High Burnup Licensing for Storage and Transportation

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Industry Comments Overview

- New requirements are being stipulated in the RIS
- Approach is based on laboratory experiments that are not representative of spent fuel assemblies
  - Ring compression testing of defueled cladding does not account for benefit of fuel-clad bond or presence of the fuel pellet.
  - Insufficient stresses in storage and transportation to cause significant fuel reconfiguration.
- Clarification needed that this is only applicable for license renewal (not initial license period)
- Licensing approach needs to be risk-informed
- RIS needs to rely on ISG-24 as the principle basis for storage and transportation of high burnup fuel.
- Backfit discussion needs to be modified

Regulatory Requirements

- Storage - 10CFR72.122(h):
  - "The spent fuel cladding must be protected during storage against degradation that leads to *gross* ruptures or the fuel must be otherwise confined such that degradation of the fuel during storage will not pose *operational safety problems* with respect to it's removal from storage"

How are Regulatory Requirements Met?

- Storage:
  - Inert environment (i.e., helium)
  - Limited/no residual water via established drying process
  - Basket/canister design prevent significant fuel movement
  - Limitation of the peak clad temp below 400°C (realistically much lower)
  - Natural events fail to cause significant stresses on the fuel
  - Confinement boundary prevents water ingress

Regulatory Requirements

- Transportation - 10CFR71.55(d)(2):
  - "The geometric form of the package contents would not be *substantially* altered under normal conditions of transport described in 10CFR71.71"

How are Regulatory Requirements Met?

- Transportation:
  - Inert environment (i.e., helium)
  - Limited/no residual water via established drying process
  - Containment boundary and canister independently prevent water ingress (moderator exclusion)
  - Limitation of the peak clad temp below 400°C (realistically much lower)
  - Impact limiters reduce stresses on package and contents during hypothetical accident conditions to prevent substantial alteration

Risk-Informed Perspective

- Risk-informed perspectives and risk analysis continually show low risks
  - EPRI and NRC Dry Storage PRAs conducted in 2007
  - Annual cancer risk between 1.8E-12 and 3.2E-14 *

High Burnup Fuel is Likely NOT Brittle

- EPRI Results
  - Best estimate: No or little re-orientation should be expected during dry storage
    - Consequence: no unexpected behavior during storage and transportation

- Fuel and cask/canister internals issue: "significant" fuel geometric rearrangement?
  UNLIKELY EVEN FOR ACCIDENT CONDITIONS

Radionuclide release (if any) due to loss of confinement is a slow, low health consequence process

* Compares to 2E-6 LCF/yr. public & 1E-5 LCF/yr . worker thresholds of negligible risk from NRC's framework for "Risk-Informed Decision-making for Nuclear Material and Waste Applications", Revision 1, February 2008

Link to Retrievability

- Retrievability
  - Framework for retrievability should focus on the dry storage system to perform the safety function, with cladding as defense in depth
  - Technologies exist today to handle fuel with gross ruptures or structural defects without impact on worker or public safety.
  - A revised performance-based and risk-informed definition for “canister-based” retrievability needs to be established.

Backfit Discussion

- Proposed Rulemaking (PRM) 72-7 requests extending backfit protection to CoC holders:
  - Allows resources to "be focused on regulatory activities that will yield the most substantial safety benefits"
  - Adheres to principles of fundamental fairness that underlie the application of the backfitting rule
  - Consistent with NRC's Principles of Good Regulation, "…regulation should be perceived to be reliable and not unjustifiably in a state of transition."
- Remove language about backfit "protection"

Summary

- Newer studies are showing that high burnup fuel is not significantly different (high burnup fuel may actually be better – as seen in operation through lower fuel leaker rate)
- Previous experimental tests were not representative of actual spent fuel
- Need to adhere to the actual words contained in the Code of Federal Regulations – no extra-regulatory requirements
- Current cask designs and loading operations already provide reasonable assurance that fuel assemblies will be protected against significant degradation.