NRC/WOG Meeting

WOG W NSSS Risk-Informed Tech Spec Completion Time Improvements for Fluid Systems

WCAP-15957

December 1, 2004

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Agenda

- Purpose of the Meeting
- Background
- NRC Issues Identified in July 22, 2004 Letter
- Approach for Addressing NRC's Issues
  - External Events
  - Tier 2 Analysis
  - Tier 3 and 10 CFR 50.65(a)(4)
  - Coordination with Other Industry Work
- Summary and Conclusions
- Open Discussion

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Purpose of the Meeting

- To discuss resolution of the issues the NRC identified with WCAP-15957 ("Risk-Informed Evaluation of Extensions to Fluid Safety System Completion Times").
- To obtain NRC feedback on the proposed revisions to WCAP-15957.

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Background

- WOG submitted WCAP-15957 to the NRC for review on April 22, 2004.
  - TS Completion Time changes for fluid safety systems.
  - Systems include ECCS, AFW, containment spray, CCW, and SW.
  - WCAP includes the generic approach and CT extension results for six plants.
  - A SE is expected on the approach and plant specific results.
- NRC/WOG met on 6/24/04 to discuss NRC issues with the WCAP.
- NRC issued a letter on July 22, 2004 recommending that the WOG revise the WCAP to address their issues.
- WOG responded in a letter on October 18, 2004 and requested a meeting to discuss resolution of these issues.

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NRC Issues Identified in July 22, 2004 Letter

- Inadequate consideration of external events.
  - Staff expects the WCAP to provide a methodology for addressing external event risk contributions.
- Simultaneous inoperability of multiple components not considered.
  - Tier 2: Staff expects the WCAP to provide a technically defensible approach for conducting Tier 2 analysis.
  - Tier 3: Staff needs assurance that 10 CFR 50.65(a)(4) will provide reasonable assurance that plant risk will be monitored and controlled to an acceptable level.
- Coordination with the established industry efforts not considered.

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Issue: External Events

- Two approaches to address external events
  - If an external events PRA is available for the event of interest, it can be used.
  - Alternate approach is provided for plants with qualitative assessments of external events.
- External events to be addressed: seismic, fire, high winds, external floods, and other external events.
- Considered results from IPEEEs (NUREG-1742 and plant specific IPEEE reports).
- The following slides discuss the alternate approaches.
  - These are approaches being considered by the WOG.
  - Still require WOG agreement.

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Alternate Approach for Seismic Events

- Identify the accidents that can result from a seismic event
  - Pipe breaks, loss of SW, loss of CCW, non pipe break small LOCAs, LOOP, transient events
- Via qualitative screening, eliminate those events that are negligible contributors to risk or for which the mitigation system is failed.
  - Low level seismic events may result in a reactor trip, low frequency relative to internal events transient IE frequency (transients).
  - High level seismic events also fail mitigation systems, CT extension not important (pipe breaks).
  - Seismic events that fail one train of a system will also fail the other, CT extension not important (loss SW, loss of CCW).

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Alternate Approach for Seismic Events (Cont'd)

- For the remaining seismically induced initiating events, non pipe break small LOCAs and LOOP, determine how the systems of interest are used for mitigation.
- Provide qualitative assessment of the importance of the systems to these remaining events.
  - For low importance systems, CT extension is not important.
- Provide quantitative screening assessment for the remaining systems relative to the remaining events.
  - Demonstrate an appropriate risk measure for the seismic event is small compared to the same risk measure for internal events.
  - Seismic contribution does not impact acceptability of CT change.

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Alternate Approach for Seismic Events (Cont'd)

- Transient events
  - Seismic event causes a reactor trip without a LOOP.
  - Event mitigated the same as an internal event transient.
  - The frequency of the event is much less than the frequency for transients from internal events.
  - No impact on the acceptability of the CT change based on internal events.
- Seismic events that cause a LOOP
  - Generally larger contributors to seismic risk.
  - Availability of onsite electrical systems important.
  - Weak point leading to LOOP are the electrical insulators.
  - Utilities to demonstrate that the seismic LOOP risk is significantly less than the internal events LOOP risk.

