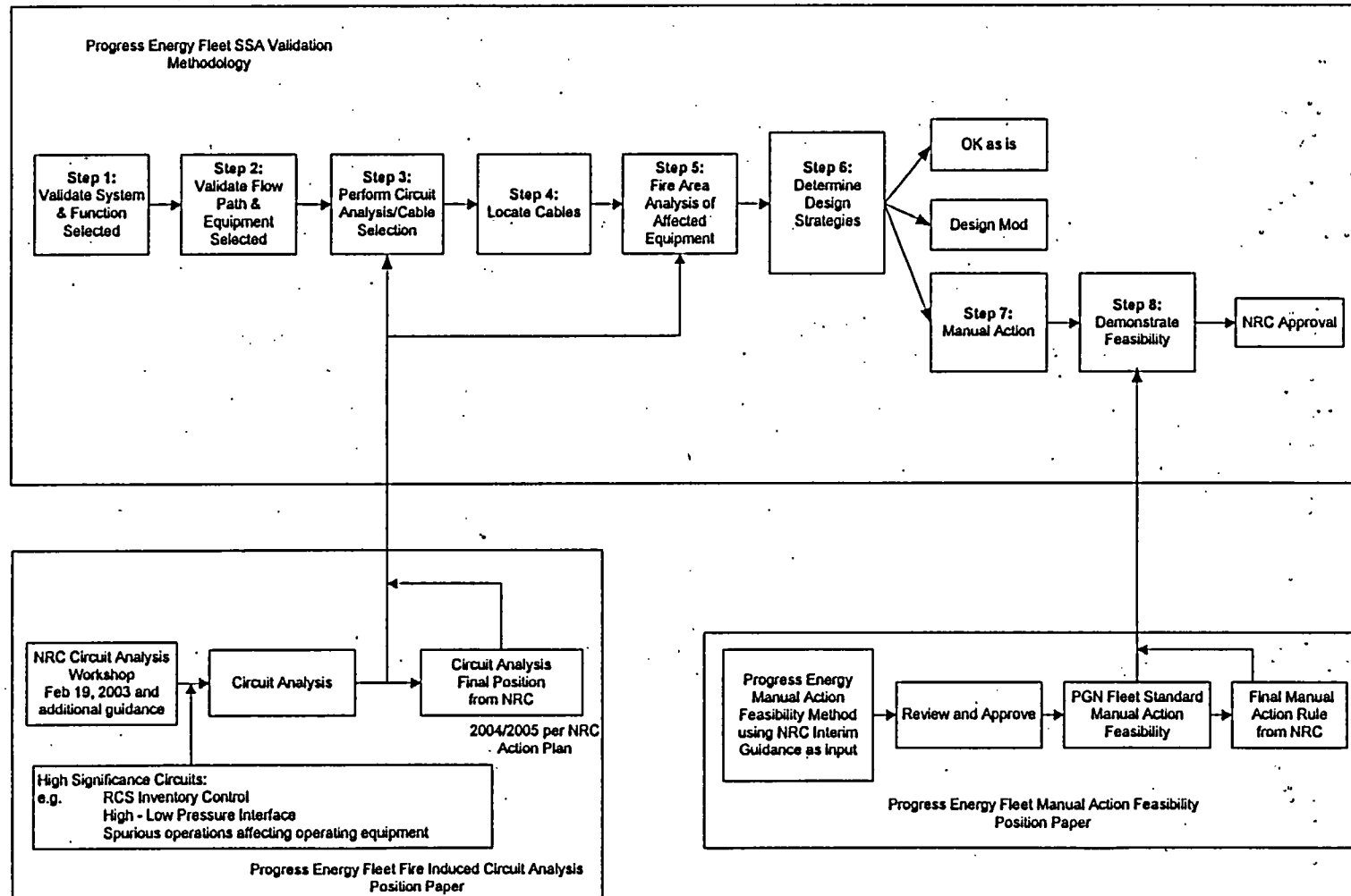
- Safety
 - ▶ Compliance
 - ◆ Current Design and Licensing Basis
 - ◆ Appendix R/NUREG 800 (HNP)
 - ▶ Apply additional Safe Shutdown Analysis criteria to ensure an adequate level of safety is maintained
- Consistent safe Shutdown Methodologies and Processes across Progress Energy fleet
- Prioritize resources from a Safety Significance perspective

