

# NRC Meeting October 16, 2008

## Multiple Spurious Operations

### NEI Circuit Failures ITF



## Agenda

- NRC Agenda Items
  - Circuit Failure Nomenclature
  - Treatment of full flow-diversion valves
  - Treatment of Process Monitoring and IN 84-09
  - Definition of Components requiring III.G.2 Type Protection
  - Application of fire modeling
  - Application of Regulatory Guide 1.174
  - Treatment of Primary/Secondary Control Circuits
  - Consideration of NEI Proposed Hot Short combinations
  - Consideration of spurious actuations causing overload of emergency diesel generators
  - Application of NEI 00-01, Multiple Spurious Operations Lists
  - Other Topics

▪ Status of NEI 00-01 Revision 2 (b)



## Circuit Failure Nomenclature

- NRC suggested "Green Box"/"Orange Box" components.
- Industry suggested "Required" and "Associated Circuit" components
- Revised position would be to use "necessary to achieve and maintain hot shutdown, restated as **Required for Safe Shutdown**" and "Important for Safe Shutdown".



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## Circuit Failure Nomenclature

- III.G.1
  - "Fire protection features shall be provided for structures, systems, and components important to safe shutdown. ..."
- II.G.1.a
  - "One train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage."
- III.G.2
  - Separation requirements for systems necessary to achieve and maintain hot shutdown conditions



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## Circuit Failure Nomenclature

- Using the words from Appendix R Section III.G provides traceability to the regulations and maintains the definition of “Associated Circuits” as explained in NRC GL 81-12 Clarification, dated 3/22/82.
- By Regulation, III.G.2 protection is required for III.G.1.a required equipment
- Regulatory guidance states additional tools may be available to address equipment “important to safe shutdown” and associated circuits



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## Treatment of Full Flow Valves

- A single flow diversion valve, impacting a system required for safe shutdown, will be considered to be a “Required for Safe Shutdown” component unless an engineering evaluation demonstrates that the effects of the spurious opening are either
  - non-impacting or
  - can be mitigated within an acceptable time, with adequate margin, using an operator manual action.
- Once impacts are demonstrated to be tolerable with respect to the safe shutdown system’s performance, they are classified as either
  - “Important to Safe Shutdown”, if an operator manual action is required to close the valve, or
  - “Non-Impacting”, if the flow loss can be tolerated for the duration of the fire event.



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## Treatment of Process Monitoring & IN 84-09

- Process Monitoring Instrumentation
  - As provided in Section IX of the enclosure to NRC IN 84-09 will be considered as “Required for Safe Shutdown”,
  - Unless described otherwise in the Facility’s Current Licensing Basis. In the latter case, the Facility’s Current Licensing Basis will govern.



## Components Requiring III.G.2 Type Protection

- Components Required to perform a safe shutdown function in the fire area under evaluation.
- Flow diversion components, off of the flow path, for systems required to perform a safe shutdown function in the fire area under evaluation for which an operator manual action or a non-impacting classification cannot be justified.



## Components Requiring III.G.2 Type Protection

- Cooling Water and Lube Oil components for Required SSD Path Components (10 CFR 50 Appendix R, III.L.2)
- Electric Power and Control, if necessary, for a Required Mechanical Component
- Associated Circuits - Common Power Supply Breakers
  - Are treated as Required, if they feed associated circuits of concern
  - Breakers for associated circuits of concern are to be coordinated with the feeder breaker to their respective bus



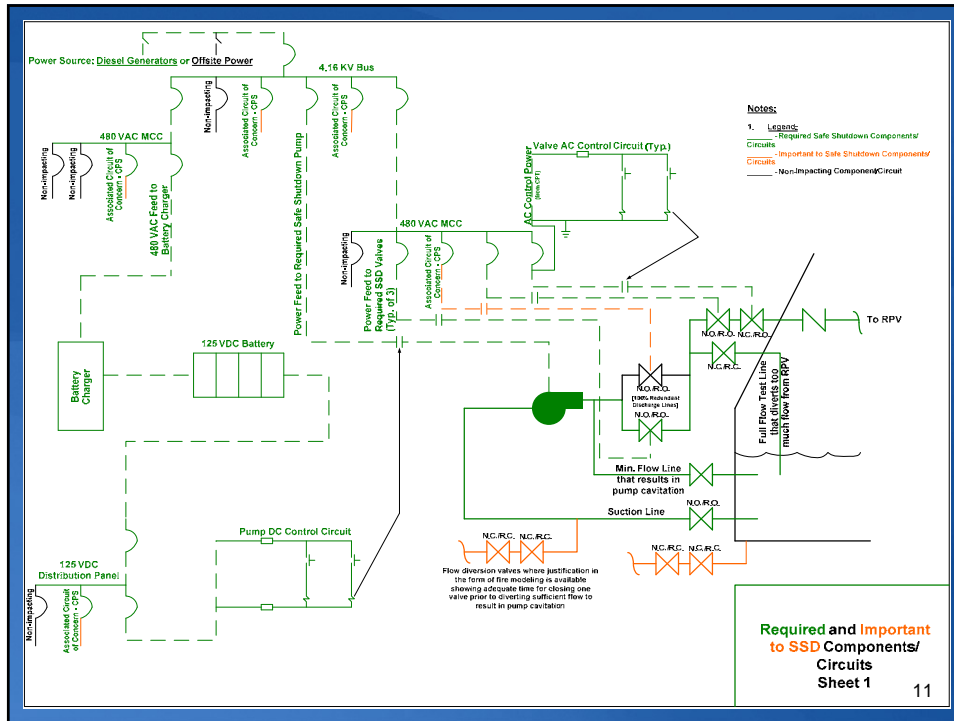
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## Components Requiring III.G.2 Type Protection

