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Developing a Regulatory Framework for Extended Storage and Transportation

National Transportation Stakeholders Forum
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U.S. Nuclear Regulatory Commission

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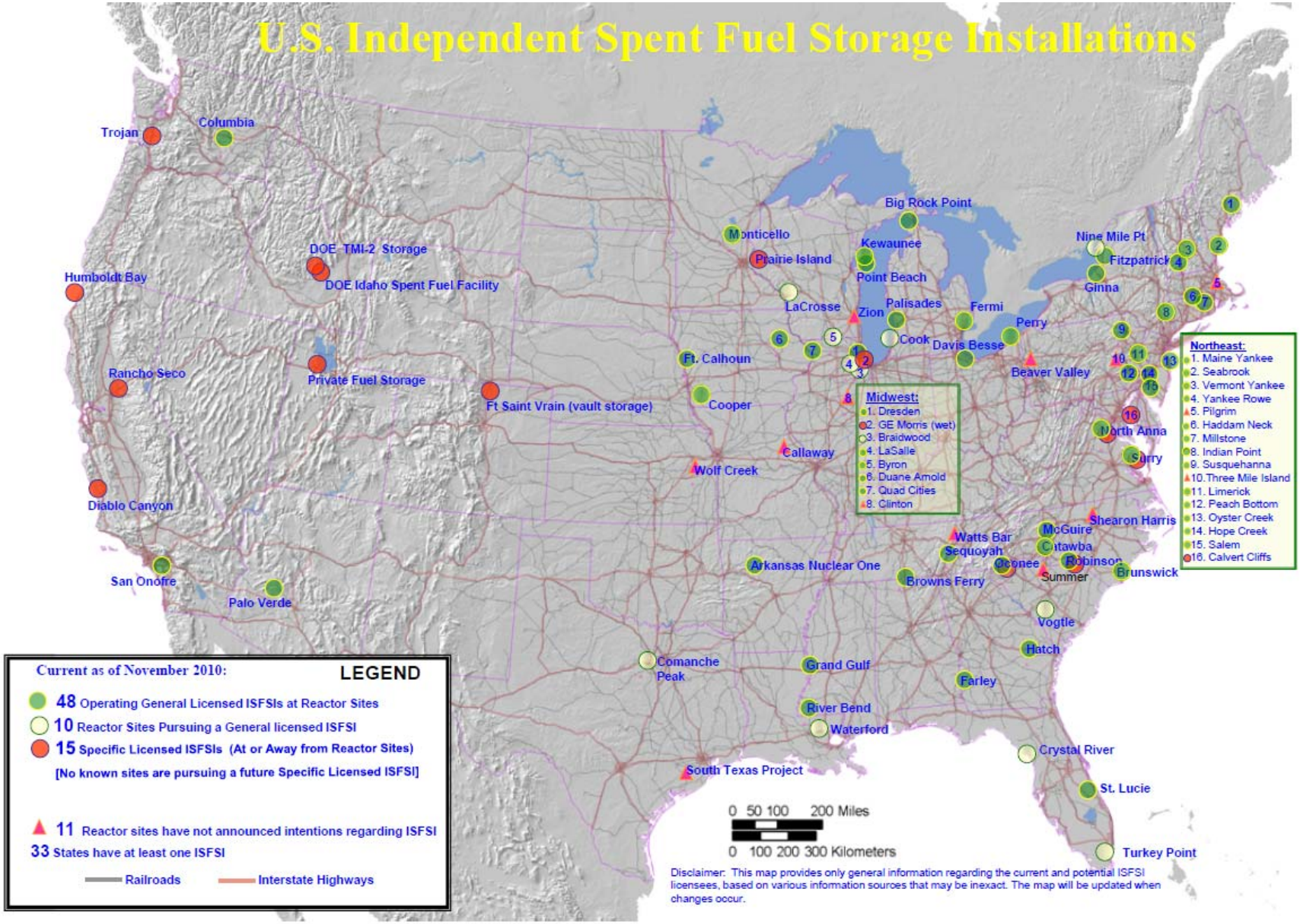
Outline

- Current Regulatory Framework
- Future Regulatory Needs
- Technical Basis (with some examples)
- Path Forward

Current NRC Regulatory Framework for Storage

- Renewable Term Licenses
- Aging Management Plan
  - Time-limited aging analyses
  - Design for prevention
  - Monitoring – how, how often, in-situ
  - Maintenance – what type
  - Corrective Actions – when