Fire Protection Initiatives

Agenda

- Provide highlights of Progress Energy's Safe Shutdown Analysis approaches for the following:
 - ▶ Fire Induced Circuit Failures and resulting Multiple Spurious Operations
 - ▶ Manual Action Feasibility Analysis
- Provide information on Progress Energy's potential use of Fire Rated Cable as a hardware option to address Fire Safe Shutdown separation

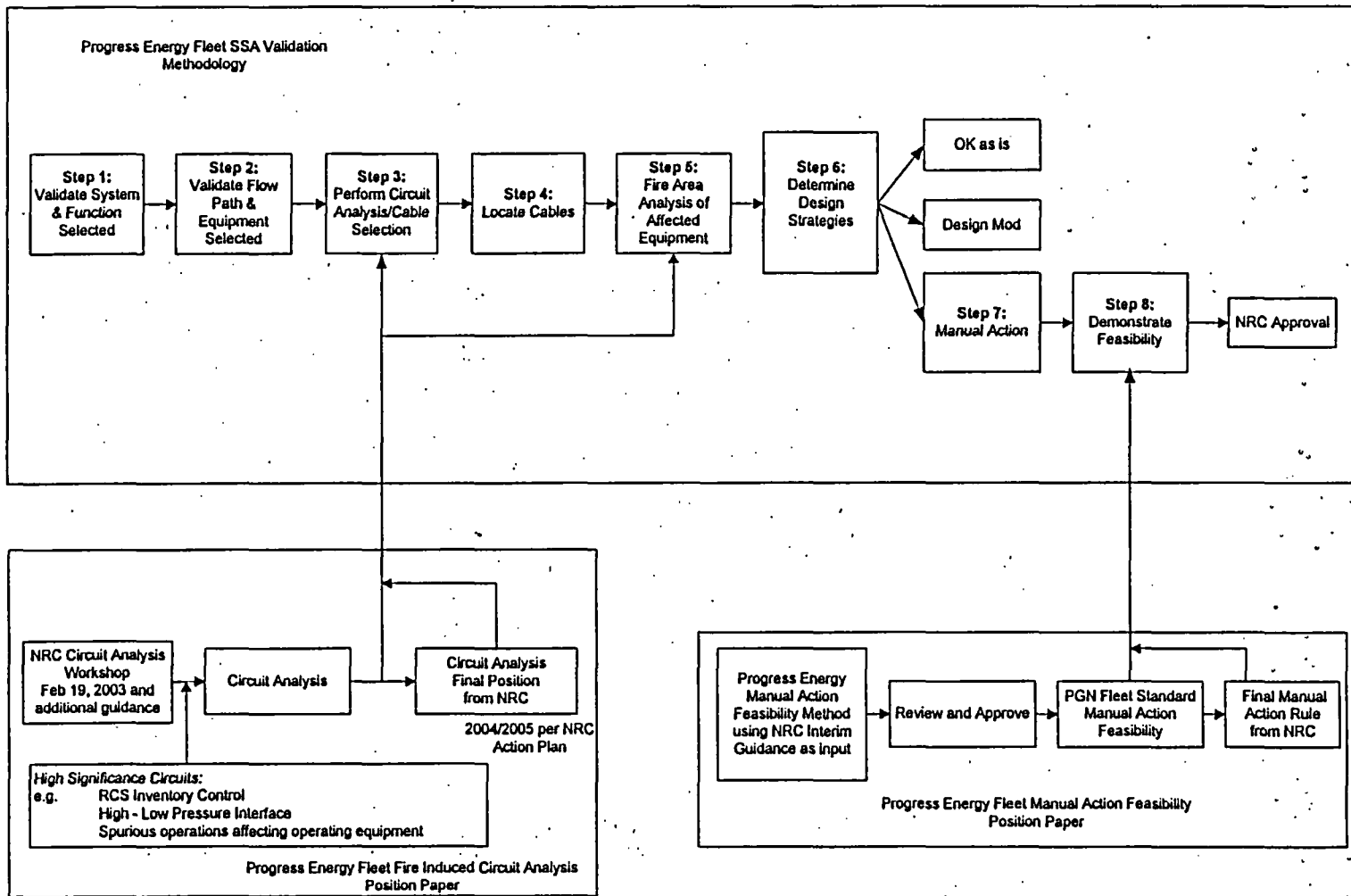
Safe Shutdown Analysis Methodology Overview