- Circuits Required for the operation of Required Components are Required Circuits
- Other Options still available:
  - Re-design/Re-location of components
  - Re-design/Re-route of circuits
  - Exemptions, Deviations, LARs



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## Application of Fire Modeling

- Fire modeling can be used, along with the appropriate consideration of DID and Safety Margins for non III.G.1.a MSOs:
  - To demonstrate all required components in an MSO are not impacted by the same fire.
  - To justify timing for Operator Manual Actions

## Application of Reg. Guide 1.174

- RG 1.174 describes an acceptable method to assess License Basis changes when the Licensee chooses to support the changes with risk information.
  - The NRC staff would review these LB changes by considering engineering issues and applying risk insights.
  - Licensees should identify how their chosen approaches and methods (whether quantitative or qualitative, deterministic or probabilistic), data, and criteria for considering risk are appropriate for the decision to be made.



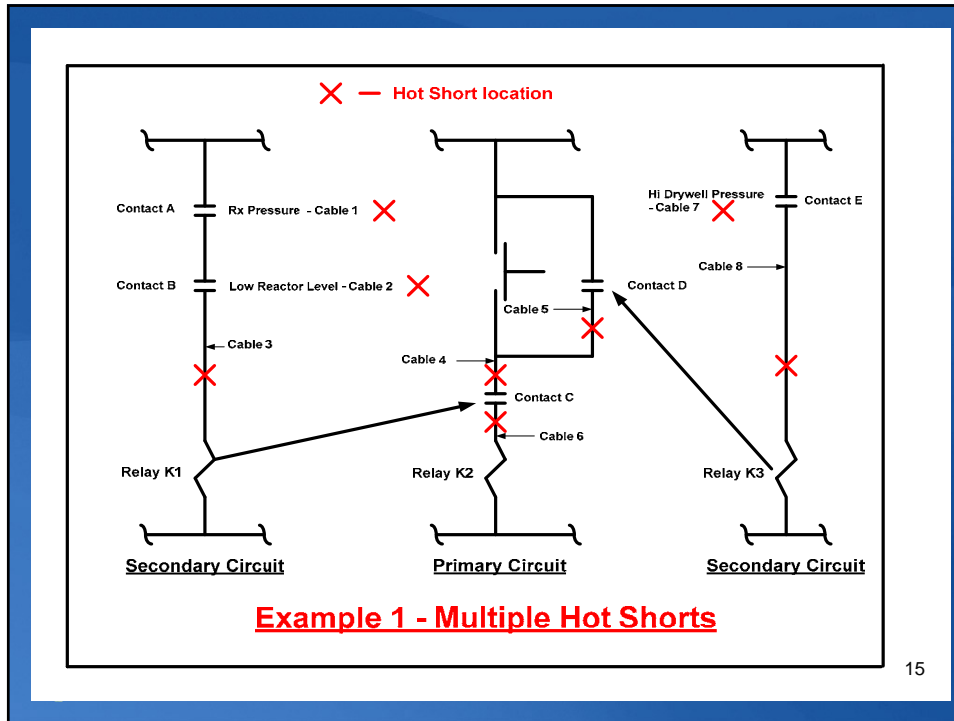
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## Treatment of Primary/Secondary Circuit Protection

- Primary / Secondary Control Circuits
  - Consider an individual, single hot short on each conductor in each affected cable
  - Consider the combined effects of hot shorts if conductors are located in the same multi-conductor cable

