BWR COMBUSTIBLE GAS CONTROL AMENDED RULE TECHNICAL SPECIFICATIONS

BWROG/ NRC MEETING
December 18, 2007

Tony Browning, FPL Energy
BWROG CGCARI Committee Chairman

COMBUSTIBLE GAS CONTROL AMENDED RULE

PRESENTATION OBJECTIVE

- Provide Background
- Completed Activities
- Remaining Issues/Concerns
- BWR/TSTF Plans

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COMBUSTIBLE GAS CONTROL AMENDED RULE IMPLEMENTATION

- **PURPOSE OF BWROG COMBUSTIBLE GAS CONTROL AMENDED RULE IMPLEMENTATION (CGCARI) COMMITTEE**

  Assist Owners in realizing expected benefits from implementation of the Amended Combustible Gas Control Rule (10 CFR 50.44)

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COMBUSTIBLE GAS CONTROL AMENDED RULE IMPLEMENTATION

BACKGROUND

- Revised Rule & CLIIP published Sept. 2003
  - Removes hydrogen ignition concerns from design basis - severe accidents only
- CLIIP for TSTF-447 allows:
  - Removes H^2/O^2 monitors from TS (move to TRM)
  - Allows physical removal of hydrogen recombiners (most plants)
- BWROG CGCARI Committee identifies additional changes beyond TSTF-447

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COMBUSTIBLE GAS CONTROL AMENDED RULE IMPLEMENTATION

BACKGROUND (cont)

- Five additional changes proposed in TSTF-478 (April 2005)
  - Not intended as a Risk-Informed TSTF (RITSTF)
- NRC RAI requests data on risk impacts for proposed changes (November 2006)
- TSTF provides response to RAIs and issues Rev. 1 of TSTF-478 (February, 2007)
- Meeting held on April 17, 2007 to discuss NRC review
- NRC issues letter to BWROG on May 8, 2007
  - Agreement on three changes: CAD Elimination, Drywell purge, Drywell Fans
  - Denial on OOS time for hydrogen igniters w/o Recombiners
  - Denial on extension for operating deinerted

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COMBUSTIBLE GAS CONTROL AMENDED RULE IMPLEMENTATION

BACKGROUND (cont)

- TSTF-478 Revision 2 submitted for 3 approved changes: CAD elimination, drywell purge bases change, drywell fans OOS time extension (July 2007)
- NRC approves TSTF-478 Rev. 2 as CLIIP (November 2007)

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COMBUSTIBLE GAS CONTROL AMENDED RULE IMPLEMENTATION

Remaining TSTF-478 Issues

- Hydrogen Igniters Out of Service (OOS) Time
  - Current ISTS allow 7 days with loss of Igniters provided back-up (Recombiner) is available
  - Rule Change eliminated Recombiner (no caveats)
  - BWROG viewed as administrative change to TS (overlooked in TSTF-447)
- Oxygen Concentration Relaxation on Startup/Shutdown
  - Current ISTS allows 24 hours deinerted operation on Startup or Shutdown based on hydrogen ignition being a DBA concern
  - Proposed extension to 72 hours since hydrogen ignition no longer a DBA (lower likelihood of occurrence, not front line mitigation, defense in depth only)
- NRC Denial Letter appears to go beyond current NRC Guidance for TS changes for "risk-informed changes". Agreement is needed on assumptions to address risk impacts.

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COMBUSTIBLE GAS CONTROL AMENDED RULE IMPLEMENTATION

BWROG/TSTF Proposed Actions for Issue Resolution

- Revise request for hydrogen igniters OOS from 7 days to 48 hours with elimination of Recombiner requirement
  - Risk calculations performed to support new OOS time
  - Risk reduction from current ISTS (RG 1.1.74/RG 1.177)
- Discuss revision to Oxygen concentration relaxation from original 72 hours to 48 hours
  - Significant operational benefits (Original RAI Response)
  - Need understanding on extent of technical justification required before proceeding with additional work