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Alternate Approach for Seismic Events (Cont'd)

- Seismic events that cause a small LOCA
  - Small LOCAs from sources other than pipe breaks (instr. lines).
  - Mitigation systems remain intact.
  - Utilities to demonstrate that the seismic small LOCA risk is significantly less than the internal events small LOCA risk.
- Seismic events that cause RCS pipe breaks
  - These events will also damage mitigation systems.
  - The availability of each train of the mitigation system is immaterial if the seismic event is large enough to damage the system, therefore, the CT length is not important.
  - No impact on the acceptability of the CT change based on internal events.

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Alternate Approach for Fire Events

- A common approach used in the IPEEE was to do a screening analysis (qualitative and quantitative) followed by a more detailed quantitative assessment of the unscreened fire zones.
- Screening Assessment
  - Qualitative screening
    - Fire zone neither created fire initiated event nor caused the loss of safe shutdown function, the zone eliminated from further consideration.
  - Quantitative screening
    - Assumed fire in fire analysis zone impacts all equipment in that zone.
    - CDF less than a screening value, then zone eliminated from further consideration.
  - Conclusions: CT extensions do not impact the screening analysis, therefore, the screening results remain applicable.

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Alternate Approach for Fire Events (Cont'd)

- Quantitative assessment of unscreened zones - requires further consideration.
  - Identify the events each system can impact, e.g., ECCS used to mitigate LOCAs and as part of F&B as backup to AFW.
  - Assess the importance of the event to fire risk, e.g., LOCAs (excluding RCP seal LOCAs) not significant contributors; F&B dominated by OA failure.
  - Based on this, identify type of accident sequences leading to core damage that should be examined, e.g., RCP seal LOCAs for ECCS.
  - Examine relevant accident sequences to determine if an increase in the system/component unavailability will impact CDF.
  - If potential impact, then assess the impact on CDF with the additional unavailability related to the CT and the impact on ICCDP.

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Alternate Approach for Fire Events (Cont'd)

- Quantitative assessment requires
  - ECCS: examine RCP seal LOCA core damage sequences.
  - AFW: examine transient core damage sequences.
  - CCW: examine RCP seal LOCA core damage sequences.
  - SW: examine RCP seal LOCA core damage sequences.
  - Containment Spray: no assessment required, negligible impact on LERF.

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Alternate Approach for High Wind Events

- The key initiator caused by high winds is a LOOP.
- LOOP with failure of other systems can occur at higher wind speeds.
  - Additional wind induced failures typically involve a complete system.
- Typically, high wind core damage is from:
  - LOOP with failure of (not wind induced) additional mitigation equipment.
  - SBO due to failure of (not wind induced) EDGs and failure of power recovery.

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Alternate Approach for High Wind Events (Cont'd)

- If high winds were screened out, then high wind risk is not expected to be impacted by the CT extension.
- Higher high wind events cause a LOOP with wind induced failure of other systems/components.
  - CT change has no impact on system availability to mitigate the event since the system failed due to high wind.
- Lower high wind events may need further consideration.
  - Mitigation equipment remains intact.
  - Utilities to demonstrate that the risk from lower high wind speeds is significantly less than the risk from LOOP internal events.
  - Recovery of offsite power is a significant consideration.

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Alternate Approach for External Flooding Events

- The key initiator caused by external floods is a LOOP with power not recoverable.
- External floods typically impact a complete system, therefore, CT extension has no impact.
- If external floods were screened out, then external flood risk is not expected to be impacted by the CT extension.
- Utilities can demonstrate that the risk from a LOOP due to external flooding events is significantly less than the risk from LOOP internal events.

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Alternate Approach for Other External Events

- These events are typically screened out for plants.
- If these other external events were screened out, then the risk from these events is not expected to impact the results of the CT extension analysis.
- If not screened out, then the accident sequences should be examined to determine if the systems of interest are risk contributors.

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Approach for Tier 2 Analysis

- Tier 2 analyses
  - Identify potential high-risk configurations that could exist if additional equipment is out of service.
  - Develop appropriate restrictions on these high risk configurations.
- Four step process proposed to identify required restrictions – the proposed approach still needs WOG agreement.
- Required input
  - Risk importance measures from the base, at-power, PRA model.
  - Risk importance measures from the model quantification for the configuration specific situation
  - Accident sequences (or cutsets) from the model quantification for the configuration specific situation

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Approach for Tier 2 Analysis (Cont'd)

- Step 1: Determine values for risk importance measures
  - Need values from the base model and the model with the equipment of interest out of service
  - RAW value of primary importance
  - RAW values should include risk from at-power, internal and external events, if possible

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Approach for Tier 2 Analysis (Cont'd)

- Step 2: Identify candidate components for Tier 2 restrictions
  - Based on the configuration specific model quantification and base model.
  - No Tier 2 restrictions
    - Components with low risk importance values
    - RAW < 2
  - Potential Tier 2 restrictions
    - Components with high risk importance values (RAW > 2)
      and
    - With an increase of a factor of X over their base case values.

