LOGISTICS

Impact on Transportation Package Design for Transport First and Then Interim Storage versus Interim Storage First and Transport

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- Storage System Design Loads
- Transport System Design loads
- Design Differences Between the Storage First and Transport First Design Options
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Introduction

- **Storage First System**
  - Fuel Assemblies Stored On Site
  - Design Criteria Based on 10CFR Part 72, NUREG (1536), and ASME Code
  - Analysis
  - Acceptance Testing (Fabrication)
- **Transport First System**
  - Fuel Assemblies Stored in the Interim Storage Facilities
  - Design Criteria Based on 10CFR Part 71, NUREG (1617), and ASME Code
  - Design also Needs to Meet Interim Storage Site Requirements for Storage
  - Analysis
  - Acceptance Testing (Fabrication)
  - Impact Limiter Testing

Storage System Design Loads

- 10CFR Part 72 Loads
  - Dead weight
  - Thermal (thermal stress)
  - Pressure
  - Handling loads
  - Accident loads
    - Seismic
    - Drop (80 inch drop)
    - Tornado wind loads
    - Tornado Missile impact loads
    - Fire
  - Nuclear (criticality and site dose rate)
  - Thermal (fuel cladding temperature)

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Transport System Design Loads

- **10CFR Part 71 Loads**
  - **Dead Weight**
  - **Thermal (thermal stress)**
  - **Pressure**
  - **Shock & Vibration**
  - **1 foot Drop**
  - **Accident loads**
    - **30 Feet Drop**
    - **Punch**
    - **Immersion**
    - **Fire**
  - **Nuclear (criticality and package dose rate limits)**
  - **Thermal (fuel cladding temperature)**

Storage First and Transport First Design Options

Storage First Option

- The system is designed for the maximum possible heat load, therefore the system design is normally dominated by the heat rejection capability
- Limited by maximum fuel cladding temperature
- Maximum fuel cladding temperature < 752°F (400°C, Normal storage condition)

Transport First Option

- The system design is limited by shielding considerations and thermal design is usually controlled by the maximum seal temperature
- Dose rate at 2m < 10 mrem/hour
- Dose rate at surface < 200 mrem/hour
- Dose rate at 1m < 1000 mrem/hour (accident)
- In addition, the system also needs to meet interim storage site design requirements

Storage First and Transport First Design Options

Effect on Heat Loads

	Heat Loads for Storage	Heat Loads for Transport
NUHOMS®- 24PTH	40.8 kW	26.0 kW
NUHOMS®- 32PTH	34.8 kW	26.0 kW
NUHOMS®- 32PTH1	40.8 kW	26.0 kW
NUHOMS®- 37PTH	30.0 kW	22.0 kW
NUHOMS®- 61BTH	31.2 kW	24.0 kW
NUHOMS®- 69BTH	35.0 kW	32.0 kW

For these DSCs, the storage radiation source terms are between 10% to 20% higher than transport radiation source terms

Storage First and Transport First Design Options

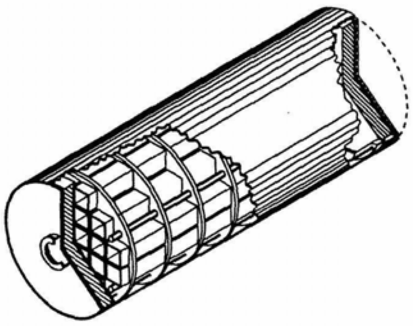
Effect due to Crane Capacities

	Storage First Design	Transport First Design
	Weight (DSC + Transfer Cask)	Weight (DSC + Transport Cask) Without Impact Limiters
NUHOMS®- 24PTH	96 metric tons	120 metric tons
NUHOMS®- 32PTH	104 metric tons	125 metric tons
NUHOMS®- 32PTH1	110 metric tons	125 metric tons
NUHOMS®- 37PTH	110 metric tons	125 metric tons
NUHOMS®- 61BTH	100 metric tons	125 metric tons
NUHOMS®- 69BTH	107 metric tons	122 metric tons

