
AREVA

Considerations for Transportation Licensing of Used Fuel Already in Dry Storage

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- History of Dry Storage in USA
- Current Status
- Challenges Encountered in Transportation Licensing
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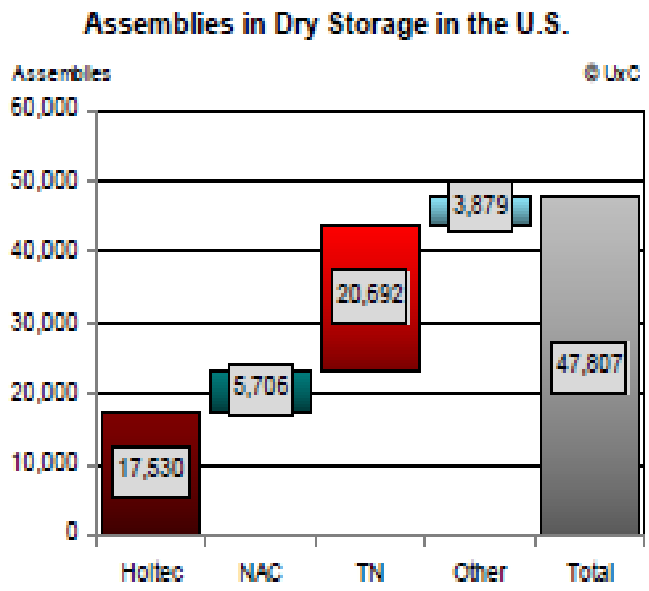
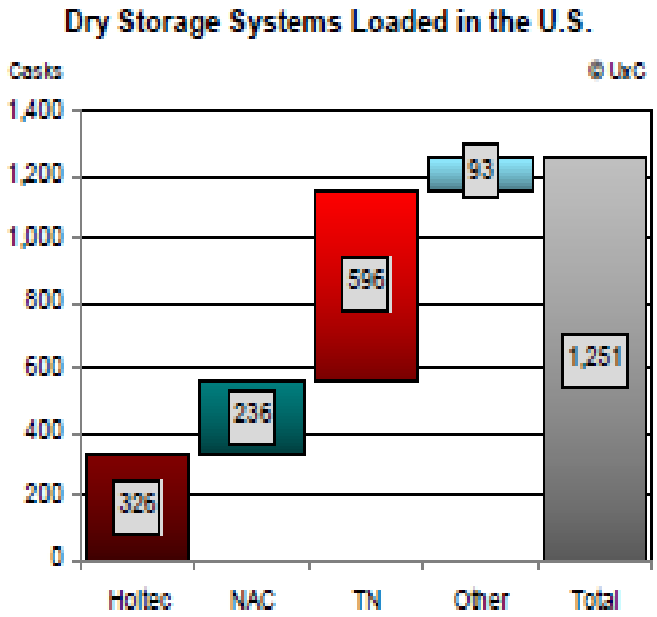
Some Early Dry Storage Systems were Designed for Storage Only

- In USA commercial used fuel is stored in fuel pools or in dry storage at sites
- Dry storage systems are typically vertical metal or concrete overpacks (casks) with or without canister or horizontal overpacks with canister
- Dry storage systems have been deployed at various utility sites for more than 20 years
- Some of the early systems are storage only designs
- Current designs are mostly dual purpose (designed for both storage and transportation)
- It is important to qualify these storage only systems for transportation