Safe Shutdown Analysis Progress Energy Status

- Initiated Safe Shutdown Analysis
 - ▶ Started at HNP in June 2003
 - ▶ Started at RNP in November 2003
 - ▶ Scheduled to start at BNP and CR3 in 2004
- Initiated baseline Manual Action Feasibility
 - ▶ CR3 and RNP started in early 2003
 - ▶ HNP as part of Safe Shutdown Analysis validation started mid 2003
 - ▶ BNP started late 2003

Safe Shutdown Analysis Methodology Overview



Fire Induced Cable Failure Position Development

- Incorporating industry circuit failure results into our Safe Shutdown design process to the extent information is available
 - ▶ Used NEI 00-01 and EPRI cable test data
- Incorporates informal NRC Guidance provided over the last year:
 - ▶ February 2003 Fire Induced Cable Failure workshop
 - ▶ Revised IP71111.05
 - ▶ Draft RIS in August 2003

Fire Induced Cable Failure Position Development

- Bins were based on industry testing, Safety Significance and NRC Guidance
- Positions developed in Fire Induced Cable Failure paper
- Safe Shutdown Design Rules created to apply to Safe Shutdown Analysis

Fire Induced Cable Failure Position Development


- Highest Significance items (Bin 1) addressed in the Safe Shutdown Analysis
- Moderate Significance Items (Bin 2) addressed on a case-by-case basis
- Low Significance Items (Bin 3) addressed only for the current design methodology

Fire Induced Cable Failure Position Development

- “Current Design Methodology” generally consists of sequential spurious operations
 - ▶ Hi/Low pressure interface is a typical exception
- “Revised Design Methodology” will address multiple spurious operations:
 - ▶ For those combinations (up to 2) that can cause an Unrecoverable Condition or Unrecoverable Equipment Damage
- Revised Design Methodology addresses up to 3-4 fire induced circuit failures in a circuit

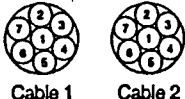
Fire Induced Cable Failure Design Rules

- Fire Induced Cable Failure Paper contains the Safe Shutdown Design rules developed to implement 'Binning' philosophy and NCGG positions into the Safe Shutdown Analysis
- Example 1:

Item	Cable Failure Mode & Related Cable Attribute	CDM (Y/N)	Bin*	Comments And General Discussion EPRI/Sandia Testing	Impacted Post-Fire Safe Shutdown Analysis Task
7A	<p>Intra-cable shorts. Single hot short within multi-conductor thermoset or thermoplastic control cable.</p>  <p>Cable 1</p> <p>Single hot short within 1 cable.</p>	Y	1	This is the typical MOV control cable example.	<p>Steps 3 & 4 Cable Selection/Circuit Analysis Current design methodology is consistent. No change.</p> <p>Steps 5 & 6 Fire Area Analysis Any and all one at a time philosophy used in the Area Analysis bounds this item. No change.</p>

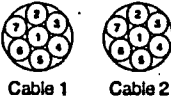
Fire Induced Cable Failure Design Rules

● Example 2:

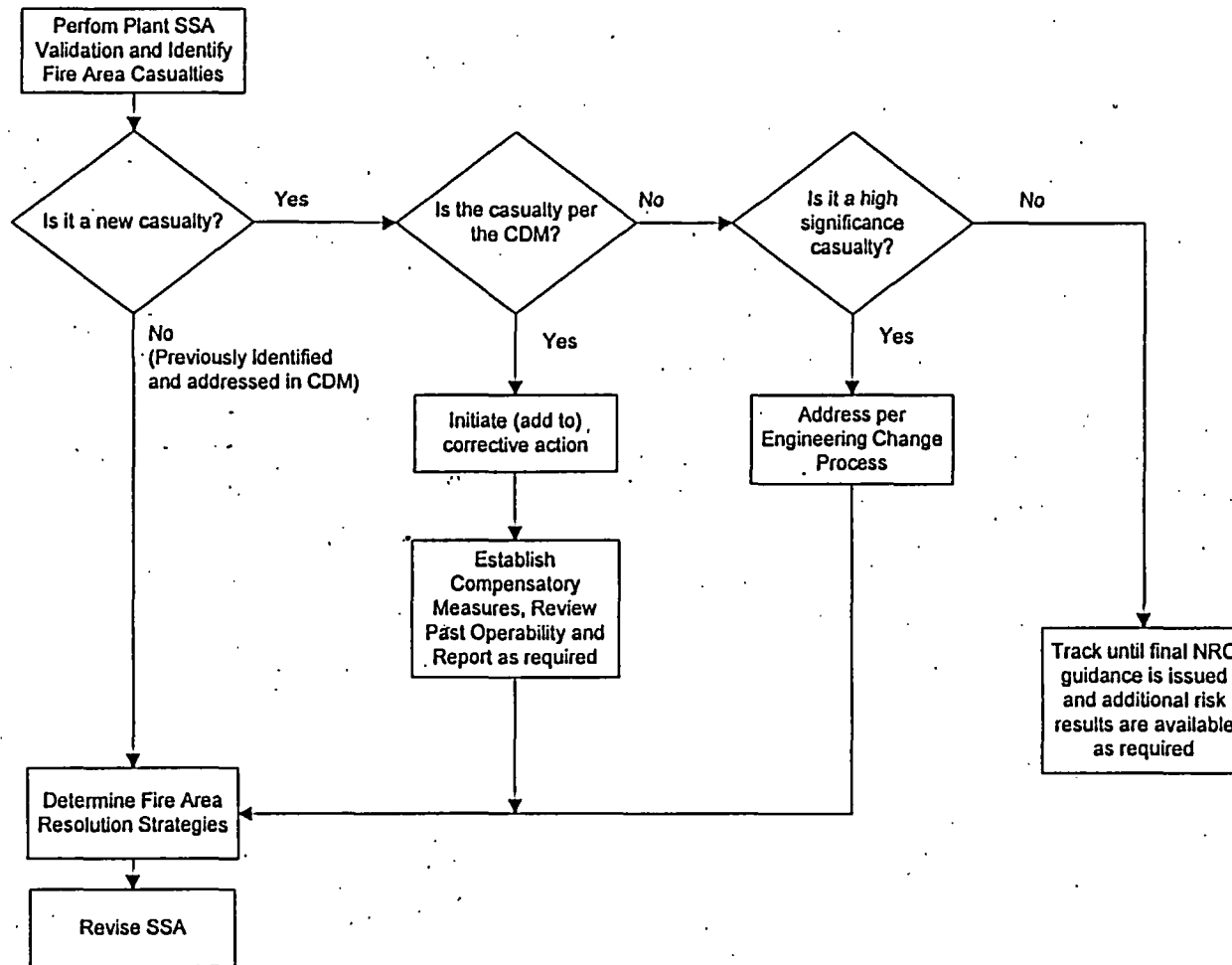
Item	Cable Failure Mode & Related Cable Attribute	CDM (Y/N)	Bin ⁺	Comments And General Discussion EPRI / Sandia Testing	Impacted Post-Fire Safe Shutdown Analysis Task
7B	<p>Multiple concurrent intra-cable shorts. Multiple occurrences of single shorts within individually distinct thermoset or thermoplastic control cable.</p>  <p>Cable 1 Cable 2</p> <p>Single hot short within each cable up to a maximum of 2 cables involved.</p>	N	1	<p>Any and all potential spurious operations that may occur concurrently from a single fire.</p> <p>For cases involving the potential failure of more than one multi conductor cable, a maximum of two concurrent spurious operations will be assumed.</p> <p>See also Item 8C.</p>	<p>Steps 3 & 4 Cable Selection/Circuit Analysis Each individual spurious operation would have been previously captured (Item 7A). No change.</p> <p>Steps 5 & 6 Fire Area Analysis Combine the effects of the spurious operations. The new safety function screen is also applied if needed. Except for hi/lo pressure interface this is a change to the current design methodology.</p>