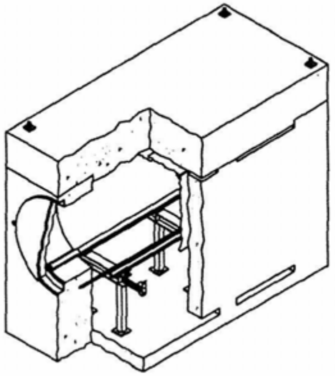
Transnuclear's Storage First System Design

- TN's Storage First System (NUHOMS®) Consists of the following Components:
  - A Dry Shielded Canister (DSC) that provides confinement, an inert environment, structural support, and criticality control for fuel assemblies
  - Transfer Cask (TC) that provides shielding and protection from potential hazards during the DSC closure operations and transfer to the Horizontal Storage Module (HSM)
  - A HSM that provides decay heat removal, physical and radiological protection for the DSC
- At the time of transportation, DSC is transferred from the HSM into a transport cask for transportation

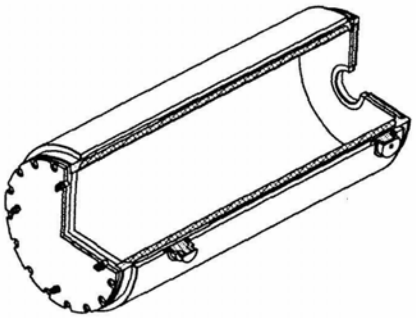
The NUHOMS® System



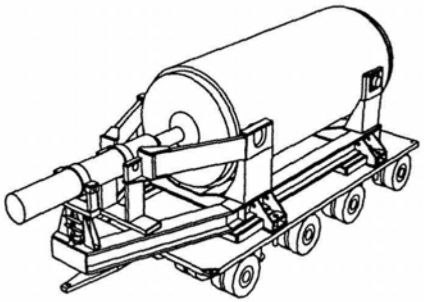
CANISTER
Provides containment and structural support for the fuel assemblies



STORAGE MODULE
Provides shielding, physical protection, and cooling for the Canister during long term storage



TRANSFER CASK
Provides shielding and physical protection for the Canister during transfer from the plant to the dry storage facility



TRANSPORTER
Transfers the Cask and Canister from the plant to the dry storage facility

System Operations



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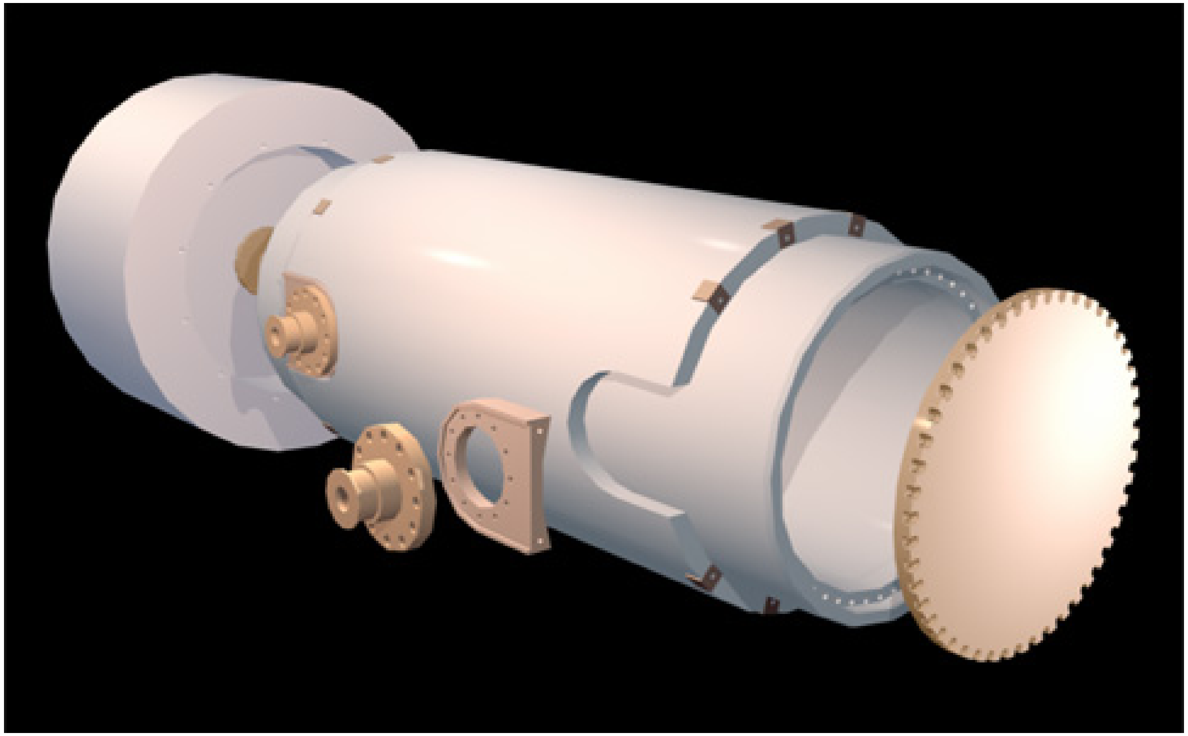
Transnuclear's Transport First System Design

