Transport and Storage Considerations for Management of Used Fuel

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Options selected to manage Used Fuel determine what issues will need to be addressed

Basic Options
- Store
- Recycle
- Disposal (Future)

Each management option has unique requirements and challenges

AREVA/TN Inc has been involved in all aspects of transport, storage, recycling and disposal of used fuel
On-Site Fuel Management Options

► On-Site wet storage
  ◆ Typical short term storage in fuel pools
  ◆ Re-racking is common
  ◆ Least expensive approach until fuel pool is full

► On-Site Dry storage
  ◆ Many Examples
  ◆ Over 50,000 fuel assemblies dry stored in the US
Off Site Fuel Management Options

- **Site-to-Site Transport and then Storage**
  - Used sparingly to take advantage of larger fuel pools
  - Oconee to McGuire (US)
  - Brunswick and Robinson to Shearon Harris (US)

- **Site-to-Central Storage Facility**
  - Early shipments to central wet storage facility (US)
  - Leibstadt to Zwilag (Switzerland)
  - Other locations

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Recycle and Disposal
Fuel Management Options

- Transport to Lag Storage
  - Can be either wet or dry
  - Can support both recycle and disposal
  - Yucca Mountain approach

- Site-to-Recycle
  - Recycling Facility

- Site-to-Disposal
  - Yucca Mountain
  - Future

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Management Issues with Used Fuel Storage

- Issues can be grouped into three areas
  - Transport now
  - Store
    - Wet and Dry
    - Short term and Extended
  - Transport later

- All options require some level of Transport
- Some of the issues are common to both Storage and Transport
Transport Now

- Regulations are well defined
- The issues are limited to a small window of time
- Issues can be addressed at the time of transport package licensing
- Approaches to safety and security evaluations are reasonably clear
  - Package Safety (Structural, thermal, criticality, shielding, containment)
  - Package Security
  - IAEA standards
  - Package license/CoC
  - Local validation of package for transport
- Transportation community share information
Wet Storage
- Pool capacity
- Re-racking of pool
- Materials issues
- Water Chemistry
- Security

Short to Intermediate Term Dry Storage
- Rules fairly well established at time of storage
- Containment/confine
- Materials issues
- Payload issues
- Natural phenomena protection
- Security Requirements

Extended Term Dry Storage
- All of the short to intermediate term issues
- Change in regulations
- Inspection/verification
- Materials Aging
- Material properties data and analytical methods for safety evaluations
Transport Later

- Dual Purpose (Transportation aspects)
  - Subject to changes in transportation regulations
  - Evolution of knowledge
  - Political pressures
  - Etc.

- Revalidation or upgrades difficult
  - Regulation differences between storage and transport
  - Transport casks built in the 1980s no longer meet current requirements
  - Testing to different requirements during fabrication (containment/thermal and shielding material testing)
  - MP187 able to meet requirements but restricted to 13kW (MP197HB now at 32kW with thermal test required)

- Counting on transport in the future carries a level of risk
How is the risk managed

- Minimize the length of time in storage
- Upgrade Dual Purpose system to stay current with current transport requirements if possible or practical
- Transportation under a one time exemption
- Use of different over-packs for storage and transportation (US, Switzerland, Spain, UK etc.)
- Flexibility and versatility in design (Transportation aspects)
Design Flexibility and Versatility
Canister Solution

- **Canister Solution**
  - Canister is dual purpose - meets the current storage and transport regulations
  - Can be stored in a licensed storage over-pack and transported in an existing licensed transport cask
  - If transport regulations change then future transport casks can accommodate these canisters as a payload
  - No need to unload or open up the canisters
  - Transport cask is the containment boundary
  - The canister is also a containment boundary but no credit is taken for this containment for transportation

- Must be opened to recycle
- May need to be opened for future disposal depending on the repository requirements
- Methods have been demonstrated for easily opening welded canister
- Transnuclear has designed the TAD canister which is compatible with the disposal requirements mandated by DOE
Design Flexibility and Versatility
Transport and Dual Purpose

TN DUO (introduced in another session)
- Dual Purpose
- Bare fuel cask
- Compatible with Recycling Facility

MP197HB (introduced in another session)
- Transport only
- Canister as a payload
- Compatible with Recycling Facility
- Able to transport canisters that are stored vertically or horizontally
- Directly compatible with NUHOMS® Concrete Storage Systems
- Directly compatible with TN NOVA® Metal Storage Systems
Conclusion

- If no other lesson is to be learned, the history in the used fuel storage and transportation industry guarantees change will occur.
- Increase of knowledge will occur which will impact regulations.
- Political pressure will modify the current regulations both locally and globally.
- Evolution of analysis methods and analytical and computational capabilities will cause evolution of the rigor required for qualification of packages.
- Economics may drive designs and regulations toward an even more risk based approach.
- Currently we are looking at:
  - SCC
  - High burn-up fuel
  - 130 year + storage in some locations
  - Higher seismic requirements
  - Multiple impact drop scenarios
  - Burn-up credit

Tomorrow ??