Fire Induced Cable Failure Design Rules

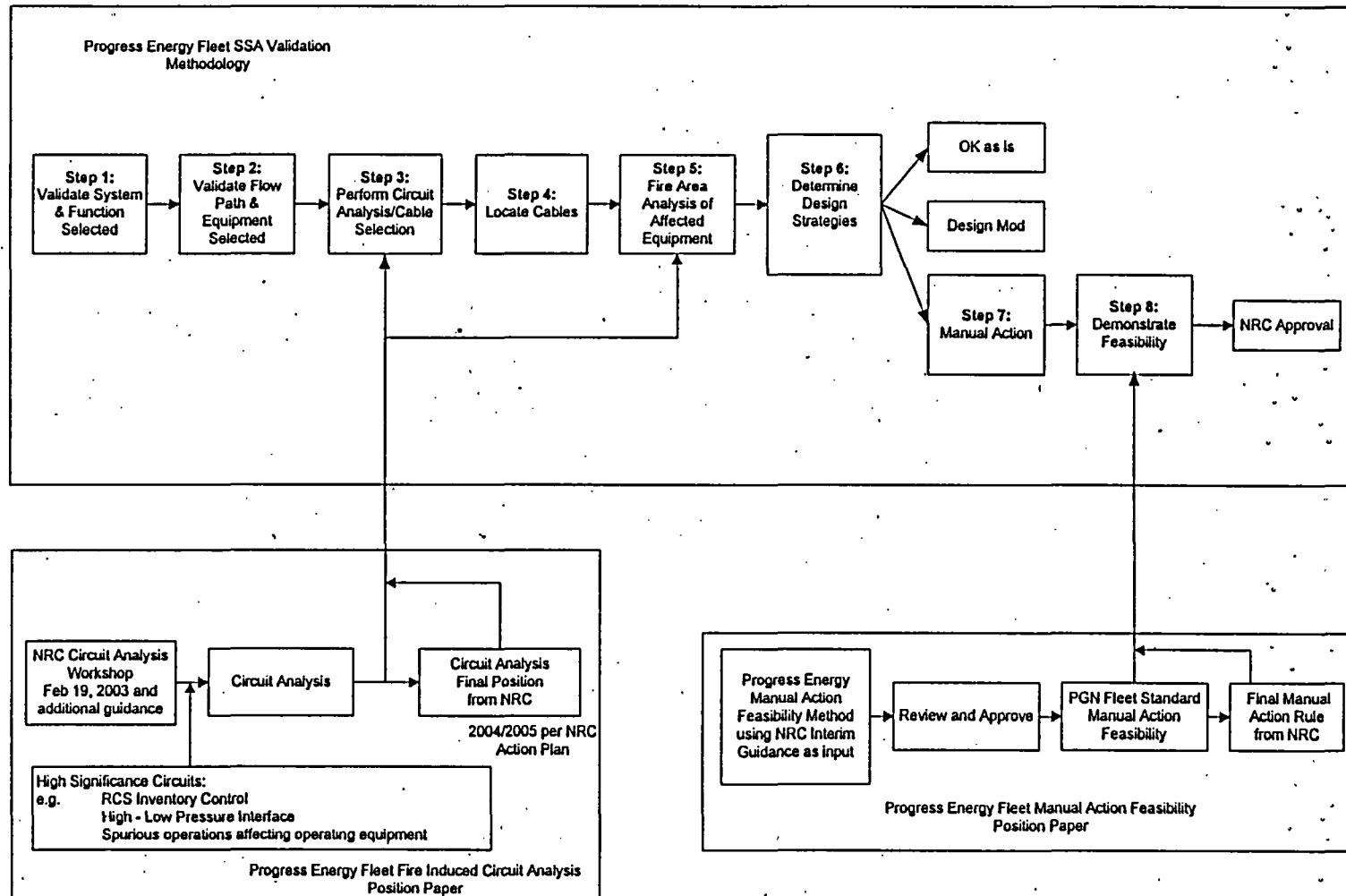
● Example 3:

Item	Cable Failure Mode & Related Cable Attribute	CDM (Y/N)	Bin*	Comments And General Discussion EPRI / Sandia Testing	Impacted Post-Fire Safe Shutdown Analysis Task
8B	<p>Multiple concurrent intra-cable shorts. Multiple occurrences of multiple shorts within individually distinct thermoset or thermoplastic control cable.</p>  <p>Cable 1 Cable 2</p> <p><i>Up to 2 cables will be postulated.</i></p>	N	1	<p>For cases involving the potential failure of more than one multiconductor cable, a maximum of two concurrent spurious actuations should be assumed. For cases where more than two concurrent spurious actuations can occur as the result of intra-cable shorting within a single multiconductor cable they should be considered. The consideration of concurrent spurious operations in more than two cables will be deferred pending additional research.</p>	<p>Steps 3 & 4 Cable Selection/Circuit Analysis See Item 8A above. This is a change to the current design methodology.</p> <p>Steps 5 & 6 Fire Area Analysis See Item 8A above. This is a change to the current design methodology.</p>

Safe Shutdown Analysis Resolution Process



Safe Shutdown Analysis Methodology Overview



Manual Action Feasibility Position Development

- Reviewed available industry information
- Developed fleet methodology
- Incorporate latest NRC draft criteria into our evaluation process moving forward

Manual Action Feasibility Historical Perspective

- Manual Operator Actions were considered acceptable because required functions could be accomplished without relying on potentially damaged cables in the fire area
- Safe Shutdown path was considered 'free from fire damage' per III.G.1
- Understand that NRC remedy to address manual action issue is through III.G.2

Manual Action Position Suppression and Detection

- From the history above, suppression and detection was not considered a requirement
 - Fire Areas that credit manual operator actions typically have fire detection installed to ensure quick response
- Progress Energy will track status of suppression and detection pending rulemaking, ongoing regulatory activities

Manual Action Feasibility Additional Positions

- Progress Energy will use NRC interim feasibility criteria as provided in recent Federal Register Notice to assess manual actions
- Remaining manual operator actions for III.G.2 not specifically approved by the staff will be submitted for approval per latest regulation

Manual Action Feasibility Criteria

- Recovery Time
- Plant Staff and Training
- Local Accessibility
- Environmental Considerations
- Equipment Preconditions
- Available Indications
- Special Equipment
- Communications
- Procedural Guidance

Manual Action Feasibility Complexity and Number Criteria

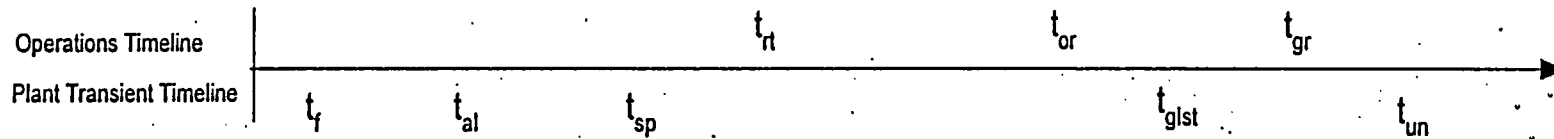
- Manual Operator Actions are prioritized
- Fire Areas are defined as High, Medium, or Low complexity areas
- Complexity drives the type of operator procedure to handle the manual actions:
 - ▶ High – Directive by Fire Area
 - ◆ Specific entry conditions for the procedure to avoid premature entry
 - ▶ Medium – Symptom based by Fire Area
 - ▶ Low – Generic Fire Safe Shutdown instruction

