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Holtec's Perspective on Storage – Transport – Storage Transitions for Spent Fuel Canisters

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Holtec's Perspective on Storage – Transport – Storage Transitions for Spent Fuel Canisters

- Holtec Systems
- Storage to Transport (10 CFR 72 -> 10 CFR 71)
- Transport to Storage (10 CFR 71 -> 10 CFR 72)
- Summary

Holtec Systems

- HI-STORM 100 Storage System
  - o -> HI-STAR 100 Transport Cask
  - o -> HI-STORE CIS (under NRC review)
- HI-STORM FW and HI-STORM UMAX Storage Systems
  - o -> HI-STAR 190 Transport Cask
  - o -> HI-STORE CIS (under NRC review)

Storage to Transport (72 -> 71)

- Relevance of the canister integrity (leak-tightness) to the various safety functions of the cask under transport conditions
  - ***Structural***
    - Not relevant. Structural safety provided by the cask, independent of the canister
  - ***Thermal***
    - Not relevant. Canister integrity issue would at most result in some gas pressure adjustments, with no impact on the thermal performance
  - ***Shielding***
    - Not Relevant
  - ***Containment***
    - Not relevant!
      - Safe enclosure of the content is shown to be provided by the cask body, and the bolted lid with the seals.
      - The canister, if present, is NOT credited in any activity release calculations

Storage to Transport (72 -> 71), cont.

- Relevance of the canister integrity (leak-tightness) to the various safety functions of the cask under transport conditions
  - ***Criticality***
    - NCT - Normal conditions of Transport
      - Not relevant. Cask Cavity is assumed to be fully flooded. Canister, if present, is NOT credited.
    - HAC – Hypothetical Accident Conditions of Transport
      - Moderately burned fuel (MBF)
        - » Not relevant. MBF under accident conditions considered to be equivalent to normal conditions.
      - High Burnup Fuel (HBF)
        - » ***Relevant!***
        - » HBF rods *may* break under HAC. This would lead to fuel reconfiguration, i.e. fuel si no longer in the same configuration as under NCT. This *may* increase the reactivity *if* the cask would be flooded with water.
        - » Defense-in-depth criticality calculations with fuel reconfiguration typically show a small effect.
        - » Nevertheless, the presence of the canister can be credited to provide “moderator (water) exclusion”. In the absence of water, any fuel reconfiguration would be inconsequential from a criticality perspective.

Storage to Transport (72 -> 71), cont.

- EPRI performed a probability evaluation of spent fuel transports some time ago[1], and concluded that the probability of a criticality accident during transport would essentially be zero (a value of 1E-16 is reported).
- Regulatory decisions and guidance should be in line with the safety relevance of the integrity of the canister

1 – Multi-Facet Approach for Evaluating Criticality Risks during Transportation of Commercial Spent Nuclear Fuel, A.J. Machiels and J.H. Kessler, EPRI, Patram Conference 2010

Transport to Storage (71 -> 72)

- The canister is the confinement (~containment) boundary for the fuel under storage conditions
- Hence every canister accepted at a 10 CFR 72 facility must meet the canister integrity requirements for the site
- The easiest and most straight forward approach to assure this is an acceptance test when the canister is received
- Possible methods
  - Fission (Krypton) product detection
  - Helium leak test
  - Surface Inspection

Summary

- Holtec has approved storage and transport systems, and a compatible CIS facility under NRC review
- Storage to Transport: Regulatory Guidance needed that recognizes the safety relevance of the canister during transport
- Transport to Storage: Acceptance test appears the easiest approach