New Reactor Fuel Design

RIC 2008 Technical Issues/Systems Session

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Outline

- **New Reactor Fuel Design Features**
- **New Reactor Fuel Acceptance Criteria**
- **New Reactor Fuel Design Impacts on Regulatory Review**
  - **Critical Heat Flux**
  - **Fuel Management and Safety Limits**
  - **Large Break Loss of Coolant Accident**

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New Reactor Fuel Design Features

PWR
- 14 ft fuel active length

BWR
- 10 and 12 ft fuel active length

PWR / BWR
- Up to 24-month cycle
- Higher density pellet (up to 97% Theoretical Density)
- Higher burnable poison content
- *Maximum rod burnup*
- *U235 enrichment < 5 wt%*

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New Reactor Fuel Acceptance Criteria

- 10 CFR Part 50, Appendix A, "General Design Criteria For Nuclear Power Plants"
- Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants"
- NUREG-0800, "Standard Review Plan," (Chapter 4, Reactor)
  - Provides guidance to assure compliance with 10 CFR 50, Appendix A

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New Reactor Fuel Design Impacts on Regulatory Review

Example: Critical Heat Flux Correlation (CHF) review for a new reactor design with a core height outside of vendor's operational experience in United States.

CHF: Represents the upper limit of allowable heat flux
- Core height dependent
- Requires Lead Test Assembly program or testing

Challenge: Not all applications contain sufficient test data to support acceptance per NUREG-0800 guidance

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New Reactor Fuel Design Impacts on Regulatory Review (cont.)

Example: Core management and safety limits

- Safety limits are based on planned operation of the core
- Initial and subsequent core loadings must be bounded by safety limits

Challenge: Not all applications contain sufficient analyses. Initial and equilibrium cycle analyses are needed to support the review

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New Reactor Fuel Design Impacts on Regulatory Review (cont.)

Example: Large Break Loss of Coolant Accident (LBLOCA)

- Codes and methods must be verified as applicable to the new reactor design
- Critical parameters must be based on approved codes and methods or on test data.

Challenge: Many applications lack statistically significant test data to support the safety limit predications. Example: Realistic LBLOCA

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Summary

To support the review schedules, the staff will be working with the applicant:

- To ensure applications contain sufficient detail
- To ensure initial and equilibrium core designs are provided for review
- To ensure that accident analyses is based on accepted methodologies and codes applicable to the new reactor and fuel design
- To ensure that subsequent amendments to the existing applications contain high level of quality

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