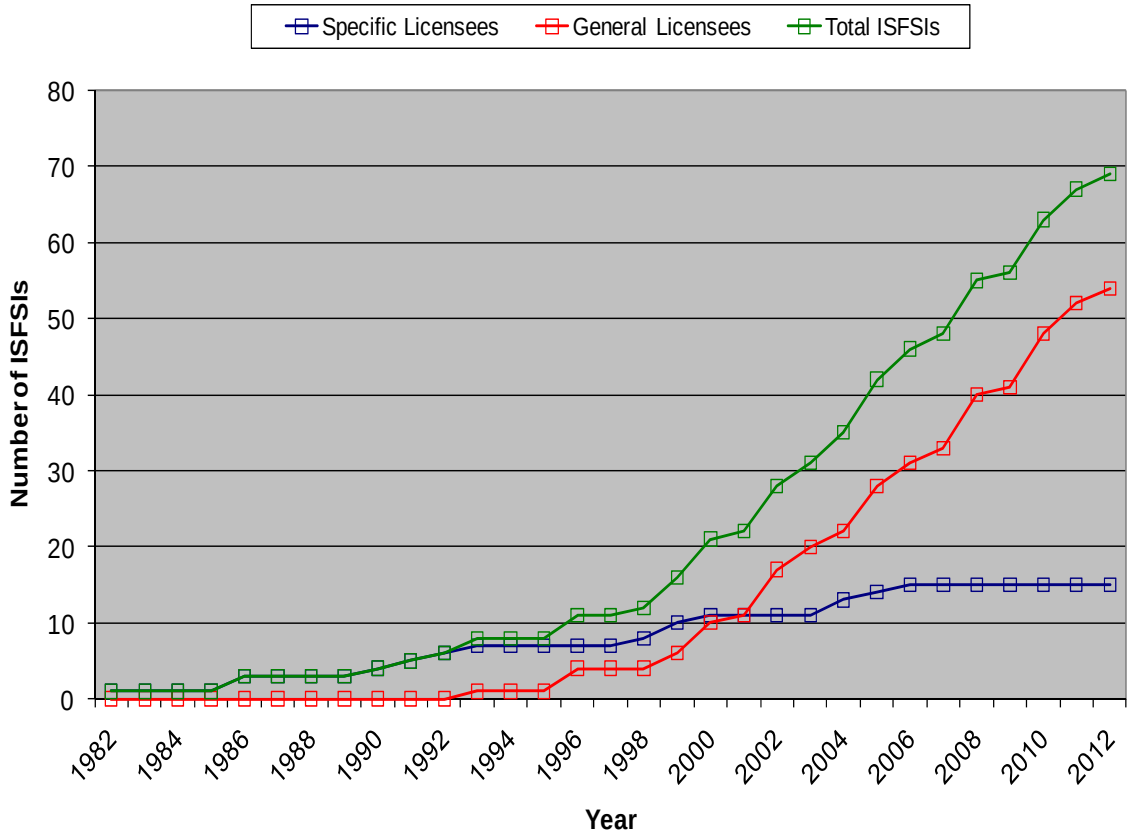

U.S. Independent Spent Fuel Storage Installations
Trojan
Columbia
Humboldt Bay
DOE TMI-2 Storage
DOE Idaho Spent Fuel Facility
Rancho Seco
Private Fuel Storage
Ft Saint Vrain (vault storage)
Diablo Canyon
San Onofre
Palo Verde
Big Rock Point
Monticello
Prairie Island
Kewaunee
Point Beach
LaCrosse
Zion
Palisades
Fermi
Perry
Cook
Davis Besse
Ft. Calhoun
Cooper
Callaway
Wolf Creek
Beaver Valley
Nine Mile Pt
Fitzpatrick
Ginna
Midwest:
1. Dresden
2. GE Morris (wet)
3. Braidwood
4. LaSalle
5. Byron
6. Duane Arnold
7. Quad Cities
8. Clinton
Northeast:
1. Maine Yankee
2. Seabrook
3. Vermont Yankee
4. Yankee Rowe
5. Pilgrim
6. Haddam Neck
7. Millstone
8. Indian Point
9. Susquehanna
10. Three Mile Island
11. Limerick
12. Peach Bottom
13. Oyster Creek
14. Hope Creek
15. Salem
16. Calvert Cliffs
North Anna
Surry
Shearon Harris
McGuire
Catawba
Watts Bar
Sequoyah
Oconee
Robinson
Summer
Brunswick
Arkansas Nuclear One
Browns Ferry
Vogtle
Hatch
Comanche Peak
Grand Gulf
Farley
River Bend
Waterford
Crystal River
South Texas Project
St. Lucie
Turkey Point
Current as of November 2010:
LEGEND
48 Operating General Licensed ISFSIs at Reactor Sites
10 Reactor Sites Pursuing a General licensed ISFSI
15 Specific Licensed ISFSIs (At or Away from Reactor Sites)
[No known sites are pursuing a future Specific Licensed ISFSI]
11 Reactor sites have not announced intentions regarding ISFSI
33 States have at least one ISFSI
Railroads
Interstate Highways
0 50 100 200 Miles
0 100 200 300 Kilometers
Disclaimer: This map provides only general information regarding the current and potential ISFSI licensees, based on various information sources that may be inexact. The map will be updated when changes occur.