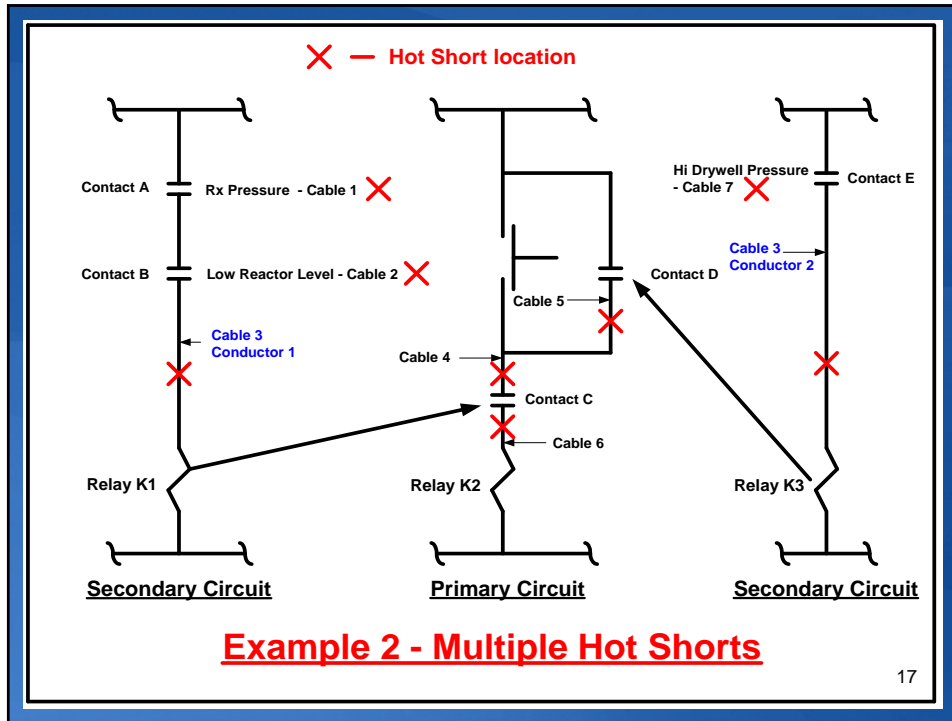


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1. **A hot short on Cable 6. [Consider this cable only]**
  2. A hot short on Cable 4 in combination with a hot short on Cable 3.
  3. A hot short on Cable 4 in combination with a hot short on Cables 1 & 2.
  4. A hot short on Cable 5 in combination with a hot short on Cable 3.
  5. A hot short on Cable 5 in combination with a hot short on Cables 1 & 2.
  6. A hot short on Cable 7 in combination with a hot short on Cable 3.
  7. A hot short on Cable 7 in combination with a hot short on Cables 1 & 2.
  8. A hot short on Cable 8 in combination with a hot short on Cable 3.
  9. A hot short on Cable 8 in combination with a hot short on Cables 1 & 2.
- Example 1 - Spurious Operation - Hot Short Combinations**
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1. **A hot short on Cable 6. [Consider this cable.]**
2. A hot short on Cable 4 in combination with a hot short on Cable 3 – Conductor 1.
3. A hot short on Cable 4 in combination with a hot short on Cables 1 & 2.
4. A hot short on Cable 5 in combination with a hot short on Cable 3 – Conductor 1.
5. A hot short on Cable 5 in combination with a hot short on Cables 1 & 2.
6. A hot short on Cable 7 in combination with a hot short on Cable 3 – Conductor 1.
7. A hot short on Cable 7 in combination with a hot short on Cables 1 & 2.
8. **A hot short on Cable 3 – Conductor 1 in combination with a hot short on Cable 3 – Conductor 2. [Consider this cable.]**
9. A hot short on Cable 3 – Conductor 2 in combination with a hot short on Cables 1 & 2.

**Example 2 - Spurious Operation - Hot Short Combinations**

## Consideration of NEI Proposed Hot Short Combinations

- Proximity to the fire source is the key parameter in determining the occurrence of spurious operation.
- Time is required to reach failure, even at the threshold temperature.
- The duration of spurious operations is limited to, at most, a few minutes.



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## Consideration of NEI Proposed Hot Short Combinations

- Although spurious operations did occur in the testing, concurrent spurious operations in separate cables were very unlikely (one occurrence out of twenty nine)
  - In the NEI-EPRI SCDU Testing
    - Test #9 had two separate cables spuriously operate simultaneously. The overlap was approximately 6 seconds.
    - Test #4 and #6 used single insulated conductors rather than single conductor cables.
    - None of the remaining 13 NEI-EPRI SCDU tests showed simultaneous spurious operations in separate cables.
  - In the 15 CAROLFIRE SCDU tests, no simultaneous spurious operations in separate cables were found