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COMBUSTIBLE GAS CONTROL AMENDED RULE IMPLEMENTATION

BWROG/TSTF Plans

- Submit new TSTF for hydrogen igniters OOS by February 2008
  - Request NRC review priority - impacted Plants unable to remove Recombiners, which have minimal impact on risk per §50.44
- Will base decision on new TSTF for Oxygen Concentration change using NRC feedback from today's meeting

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BWR HYROGEN IGNITER DRAFT TECH SPEC CHANGE

BWROG/NRC MEETING

DECEMBER 18, 2007

Ron Byrd, Entergy

IGNITER TS CHANGE

Purpose

- Discuss need for TS change
- Review previous issues with TSTF-478
- Discuss proposed new TSTF
- Discuss technical justification
- Discuss submittal and review of new TSTF

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IGNITER TS CHANGE

Need for TS Change

- 10 CFR 50.44 rule change
  - Eliminated DB LOCA hydrogen release (recombiners).
  - Maintained igniters for severe accidents.
- TS basis for igniters is a beyond DB degraded core event.
- The TS allows 7 days operation with both igniter divisions inop (less than 90%) provided the function is maintained (by recombiners).
  - Recombiners are not effective for severe accident.
  - No other TS function provides beyond DB hydrogen control.
  - Beyond DB hydrogen control addressed by EPs/SAPs.
- TS tie to recombiner was missed in TSTF-447.

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IGNITER TS CHANGE

TSTF-478 Previous Change

- Hydrogen Igniter TS Action Corrections
  - Fix to no longer require Recombiners.
    - Action requires recombiner in one hour and allows operation for 7 days.
  - Change based on Rule and supporting analysis that recombiners can be eliminated.
  - PRA analysis performed.
    - Concluded minimal risk impact.
  - SAMG actions defined.

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IGNITER TS CHANGE

TSTF-478 Issues

- Risk Assessment Concerns
  - No consideration of decay heat loss and long term SBO
  - CDF used was not for most limiting BWR
  - No info on quality of plant PRAs
  - Time of inoperability should be minimized
- GSI-189 security event issues

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IGNITER TS CHANGE

Proposed New TSTF

- Minimizes inoperability
  - Reduce igniter AOT from 7 days to 48 hours.
- Eliminates requirement for recombiners.

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ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One primary containment and drywell hydrogen ignitor division inoperable.	A.1 Restore primary containment and drywell hydrogen ignitor division to OPERABLE status.	30 days
B. Two primary containment and drywell hydrogen ignitor divisions inoperable.	~~B.1 Verify by administrative means that the hydrogen control function is maintained.~~	~~1 hour~~ ~~AND~~ ~~Once per 12 hours thereafter~~
	~~AND~~	
	B.1~~2~~ Restore one primary containment and drywell hydrogen ignitor division to OPERABLE status.	48 hours ~~7 days~~
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	12 hours

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IGNITER TS CHANGE

.**Technical Justification**

- Positive safety benefit
  - Qualitative risk improvement
  - Risk sensitivity analysis provides risk perspective of 48 hr CT
- GSI-189 resolved and closed
  - Voluntary commitments made to enhance loss of power concerns
  - Backup power provided to supplement normal and emergency power

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IGNITER TS CHANGE

.**Technical Justification (continued)**

- Loss of hydrogen igniters is rare, unexpected occurrence
  - Cannot voluntarily remove both divisions from service (LCO 3.0.2 Bases).
  - Inoperability due to power distribution system requires 8 hour restoration (TS 3.8.9)

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IGNITER TS CHANGE

Submittal and Review of New TSTF

- Draft Traveler (TSTF-xxx) developed for proposed TS change
- Risk assessment developed for risk perspective
- The submittal is not risk-informed
  - Qualitative safety improvement
  - Supplemental risk info does not need to include all elements of RG 1.174 and 1.177 (additional information not needed for reduction in risk conclusion).
- NRC review needs?