Dry Cask Storage

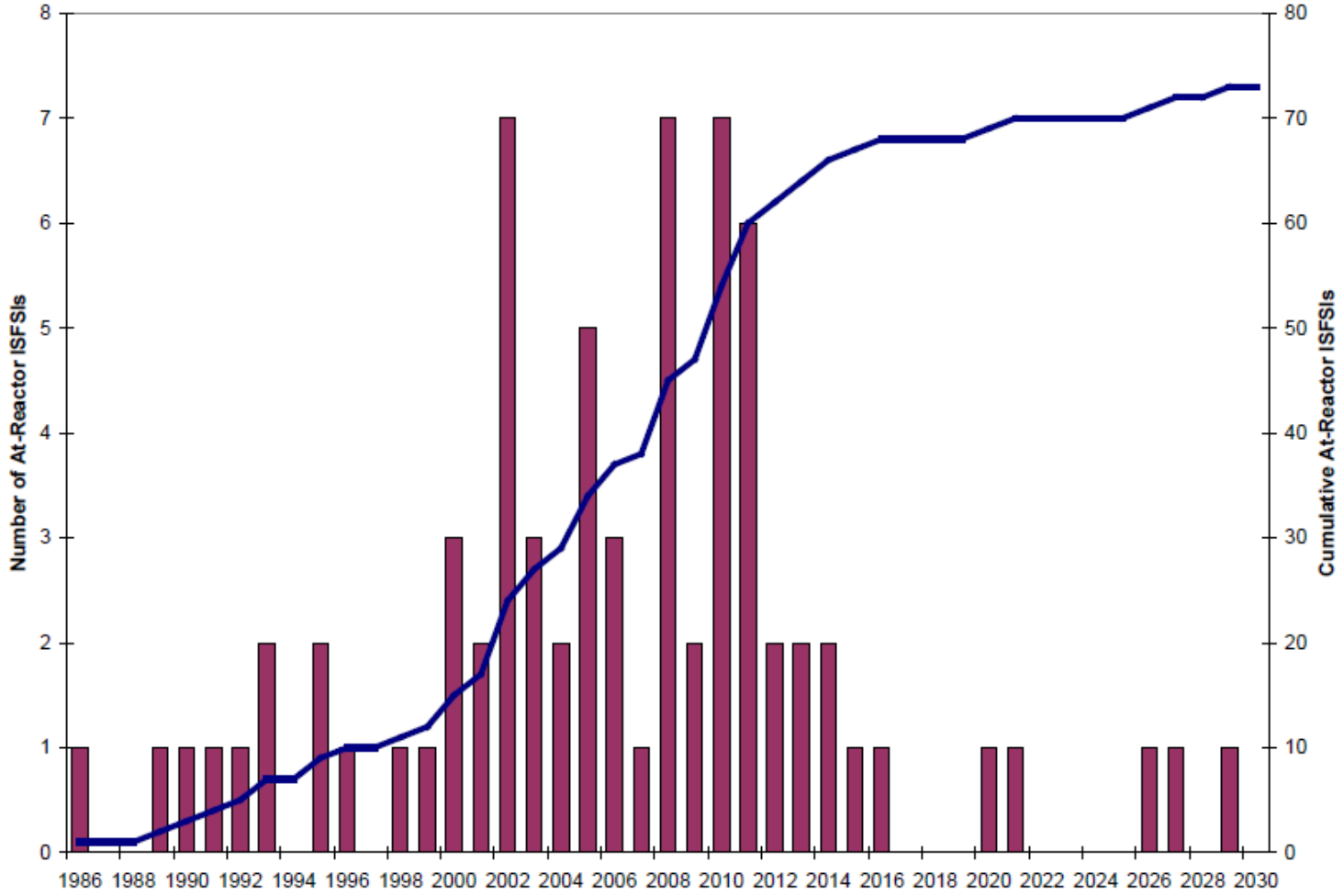
63 licensed ISFSIs (8 more than 2010)