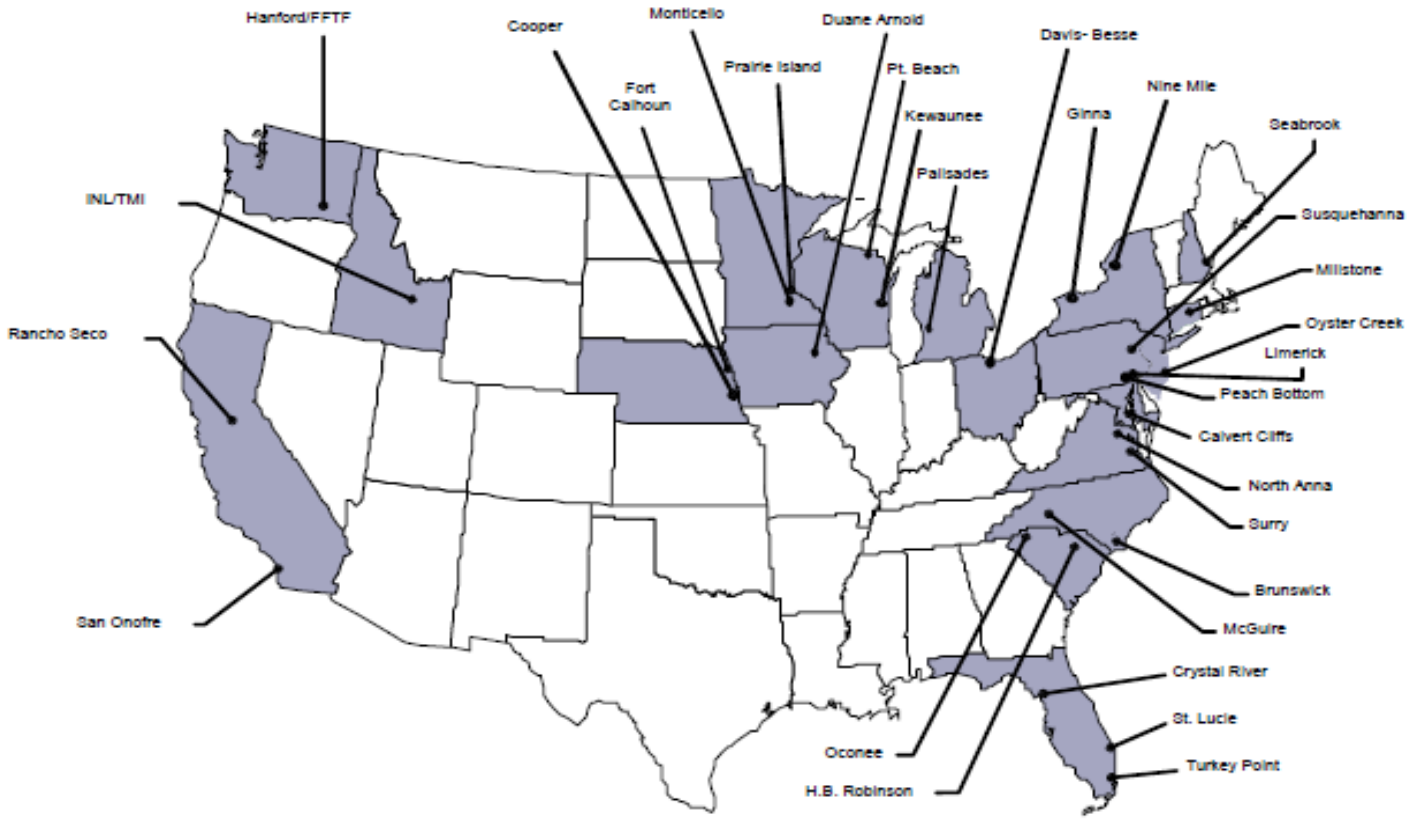
More than 50,000 Used Fuel Assemblies in Dry Storage in USA

- **Data Taken from StoreFUEL May 4, 2010**





Transnuclear Used Fuel Storage Sites in USA



NUHOMS® & TN Metal Storage Casks

Assemblies in Storage will Need to be Transported in the Future

- Site to Site
- Site to Central Storage Facility
- Site to Recycling Facility
- Site to Disposal Facility

Challenges Encountered in Transportation Licensing

- **Transnuclear is currently licensing for transportation a cask design which was initially approved for storage only**
- **Challenges Encountered in Transportation Licensing:**
  - **Difference in Storage and Transportation Regulations**
  - **Cask Drop Analysis**
  - **Fuel Drop Analysis & Fuel Cladding Material Properties**
  - **Computer Codes and Analytical Methods**
  - **Fabrication Considerations**
  - **Effect of Loaded and in-Storage Casks Considerations**

Differences in Storage And Transportation Regulations

- Differences in criticality analysis using burnup credit
- Testing requirements during fabrication for gaps (effect on shielding and thermal performance)
- Leak testing of containment boundary
- Currently accepted regulatory practices and expectations are different now than they were when these storage only systems were licensed

Actual Cask Drop Tests are Impracticle

- **Cask Drop Analysis:**
  - **Impractical to perform regulatory drop tests on already loaded casks**
  - **Postulated drop accidents need to be evaluated by analysis**
  - **Computer code models need to be extensively benchmarked against other similar drop tests to confirm code and modelling verification and validity**
  - **Results in a very conservative cask drop model**

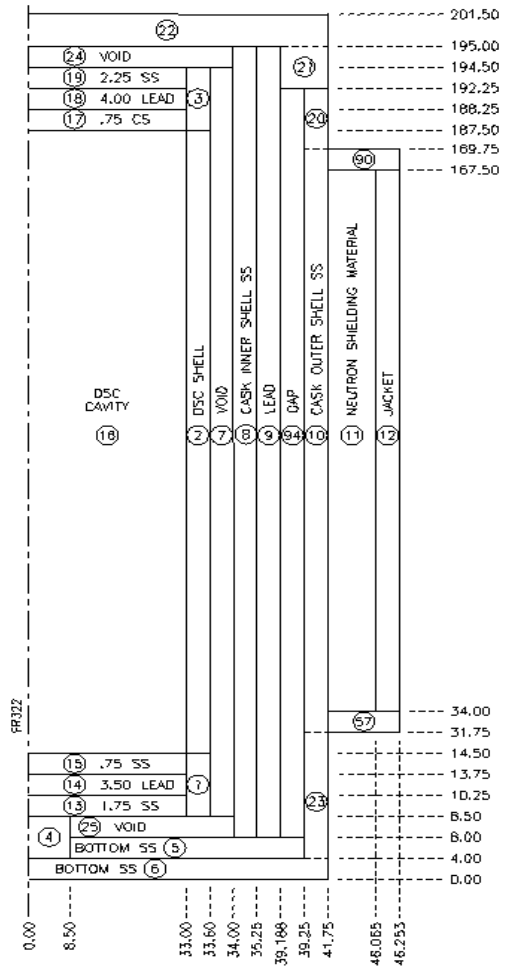
Conservative Approaches to Fuel Drop Analysis