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Probabilistic Risk Sensitivity Cases To Examine TSTF-478 Changes

Mark III Plants

Completion Time for Both Igniter Divisions Unavailable

Ron Byrd (Entergy-BWROG)
&
E.T. Burns (BWROG)

December 18, 2007

Purpose

Provide risk perspective of a reduced Allowed Outage Time (Completion Time (CT)) for the Mark III hydrogen control mitigating system, i.e., the igniters.

Summary of Completion Time (CT)

- Summary of Completion Time (CT) Cases to be evaluated

System	Completion Time (CT)	
	Current	Proposed
Both Hydrogen Igniter Divisions	7 days[1]	48 hrs.

Proposal

- The BWROG seeks to modify the Mark III CGC requirements to:
  a) Reduce the allowed CT to 48 hours when both divisions of the igniters are unavailable (less than 90% per division)

     AND

  b) Eliminate the requirement that the recombiner be available during the 48 hour CT for both igniter divisions

Additional Measures

- Generic Issue-189:
  - BWR/6 plants have voluntarily provided commitments to have backup power supplies to power the igniters in the event of a station blackout.
  - Therefore, even in the event of a loss of normal and emergency power to both igniter divisions, alternate means to power one division of igniters would be available.

Methodology (Page 1)

- Perform a best estimate evaluation for a typical Mark III plant
- Supplement by several sensitivity calculations to demonstrate a range of possible risk metrics given variations in assumptions or the plant risk profile (e.g., higher CDF)
- Demonstrate that the proposed CT results in acceptable risk metrics and a public safety benefit

Methodology (Page 2)

- Because of the epistemic uncertainties in the probabilistic evaluations the approach is to:
  - Demonstrate the risk safety enhancement of the proposal.
  - Use the risk metrics specified by Regulatory Guides
  - Provide range of sensitivity cases to support input to decision-makers
- Only the igniters are credited as an adequate mitigation measure for combustible gases over the severe accident spectrum.

Risk-Informed

- Because the proposed change does not increase risk, the requirements for detailed analyses are not invoked by RG 1.177
- Because the submittal is not risk-informed, i.e., risk decreases not increases
- All elements of RG 1.174 and 1.177 are not necessary for inclusion
- Submittal/Analysis is to provide risk perspective

Internal + External Events: ICLERP

- Comparison of Results for 7 Day and 48 hours CT

Risk Metric	Risk Metric Calculation Internal and External Events	Acceptance Guideline	
		Value	RG
ICLERP 7 days	3.45E-8	5E-8	RG 1.177
ICLERP 48 hours	9.86E-9	5E-8	RG 1.177
ΔLERF 7 days to 48 hours	-1.20E-8/yr	1E-7/yr	RG 1.174

NRC Issues on Previous Submittal

- The new approach avoids the need to address:
  - Large Late Releases (Not part of R.G. 1.174 or 1.177)
  - Security related issues in a qualitative assessment of the Technical Specification (Not included in probabilistic risk models)
  - Use of internal NRC calculations as the basis for decisions (Sensitivity calculations are performed to address impact.)
  - A comprehensive review of all Mark III PRA results, EALs, and evacuation studies to find the most limiting case
  - Justifying operation in a condition effectively without the containment barrier
  - Any required monitoring using performance measurement strategies

Summary

- NRC recognized in the final Hydrogen Rule (10CRF50.44) that the recombiner has NO impact on the Mark III risk profile.
- The current Technical Specification allows a 7 day CT for both divisions of igniters if the recombiner is available.
- The proposal and risk assessment presented here uses the fact that the CT will be reduced significantly to a shorter allowed CT (e.g., 48 hours), if the condition that the recombiners remain available is eliminated.
- A shorter CT in the Technical Specifications will reduce risk to the public and be a safety enhancement.