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Approach for Tier 2 Analysis (Cont'd)

- Step 3: Consider external events
  - For PRA models that do not quantitatively consider risk from external events.
  - Based on the IPEEE, identify components important to the mitigation of external events.
  - Qualitatively assess the importance of these components to each external event with the TS equipment of interest out of service considering:
    - The importance of the components to the specific external event risk.
    - The importance of the specific external event to total risk.
  - Components considered important to external event mitigation are added to the candidates for Tier 2 restrictions.

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Approach for Tier 2 Analysis (Cont'd)

- Step 4: Review accident sequences and identify Tier 2 restrictions (optional step)
  - Identify the accident sequences from the configuration specific model quantification that contain the candidate components.
  - Identify restrictions for one candidate component for each sequence
  - Potential restrictions:
    - Restrict voluntary outage of candidate component.
    - Develop compensatory actions for the sequence of interest.
    - Operator awareness of sequences causing increased risk level.
    - Demonstrate alternate mitigation systems in the sequence are operable.

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Tier 3 and 10 CFR 50.65(a)(4) Issue

- Staff needs assurance that 10 CFR 50.65(a)(4) will provide reasonable assurance that plant risk will be monitored and controlled to an acceptable level.
- Configuration Risk Management Programs (CRMPs) were included in the Administrative Controls section of the Tech Specs for those plants implementing Risk-Informed Completion Times prior to the 50.65 (a)(4) rule change in 1999.
- The final rule stated: "After revisions to the maintenance rule are completed, the NRC will expeditiously support licensee requests to remove the CRMP requirements from plant TS."
- The staff has approved Amendments to remove the CRMP from the Tech Specs.

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Tier 3 and 10 CFR 50.65(a)(4) Issue (Cont'd)

- Risk Management Tech Spec Initiatives have relied/rely on 50.65(a)(4) and Regulatory Guide 1.182 to support the changes, e.g., TSTF-358, TSTF-359, and TSTF-427.
- Implementation guidance was developed for TSTF-359 and is being developed for TSTF-427.
- Licensees implementing these changes have/will utilize the implementation guidance.
- Implementation guidance will also be developed for the Fluid Systems Completion Time extensions.
- The implementation guidance will include the appropriate CRMP attributes required to implement the changes.
- Therefore, including a requirement in the Administrative Controls is not necessary.

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Coordination with other Industry Work

- Coordination with the established industry efforts not considered.
- This Topical Report has been identified to NEI as one of the WOG W NSSS Risk-Informed Tech Spec Initiatives

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Summary and Conclusions

- WCAP-15957 will be revised consistent with the approaches discussed to address the issues identified by the NRC.
- Some issues will require coordination with the Industry.
- Plant specific results have been included and approved by the NRC in Joint Application Topical Reports submitted by the CEOG.
- Approximately $450K has been expended on the Topical Report.
- Including multiple plant results is an efficient use of both Industry and NRC resources, and ensures a common approach to address generic issues.

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Open Discussion

Maintenance Rule (a)(4) Program

- 10CFR50.65(a)(4) Maintenance Rule program is a robust program for managing plant risk
  - (a)(4) requires assessing and managing configuration risk when equipment is removed from service for maintenance and testing
    - Other impacts also assessed include severe weather, grid stability and evolutions increasing plant trip (e.g. TVFT)
    - Utilities use risk monitors to assess risk - capable of accounting for inter-system dependencies as well as unit cross-ties
    - Some configurations allowed by Tech Specs require risk management actions

Maintenance Rule (a)(4) Program

- (a)(4) program implemented in November 2000
  - (a)(4) program implementation reviewed by NRC
  - PRA models have been peer reviewed
  - (a)(4) is fully integrated into the safety culture at all Dominion sites

- (a)(4) satisfies Configuration Risk Management Program (CRMP)
  - Guidance in NUMARC 93-01 section 11 more comprehensive
  - Improved Tech Specifications credits (a)(4) program for some LCOs