Pressurized Water Reactor Owners Group (PWROG)
Meeting with NRC on Staggered Integrated ESF/LOOP Testing Topical Report (WCAP-15830, Revision 01)

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Staggered Integrated ESF/LOOP Testing, WCAP-15830

Agenda

- Introductions and Opening Remarks
- Overview of Methodology and Approach
- Overview of Changes
- Questions and Comments
- Review Schedule
- Summary and Closing

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WCAP-15830 History

- 04/2003 Submitted WCAP-15830 Revision 0
- 04/0005 Responded to RAIs
- 03/0006 Notified by NRC of intention to not approve
- 08/2006 OG submitted response to NRC concerns (additional RAIs)
- 01/2007 NRC and OG reached agreement on response and a path forward (meeting and conference call)
- 02/2007 Withdrew Revision 0
- 07/2007 Submitted Revision 1

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Introduction

- Purpose of Meeting
  - Provide overview of WCAP-15830-P, Revision 1,
  - Re-confirm scope of the review and schedule.
- Meeting Format
  - Overview of Methodology and Approach,
  - Overview of Changes,
  - Question and Answers,
  - Review scope and schedule.
- Meeting Goals
  - Brief reviewers on new revision of WCAP-15830,
  - Outline a plan to complete NRC review process

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Program Objectives

- Develop a generic methodology that individual plants may use as a model to apply staggering ESF/LOOP testing at their plant,
  - Extend the test interval of Surveillance Requirements typically addressed by the Integrated ESF/LOOP test to every other refueling outage on a staggered basis.

- Provide plant specific demonstrations as a proof of principle,

- Obtain NRC approval of the Generic Methodology and Approach.

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Industry Benefits

- Dose / radiation exposure reduction
- Reduced human performance challenges
- Reduction in safety-related equipment wear and tear
- Reduction in RCS mass addition challenges
- Reduced outage time

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Approach

- Applies a Risk-Informed approach, based on RG 1.174 to demonstrate that any change in risk will be negligible.
- Uses a balanced approach between Risk-Informed and Deterministic assessments
- Consistent with the methodology described in NEI 04-10, Risk-Informed Technical Specifications Initiative 5b Risk-Informed Method for Control of Surveillance Frequencies

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Assumptions

- Proposed change for use at plants with 18 month refueling cycle. (Note 1)
- Once approved, this methodology will be applied to similar generic methodology being developed for W-NSSS units (WCAP-16354).
- Utilities desiring to adopt a staggered integrated ESF/LOOP test program must;
  - submit a plant specific risk analysis and defense-in-depth evaluation,
  - request a change to the affected TS surveillance intervals

Note 1:
Methodology may also be applied to 24 month refueling cycle plants, but additional analyses would be required.

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Methodology

1. Review TS Surveillance procedures (for demonstration plants) to identify overlap in component and functional testing with the integrated ESF/LOOP test

2. Categorize components (A, B and C)

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Methodology

Component Categories:

- Category A (Further divided into sub-categories)
  - Component/function tested solely by IESF test
  - Risk significant and addressed (or should be addressed) by PSA model

- Category B
  - Component/function tested solely by IESF test
  - Not Risk significant and not addressed by PSA model

- Category C
  - Component/function not tested solely by IESF test
  - Other equivalent testing performed within the RO interval

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Methodology

3. Perform a Risk analysis to quantify the associated change in plant risk
   - Analyze Category A components

Category A Sub-categories:

- Category A-1:

  Components, which are used to verify the tested functions, are modeled explicitly.

- Category A-2:

  Components, which are used to verify the tested functions, are not modeled explicitly, but the model does include another component which subsumes the tested component.

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Category A Sub-categories continued:

- Category A-3:

  Components/functions have a potential adverse indirect impact on a modeled component, where this indirect effect is covered appropriately in the PRA model but the specific Category A-3 component has not been subsumed into the model.

- Category A-4:

  Components that have a potential adverse indirect impact on a modeled component. Unlike the Category A-3 components, this indirect effect is not covered in the PRA model.

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Methodology

4. Adjust Risk Model as necessary
   - Category A-3 and A-4 components
   - Recalculate CDF and LERF for Base Model
5. Recalculate and evaluate the change in risk
   - Requantify Model with Extension
   - Evaluate the change in CDF and LERF against acceptance criteria
   - If acceptance criteria is exceeded:
     - Determine dominate contributors
     - Evaluate alternate or separate effects tests
     - Repeat the process and reevaluate the change in risk

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Methodology

6. Perform a Deterministic Analysis

- Objective:
  - Show that there are no failures for Category A components that have a non-constant failure rate and a Mean Time Between Failure (MTBF) greater than test interval (36 months),
  - Show that the change in test interval will not degrade the performance of either train of the ESF system and will not invalidate any assumptions in the plant licensing basis.
- Consists of:
  - Failure Modes and Effects Analysis (FMEA),
  - Significant Hazards Analysis.
- Reinforces the conclusions of the corresponding risk-informed analysis
- Provides the necessary balance between risk and deterministic arguments required by RG 1.174.

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7. Failure Modes and Effects Analysis (FMEA)

- Plant specific Failure Modes and Effect Analysis (FMEA) of systems/equipment that are only be tested by the integrated ESF/LOOP test (Category A components)
- Considerations:
  - Failure Mode,
  - Failure Mechanism (cause),
  - Failure Effects and Consequences,
  - Safety Significance and impact on margin of safety.

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Methodology

8. Significant Hazards Analysis

- Evaluation of the impact of the failure modes identified by the FMEA on the overall performance of an ESF train in response to an actuation signal,
- Analysis of how the operation of the ESF train, that has not been tested during the refueling outage, will be impacted if a time dependent failure occurs,
- Questions to be considered:
  - Will the effect of a failure on the ESFAS create a significant increase in the probability or consequences of an accident previously evaluated?
  - Will it create the possibility of a new or different kind of accident from any accident previously evaluated?
  - Will the failure result in a significant reduction in a margin of safety?

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Methodology

9. Evaluate Analyses results per RG 1.174 criteria.

- The change in risk must be less than 1.0E-6/yr for CDF and less than 1.0E-7/yr for LERF,
- Evaluate Quantitative and Qualitative Results,
- Conclusions and Recommendations

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Changes in Revision 1

- Incorporated changes identified in new RAI responses
- Expanded Deterministic Assessment significantly
- Ensured consistency with NEI-04-10
- Added new section on Implementation
- Go to 'Summary of Changes' Handout
  - Review change details

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Wrap-up

- Questions and Comments
- Summary and Schedule