BWROG
Technical Specification Change – Containment Inerting

BWROG/NRC MEETING

DECEMBER 18, 2007

Tony Browning, FPL

Containment Inerting Change

Purpose of Presentation

- Discuss proposed change
  - Original request (TSTF-478)
  - NRC Identified issues
- Discussion of Alternative Actions
- Future Direction for Tech Spec Change

Containment Inerting Change

Original Change (TSTF- 478)

- Based on §50.44 rulemaking – combustible gas concentrations no longer design basis
  - Revised TS Bases to §50.36(c)(2)(ii) - Criterion 4
  - Extend allowance on de-inerting on startup/shutdown from 24 to 72 hours
    - Deterministic change based upon revised rule

Containment Inerting Change

Original Change (TSTF- 478) (cont)

- Change is an operational enhancement
  - Simplifies plant startup - begin inerting after performing low power activities & Surveillances
    - Removes potential Operator distractions
  - Extends personnel access to Containment during startup
    - Leakage walkdowns
  - Simplifies plant shutdown – complete de-inerting before taking turbine/generator offline
    - Removes potential Operator distractions
- "Normal" startup/shutdown – extended de-inerted time not expected
  - Extension is for contingencies

Containment Inerting Change

Original Change (TSTF- 478) (cont)

- NRC Request for Additional Information (RAI)
  - Operational Hardships
  - Risk Assessment
- BWROG/TSTF Response
  - Outlined startup/shutdown timelines
    - Highlighted potential impacts/Operator distractions
  - Risk Assessment performed
    - Used RG 1.174 Guidelines
    - Key inputs conservatively biased
      - Maximum de-inerted time always used
      - No mitigation for combustible gas mix after core damage
      - Included External Events quantifications

Containment Inerting Change

Original Change (TSTF- 478)

BWROG Risk Assessment (cont)

- Conclusion
  - The deinerted time extension from 24 hours to 72 hours met the “very small risk increase” criterion of RG 1.174 for ΔCDF and ΔLERF
  - Sufficient conservatisms in the analysis to address “safety margins” and “defense-in-depth”

Containment Inerting Change

NRC Issues with Original change

- Need to consider both RG 1.174 and RG 1.177
  - NRC Staff estimates did not support change as "very small increase" in ΔLERF or ICLERP
- Additional issues with BWROG risk assessment
  - Large late releases inappropriately removed
  - Security related issues/defense-in-depth
  - Ensure bounding results for all affected plants (mean vs high confidence)
  - Level III PRA issues - EAL's and evacuation time studies to find most limiting case
- *"Although exceeding the acceptance guidelines in RG 1.177, the risk increase is not so large as to call into question the presumption of adequate protection of public health and safety."*

Containment Inerting Change

Discussion of Alternatives and Issues

- *"…that alternatives that can achieve the TSTF's objectives with smaller risk impacts should be considered."*
- De-inerting time can be reduced from 72 to 48 hours
  - Revised time in Startup/Shutdown will allow needed flexibility
    - Allows containment access during startup for walkdowns
    - Permits inerting after majority of startup testing/evolutions
    - Sufficient "lead time" on shutdowns

Containment Inerting Change

Discussion of Alternatives and Issues (cont)

- Agreement is needed on assumptions for risk assessment
  - Assumptions on number of de-inerted hours/year (RG 1.177)
    - 24 month cycles (startup/shutdown)
    - 1 forced outage/cycle requiring de-inerting
  - Perform analysis for "standard" BWR/Mark I and II
    - Key parameters/sequences to be evaluated (plant-specific uncertainties)
    - Address PRA Quality (RG 1.200)
  - External Events (qualitative assessment only)
  - Large late releases (evacuation time estimates) and security-related issues will not be addressed
  - Credit Severe Accident Management (SAM) strategies for defense-in-depth considerations
    - Containment sprays
    - Venting

Containment Inerting Change

Direction for Revised Tech Spec Change

- LCO Note on 48 hour Allowance for Startup & Shutdown
- Existing Completion Time (24 hours) unchanged
- Revise Applicability/Required Action B.1 same as original TSTF-478

Containment Inerting Change

Conclusion

Appropriate balance between desired operational flexibility and overall plant risk is achievable within existing regulatory framework