



# 10 CFR 50.46c Rulemaking Industry Preparations

**Tom Eichenberg**

REG-TAC Chairman

**NRC Public Meeting**

April 29-30, 2014

# Scope

- FRN
- Question 1: Performance Based
- Question 2: Periodic Breakaway Testing
- Question 3: Analytical Long-Term Cooling PCT
- Question 9: Staged Implementation
- Question 10: New Reactor Implementation
- Question 11: Re-structuring 10 CFR Chapter 1 with respect to ECCS Regulations
- Question 12: Cumulative Effects of Regulation, etc.

# FRN Question 1

## Performance-Based Peak Cladding Temperature Limit

- Stated Goal - protect against loss of coolable geometry
  - *Brittle Failure* Upon Quench
  - High Temperature *Ductile* Failure
  - Autocatalytic oxidation
- SRM Directive - achieve performance based ECCS – ML030910476, March 3, 2003.
  - Prescriptive limit(s) inconsistent with the performance based directive
  - 2200F
    - “...provide a substantial degree of conservatism...” - FRN Volume 39 #3, January 4, 1974, pg 1002

# FRN Question 1

## Performance-Based Peak Cladding Temperature Limit

- Current test methodology may be adequate to higher temperatures
  - Industry coordinated LOCA round robin showed no catalytic oxidation using wide range of steam flows
- Vendor LOCA evaluation models already consider exothermic heat generation
  - “Autocatalytic” phenomenon is an energy balance issue
    - Reaction energy release versus heat transfer to steam
    - Science is well understood and no new test required
- Additional material data may be needed for high (>2200F) temperature ductile failure issues

## FRN Question 2

### Breakaway Oxidation Testing

- Short breakaway oxidation has only been observed in electrolytic (not used in US nuclear batch application) production process
- Kroll processed materials do not exhibit short breakaway times
  - Periodic cladding testing is an unnecessary burden
- Fuel vendor specific test program
  - Results discussed at annual meeting
  - No anomalous breakaway oxidation time expected
- No value in licensee reporting on breakaway oxidation
  - No fuel would be made from failed material

## FRN Question 3

### Analytical Long-Term Peak Cladding Temperature Limit

- Performance based
  - No prescriptive analytical limit in the rule
  - Vendors will submit a long term cooling evaluation method for NRC review and approval
  - Suggest NRC-industry interaction to develop technical basis and understanding leading to regulatory guide
  - Define long term “extended period of time”

## FRN Question 9

### Staged Implementation

- Industry supports staged implementation
- Listing plants names does not allow NRC flexibility to manage plant ECCS performance changes
  - Describe track assignments by ECCS performance
  - Avoids rule exemption request
  - Transition to advanced cladding
- Implementation allowed to address multiple issues (e.g., TCD), only one expensive reanalysis required of licensees

## FRN Question 9

### Staged Implementation

- All licensees appear to require LAR regardless of track
  - Compliance with the rule may create a technical specification (TS) issue
  - Only TS approved methods can be used to develop COLR (e.g., new vendor hydrogen pickup topical report, CP correlation, etc.)
- Industry Requests a Regulatory Information Summary
  - Format, Content, Scope
  - Standardize Review / Time Frame
- Enforcement guidance memo (EGM) may be needed
  - Can a licensing success path be defined not requiring LAR?
    - Track 1 plant issue
  - Needed exemptions can be avoided?
- Suggest NRC-industry interaction to develop details for vendor topical reports and licensees compliance submittal

# **FRN Question 10**

## **New Reactor Implementation**

- Industry defers to written comment response

## **FRN Question 11**

### **CFR Restructuring**

- Industry has not identified any benefits and efficiencies
- Significant burden, cost, and complexities exist

# FRN Question 12

## Cumulative Effects

- NRC requests specific comment on the proposed rule's implementation schedule in light of any existing CER challenges
  - Sufficient time (tie to Q9)
  - Ongoing CER challenges
    - Fukushima, NFPA-805
    - Reactivity Insertion Accidents, GSI-191
    - Open Phase Condition, Degraded Grid Voltage, etc.
  - Unintended consequences
    - Qualified Human Resources
    - Relationship to other rules (50.59?)
  - Regulatory analysis – details in written FRN comments



# Industry Overview

## FRN 50.46c(m)

- Corrective Action and Reporting
- What is really needed?
- Industry feels the current process needs improvement
  - Relative vs. Absolute Margin
  - Why is LOCA any different than anything else.
    - Handle under existing processes (50.59, part 21)
- This topic needs a workshop all by itself.

# FRN 50.46c(m)

- Reporting

- “predicted response” is subject to miss-interpretation
- “Operation inconsistent” – needs clarification
- “submitting a reanalysis” – new requirement
- “a demonstration” – what does this mean?
- “30 days” – 60 days better aligns with other requirements
- 0.4% ECR significance determination is not performance based
- “calculated” – new requirement to calculate versus estimate  $\Delta$  PCT
- Including rackup of PCT and ECR in UFSAR
- Does rackup PCT and ECR re-baseline AOR

# FRN

- Definition – increase number of definition
  - e.g., Long term cooling evaluation model, break spectrum
- Allow use of CP in Appendix K for oxidation and beyond
- Clarify acceptance of hydrogen pickup for LOCA
- Grandfathering irradiated assembly / re-inserts
- 1% core wide oxidation not performance based
- Crud inspection implications
- Complex multifaceted rulemaking
  - NRC internal coordination
- More Industry –NRC communication needed

# Summary

- More Communication Needed
  - Better Define a Variety of Issues
  - Test Drive an Implementation Plan
- Regulatory Guidance
  - Clarification
  - Missing
- Practical Implementation
  - Resource Constraints
    - Regulatory / Industry
  - What is Compliance

# Standard Tech. Spec.

## NUREG-1431

### 5.6.3

#### CORE OPERATING LIMITS REPORT

- a. Core operating limits shall be established prior to each reload cycle, or prior to any remaining portion of a reload cycle, and shall be documented in the COLR for the following:

[ The individual specifications that address core operating limits must be referenced here. ]

- b. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

-----REVIEWER'S NOTE-----  
Licensees that have received prior NRC approval to relocate Topical Report revision numbers and dates to licensee control need only list the number and title of the Topical Report, and the COLR will contain the complete identification for each of the Technical Specification referenced Topical Reports used to prepare the COLR (i.e., report number, title, revision, date, and any supplements). See NRC ADAMS Accession No: ML110660285 for details.

[ Identify the Topical Report(s) by number, title, date, and NRC staff approval document or identify the staff Safety Evaluation Report for a plant specific methodology by NRC letter and date. ]

- c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.