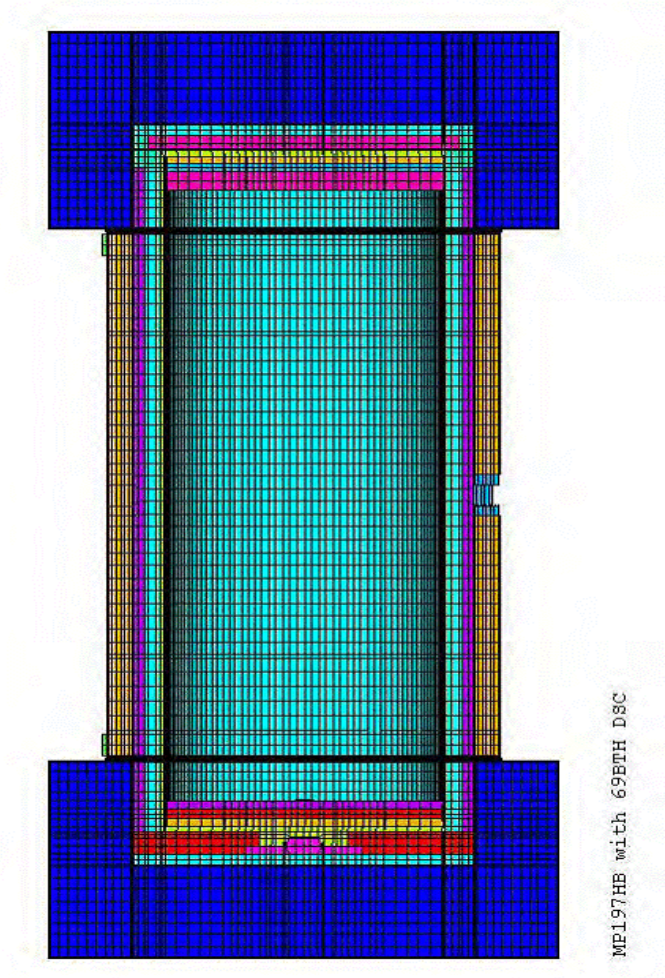
- **Fuel Drop Analysis & Cladding Material Properties:**
  - **Almost all the fuel in early storage designs is lower burnup (<45GWD/MTU)**
  - **Current fuel drop analysis approach envelops higher burnup fuels (>45 GWD/MTU)**
    - **Fuel cladding material properties**
    - **Gaps between fuel assemblies and container**
    - **Gaps between container and shock absorber**
    - **No structural credit for fuel pellets**
    - **Assumptions made based on higher burnup fuel are very conservative for lower burnup fuel**

Computer Codes And Analytical Methods are Complex

- **Analysis Methodologies have evolved over time to accommodate higher burnup, higher enrichment and higher decay heat fuel and capacity of casks have also increased:**
  - **Application of same methods for the casks which are in storage with relatively lower burnups, enrichments and decay heats is overly conservative**
  - **Additional benefits obtained by increasing margins is not warranted because demands on the transportation cask with lower burnup, cooler payload is not as challenging as high burnup payload**

Evolution of Thermal Analysis Models





Fabrication Considerations

- Requirements for leak testing of the cask during storage licensing and during transportation licensing are different
- Cask shielding material integrity testing requirements are different during storage licensing and during transportation licensing
- Qualification testing requirements for basket neutron absorber materials have evolved over time
- Thermal (effect of gaps during fabrication) testing if requested during regulatory review is also a challenge as these casks are already fabricated and loaded

Summary

- It is overly conservative to apply the current practices and approaches which are based on higher burnup, higher enrichment and higher decay heat load systems to early storage system designs
- More realistic models should be considered which accounts for the lower burnups and lower decay heat loads of earlier storage designs
- During preparation of safety analysis for transportation application, careful considerations should be given to the challenges outlined earlier to avoid lengthy regulatory review
- Pre-application meeting with the regulators is essential to discuss proposed analytical approach and staff expectations to avoid unnecessary Request for Additional Information (RAI)