

Aging Management in Storage and Transportation of Spent Nuclear Fuel



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Need

- Condition of Components at end of Storage must be known to analyze the behavior of Components during transportation
- Models and analysis of components at the start of storage are not confirmation of the condition of components at the end of storage.
- Not an issue where canister has aging management plan in place for storage license extension
- Only for systems and fuel that have been in prior storage



IAEA Joint Working Group on Guidance for an Integrated Transport and Storage Safety Case for Dual Purpose Casks for Spent Nuclear Fuel

- Issue - License duration differences and regulation changes
- Task – Prepare a Joint Safety Case (SRP)
 - Scope - Direct loaded and canisterized systems
 - Section 1.9 – Mandatory aging management program (most likely based on NUREG-1927) to be developed by sub-group over the next nine months
- Japanese approach on HBU fuel – Lower storage temperatures (275°C), demonstration program, aging management program, cask never opened for transport.



Regulation Synopsis

- 71.33(b)(3) - package must include description of chemical and physical form of contents
- 71.83(a) - 1st use - No cracks, pinholes, defects that substantially reduce packaging effectiveness
- 71.85(b) - 1st use - Testing 150% of operating pressure
- 71.87 (b) - Only superficial defects
- 71.87(c) - Closure devices properly installed, secure, defect free
- 71.87(f) - Loaded according to written procedures
- 71.87(g) - Neutron absorbers present and in proper condition
- 71.87(h) - Structural part used for lifting is rendered inoperable



Storage Changes affecting Transportation

- Has condition of contents, absorbers, shielding changed during the storage period?
- **Analysis of structural behavior of package and contents**
 - Condition of package at start of transport; has it changed from initially analyzed condition during storage?
 - Have material properties changed during storage?



Components of Concern

Direct Load

- Fuel Condition
- Absorbers
- Basket
- Seals
- Shielding
- Cask Structure

Canisterized

- Fuel Condition
- Absorbers
- Basket
- Canister Leak-Rate
- Canister Condition

Cladding Issues

- Since the DCSS interior and cladding cannot reasonably be inspected:
 - **LBU** - NUREG/CR-6745, “Detailed Examination of Spent PWR Fuel Rods after 15 Years in Dry Storage,” Sept 2003. DCSS interior and low-burnup fuel cladding had no deleterious effects after 15 years of storage.
 - **HBU** - No data regarding potential long-term degradation of high-burnup fuel cladding. Applicant should provide supporting data demonstrating high-burnup fuel performance during storage.



Absorber & Basket

- Absorbers
 - Boron depletion during 80 yr storage not an issue
 - Has incomplete drying resulted in degradation? (material specific)
- Basket
 - Weld cracks

Canister

- If used as a second independent barrier and moderator exclusion claimed
 - Retains containment capability
 - Has not degraded during storage to condition where it breaches during HAC
 - No observable rust on welds, crevices of the coolest canister.
- Moderator exclusion not needed
 - Maintains capability to be transferred to transport overpack
 - Data to show withdrawal forces within approved specifications has been acceptable.
- Confirmation testing to be acceptable may be site specific



Summary

- Aging management need to assure systems and fuel that have seen prior storage can meet 10 CFR 71 requirements for safe transportation
- Additional work is necessary to implement aging management inside the canister
- International Issue