



ICNC 2011

Regulatory Uncertainty

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Introduction

- Significant increase in SFP NCS licensee amendment requests
 - ~ 35-40 SFP NCS LARs since 2006
 - ~ 6 per calendar year
 - Prior to 2006 (back to 2000) no more than two a year
- Significant increase in complexity of SFP NCS analysis

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The Regulations (1/1)

- 10CFR50 Appendix A GDC
 - 61: Fuel Storage, Handling, & Radioactivity
 - 62: Prevention of Criticality
- 10CFR70.24
 - Monitor/Detect/Mitigation/Recovery
 - Emergency Plan/Drills
- 10CFR50.36
 - Limiting Conditions for Operation
 - Design Features
- 10CFR50.68
 - No Boron; $k_{eff} \leq 0.95$ at 95/95
 - Boron: $k_{eff} < 1.0$ w/o & ≤ 0.95 w/ at 95/95

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The Guidance (1/2)

- RegGuide 1.13, *Spent Fuel Storage Facility Design Basis*,
 - Initial 1971
 - Rev 2 2007
 - GDC 61
- NUREG 0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition — Auxiliary Systems*
 - Initial Nov 1975
 - Rev 3 2007
 - Section 9.1.1 GDC 61
 - Section 9.1.2 GDC 62

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The Guidance (2/2)

- Generic Letter 1978-11, *Review and Acceptance of Spent Fuel Storage and Handling Applications*
 - April 1978
 - Modified by GL 1979-04, *Modifications to NRC Guidance "Review and Acceptance of Spent Fuel Pool Storage and Handling"*
 - January 1979
- "Kopp Letter"
 - Internal Memorandum
 - November 1998
 - Soluble Boron credit

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The History (1/3)

- GDC & pre-GDC
- Initial SFP racks low density
- 10 CFR 70.24
 - Exemptions
- SFP re-racking begins
 - Mid – Late 1970s
 - Installed neutron absorber
- GL 1978-11 & 1979-04
 - Guidance for re-rack
- GL 1996-04 Boraflex Degradation
 - PWR SFP NCS Soluble Boron Credit
 - BWR no LAR

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The History (2/3)

- Kopp Letter
 - Guidance for soluble boron credit
 - Depletion uncertainty
- 10 CFR 50.68
 - Either/or with respect to 10 CFR 70.24
 - Soluble Boron Credit
- Current SFP NCS LARs
 - PWR
 - Regain lost storage capacity
 - BWR
 - Interim Boraflex degradation compensation
 - Boraflex replacement

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The History 3/3

- It isn't your Grandparent's SFP
 - Increased SFP capacity due to re-rack
 - Increased fuel enrichments
 - Increased use of burnable absorbers
 - New fuel assembly designs
 - New fuel assembly materials
 - Burnup credit
 - Soluble Boron credit
 - Deterioration of installed neutron absorbers
 - Increased storage configuration complexity
 - Operating Parameters

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The Uncertainty (1/5)

- More Complex Analyses Required
- More Complex Storage Configurations
- Material Degradation
- New Information
- Lack of a Holistic Approach
- Low Quality Submittals

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The Uncertainty (2/5)

- Historic assumption ‘...my analysis is conservative because it ignored Xe-135...’
 - Is it conservative to ignore Xe-135?
 - No, it is a fact of life.
- What is the harm in the assumption?
- Uncertainty
 - What nuclides are included?
 - Does the analyst understand all the phenomena.

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The Uncertainty (3/5)

- Historic assumption ‘...conservative because it ignored spacer grids...’
 - Is it conservative to spacer grids?
 - How do you know?
 - What is the basis for the assumption, are there any conditions or limitations?

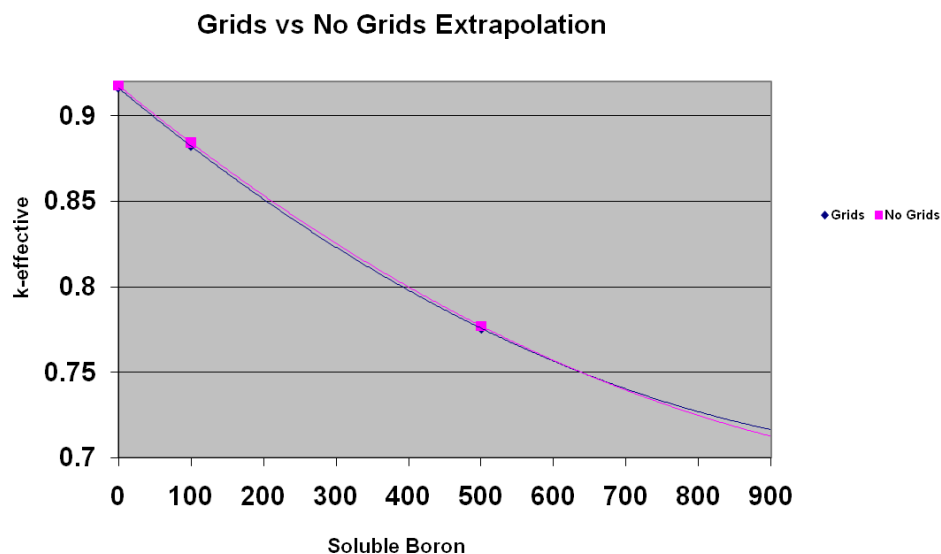
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The Uncertainty (4/5)



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The Uncertainty (5/5)



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The Solution 1/5

- NRC/NRR is Engaging Industry
 - Hosted five public meetings
 - RIC Session in 2010
 - Attendance/Presentation at industry forums.
 - Attendance at industry conferences
 - Formal NCS training
 - Preparing new guidance
- Coordinating with other NRC offices
 - NMSS, RES & NRO
 - Joint NCS Technical Advisory Group
 - Joint Contract with ORNL

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The Solution 2/5

- NRC/NRR Guidance Documents
 - NRR Action Plan
 - Update expected any day
 - Interim Staff Guidance, DSS-ISG-2010-01, Staff Guidance Regarding the Nuclear Criticality Safety Analysis for Spent Fuel Pools
 - Draft October 2010
 - ADAMS ML102220567
 - Final expected October 2011

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The Solution 3/5

- What is in DSS ISG-2010-01?
 - Selection of the FA to be modeled.
 - Depletion modeling of the fuel in the reactor
 - Rx Operating Parameters
 - Depletion uncertainty from the Kopp Letter.
 - Criticality analysis in the SFP
 - Axial BU Profile
 - Accident conditions
 - Validation of the criticality code
 - Actinides and Fission Products
 - Relies heavily on other documents
 - NUREG/CRs

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The Solution 4/5

- Future Work
 - Joint NRR/NRO/NMSS/RES Contract
 - NUREG/CR Depletion Validation
 - NUREG/CR Criticality Code Validation
 - More Durable Guidance
 - New RegGuide on SFP NCS
 - Revise RegGuide 1.13
 - Revise SRP 9.1.1
 - Retire the Kopp Letter

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The Solution 5/5

- What Licensees Can Do Today?
 - Review recent submittals, Requests for Additional Information responses, and Safety Evaluations from other licensee LARs
 - Review recent problems that have occurred at SFPs that have resulted in enforcement actions
 - Recognize that margins have decreased requiring more analyses with less engineering judgment
 - Take a holistic approach
 - Come in for pre-submittal meetings
 - Improve quality

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The Conclusion

- A NCS analysis for SNF is complex and multi-faceted.
- Regulatory certainty is two way street.