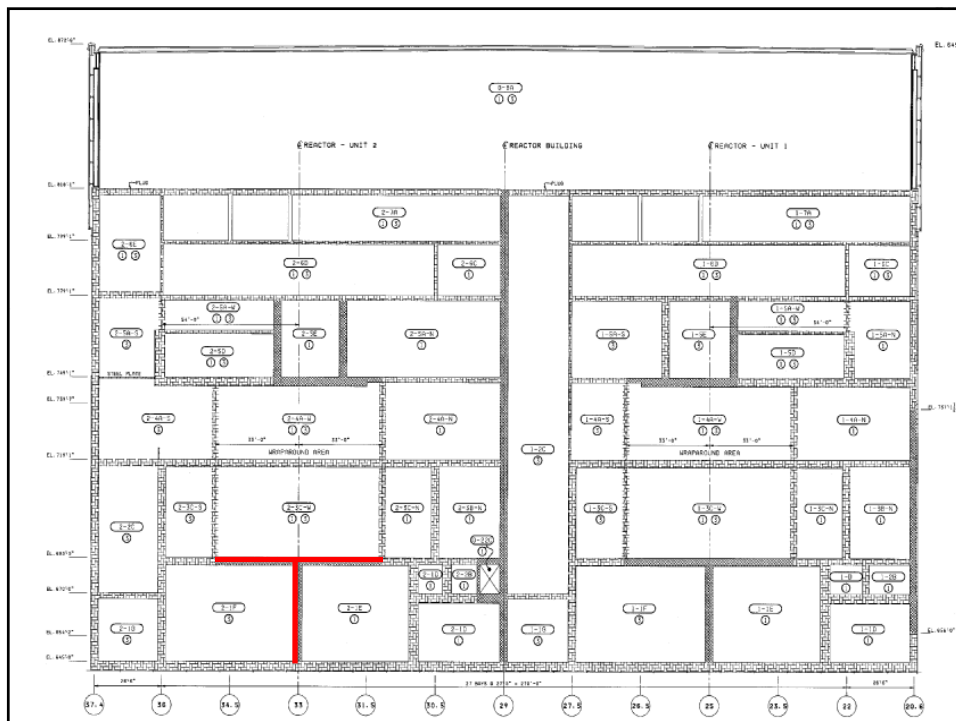
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## Consideration of NEI Proposed Hot Short Combinations

- Deterministic Analysis Assumptions
  - All circuits within fire area damaged
    - Evaluate each conductor in each affected cable for the effects of a hot short, short-to-ground or open circuit
  - Barriers separating fire areas capable of withstanding the hazard within the fire area



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## Consideration of NEI Proposed Hot Short Combinations

- NEI Proposal for addressing multiple hot shorts and multiple spurious operations:
  - Individual components, on the MSO List, are evaluated for spurious operations using the criteria outlined herein and in Appendix B.
    - This addresses one aspect of multiple hot shorts.
  - The MSO List from Appendix G, as supplemented by the Plant Unique Expert Panel Review, is evaluated for spurious operations
    - This addresses another aspect of multiple hot shorts and addresses multiple spurious operations.



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## Consideration of Spurious Operations overloading an Emergency Diesel Generator

- EDG loading is maximized during Chapter 15 Design Basis Accident conditions, along with a LOOP.
- Design Basis Accident conditions are not postulated to occur along with a fire.
  - As a result, EDG loading is not at its peak and sufficient margin to handle spurious operations should be available.
  - Operator actions to shed non-required loads may be used and would be available based on protection of the load breaker using III.G 2 features.



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## Application of NEI 00-01, MSO List

- The use of the MSO List in NEI 00-01 Appendix G is addressed in Chapter 4.
  - Generic List, supplemented by Plant Unique Expert Panel Review
  - MSOs are entered into the Plant's Safe Shutdown Analysis
  - Impacts are identified and, appropriately, dispositioned



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## Other Topics

- Spurious Operations are currently evaluated on a "One at a Time" Basis
- Cable Fire Test results suggest "multiple simultaneous failures" need to be considered.
- Industry III.G.1 and 2 Proposal to address test results
  - Supplement Current SSA, meeting NEI 00-01, Chapters 1, 2 and 3 as explained below
  - Evaluate - Multiple Simultaneous Hot Shorts/Spurious Operations
    - Using the NEI 00-01, Chapter 4 Process
      - Appendix B – Circuit Failure Criteria
      - Appendix F – Expert Panel
      - Appendix G – List of Generic MSOs



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## Other Topics

- **Industry III.G.1 and 2 Proposal**
  - Address the impact of each MSO Scenario individually
  - Application of Circuit Failure Criteria in Appendix B for simultaneous multiple hot shorts affecting individual components in an MSO
  - Application of Chapter 4 and Appendix G for addressing simultaneous spurious operation of multiple components
  - Appropriate use of available tools
    - Fire modeling
    - Focused-Scope Fire PRA



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## NEI 00-01 Status

- **Industry Feedback on proposed method generally positive**
- **NEI 00-01 revision 2(b) is mostly complete.**
  - MSO lists updated based on recent industry expert panels.
  - Document updated with NEI CFITF understanding from the September 25, 2008 telecom
- **Next Draft, assuming no significant changes from today's meeting, will be issued by mid-November**



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