



Certification/Licensing Approaches for High Burnup Spent Fuel

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Overview

- Purpose
- Storage
 - Regulatory Requirements and Guidance
 - Certification/Licensing Approach
- Transport
 - Regulatory Requirements and Guidance
 - Certification Approach
- On-going Research and Other Activities
- Summary

Purpose

- Develop certification/licensing approaches for high burnup spent fuel storage and transportation applications while on-going research and other activities continue

Geometric Form – Storage

Current Regulatory Requirements and Guidance

- **Confinement barriers and systems**
 - Maintain cladding integrity 10 CFR 72.122(h)
- **Retrievability**
 - Be able to readily retrieve fuel per 10 CFR 72.122(I)
- **Guidance**
 - ISG-11, “Cladding Considerations for the Transportation and Storage of Spent Fuel”
 - ISG-2, “Fuel Retrievability”

Licensing Approach – Storage

- Initial 20-Year License Term
 - 10 CFR 72.42(a) authorizes licenses up to 40 years
 - Idaho cask inspection of low burnup fuel and discussion in ISG-11 give staff reasonable assurance for 20 year initial license
- License Renewal
 - Demonstrate that fuel and canister will remain as expected for period of less than or equal to 40 years through data from time limited aging analysis, research, demos, etc.

Canister Qualification for Storage

- Appropriate learning aging management program and inspections/tests of canisters if relied on as a component important to safety
- Conservative assumptions with respect to canister behavior under accident conditions

Geometric Form – Transport

Current Regulatory Requirements and Guidance

- **Normal Conditions of Transport:**
 - geometric form of the package contents would not be substantially altered per 10 CFR 71.55(d)(2)
 - Loading/Unloading procedures per 10 CFR 71.89



United States Nuclear Regulatory Commission

Protecting People and the Environment

Certification Approach – Normal Conditions of Transport

- Verify assembly condition, if not canned, at the time of loading
- Evaluate fuel structural performance using best estimate materials data
- Evaluate thermal, containment, shielding, and criticality safety requirements assuming worst credible fuel configuration (defense in depth)
- Verify loading/unloading safety requirements and procedures based on fuel conditions after transport to meet 71.89

Geometric Form – Transport Current Regulatory Requirements and Guidance

- **Hypothetical Accident Conditions:**
 - fissile material evaluated in the most reactive credible configuration per 71.55(e)
 - Certification approach already developed and historically used
- **Guidance**
 - ISG-19, “Moderator Exclusion Under Hypothetical Accident Conditions and Demonstrating Subcriticality of Spent Fuel Under the Requirements of 10 CFR 71.55(e)”

Canister Qualification for Transport

- If used as a second barrier for moderator exclusion, appropriate tests and analyses are needed to determine canister condition prior to transport
- Conservative assumptions with respect to canister behavior under accident conditions

On-Going Research and Other Activities on High Burnup Fuel

- Vibration tests for Normal Conditions of Transport
- Bend tests to characterize cladding properties
- Fuel reconfiguration consequences evaluation
- High Burnup Dry Storage Cask Demo
 - Licensees expected to monitor and take appropriate action
 - NRC will monitor results

Summary

- Certification/licensing approach necessary to address current high burnup fuel applications.
- Licensees will be expected to monitor research and other activities to determine applicability.
- Approving high burnup fuel for storage and renewal beyond 20 years.
- Defense in depth, operational controls, oversight and inspection have significant role in certifying high burnup transportation packages



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