Manual Action Feasibility Timeline Goal

- Demonstrate that the time to complete manual operator actions is bounded by the time to reach an unrecoverable condition

Manual Action Feasibility Timeline Graphic

Figure 4.1 Event Timeline



- t_f - fire begins
- t_{al} - fire alarm
- t_{sp} - spurious actuation occurs
- t_{rt} - operator trips reactor
- t_{or} - operator response (s)
- t_{glist} - goal parameter (s) out of acceptable range (lost)
- t_{gr} - goal recovery
- t_{un} - unrecoverable condition is reached

Safe Shutdown Analysis Summary

- Looking forward, Progress Energy Safe Shutdown Methodology includes:
 - ▶ Recent circuit failure information used to establish Fire Safe Shutdown design rules
 - ▶ NRC Draft interim feasibility criteria from 11/26/03 Federal Register Notice used as an input
 - ▶ Manual Action Timelines is based on comparison of operator timeline vs. plant transient response timeline
- Revised Design Method will be implemented under the Fire Protection License Condition Review Process
- Manual operator actions for III.G.2 will be submitted after validation efforts are complete as required by the NRC requirements

Fire Rated Cable Background

- Control cables not protected from spurious actuation at HNP
- Fire Rated Cable will be an option for the Progress Energy Fleet to address SSD fire area casualties
- Other typical hardware options include raceway wrap and reroute of conventional cable

Fire Rated Cable Industry Information

- Benchmarked the industry for use of 3 hour fire rated cable
- Meggitt Safety System fire rated cables installed at other nuclear plants
- Cable Manufacturer
 - ▶ Meggitt Safety Systems Inc.
 - ▶ Semi Valley, California

Fire Rated Cable Cable Qualification

- Qualification addresses:
 - ▶ Approved Appendix B Supplier
 - ▶ EQ requirements
 - ▶ Seismic requirements
 - ▶ 3 hour fire rating requirements

Fire Rated Cable

Cable Seismic Testing

- Seismic Shake Table Test
 - ▶ Seismic Qualification Reporting and Testing Standardization Program (SQURTS)
 - ▶ Bounding conductor sizes
 - ▶ Terminations
 - ▶ Progress Energy Bounding Seismic response spectra

Fire Rated Cable

Cable Fire Testing

- Cable Supports
 - ▶ Established detailed cable route
 - ▶ Detailed support type identification
 - ▶ Cable routed to minimize seismic II/I concerns
 - ▶ Cables routed to decrease vulnerability to overhead hazards
- Electrical Requirements
 - ▶ Identified conductors/sizes

Fire Rated Cable

Cable Fire Testing

- Testing contracted with Framatome and Omega Point Labs
- UL Standard 2196, Standard for Tests of Fire Resistive Cables, First Ed. 5/11/2001
- Testing multiple support configurations
- Testing multiple conductor and cable sizes
 - ▶ Four cables with cable splices
- Fire Test plan comments
- Recognized NRC commented in 2000 on UL Standard 2196

Fire Rated Cable Summary

- Fire Test per UL 2196
- Plan to bound configurations used in plant
- Evaluating the need to submit for approval

Fire Protection Goals

- Safety
 - Compliance
 - ◆ Current Design and Licensing Basis
 - ◆ Appendix R/NUREG 800 (HNP)
 - Apply additional Safe Shutdown Analysis criteria to ensure an adequate level of safety is maintained
- Consistent safe Shutdown Methodologies and Processes across Progress Energy fleet
- Prioritize resources from a Safety Significance perspective