- **MP197HB transport cask, placed in the spent fuel pool with 69BTH DSC during loading operation. Contains the 69BTH DSC and Impact limiters during transport operations.**



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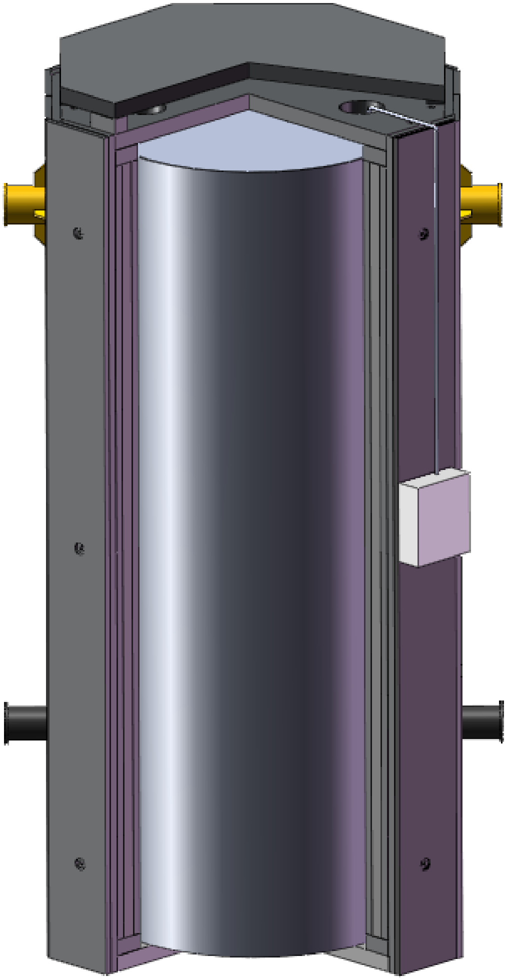
Transnuclear's Transport First System Design

- **TN NOVA storage system used to store the NUHOMS®-69BTH DSC in the vertical position.**



Conclusion

- **Storage first system has following advantages**
  - **Maximize heat loads - no dose rate limits**
  - **Maximize capacities - No limitation imposed by geometries**
  - **Maximize enrichment - Take boron credit in the pool**
- **NUHOMS® storage first system has several additional advantages**
  - **Horizontal Transfer**
    - **No Safety-Class Lifts at ISFSI**
    - **Minimize Stakeholder Concern**
  - **Optimize ISFSI Space Available**
    - **Optimum Cost-effective Shielding for Low Dose Rates**
    - **Most Space-Efficient Design**
  - **Proven, Demonstrated and simple Operation**
    - **Over 500 Canisters Loaded**
    - **Continuous Monitoring is not Needed**

Conclusion

- **Transportation first option also offers certain advantages under conditions where interim off-site storage facility is available**
  - Cost-effective since fuel is transported off-site
    - **Cost of ISFSI Maintenance is not required**
  - No need to consider the effects of aging and radiation / thermal environments under long term storage
  - The number of casks and schedule of shipments can be optimized to further reduce operation and maintenance costs