Expect 10 sites pursuing General License

Over 1400 loaded storage casks



At-Reactor SNF Dry Storage Facilities



SOURCE:

Impacts Associated with Transfer of Spent Nuclear Fuel from Spent Fuel Storage Pools to Dry Storage After Five Years of Cooling, EPRI 11/10

EPRI Estimates of Dry Cask Loadings needed to move Spent Fuel into Dry Storage after 5 years

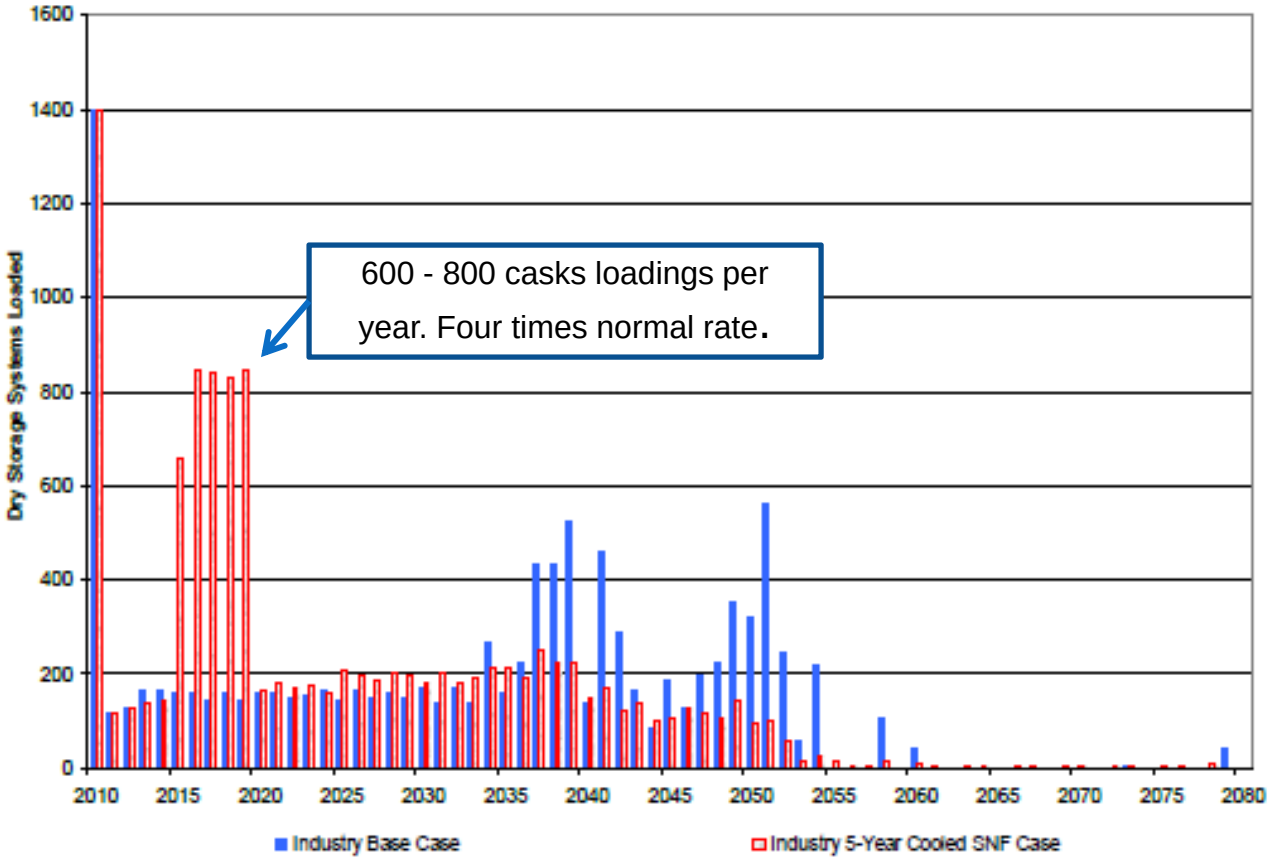


Figure 4-1
Comparison of Dry Storage Systems Loaded Annually Under the Industry Base Case and the Industry 5-Year Cooled SNF Case

EPRI Estimates of Total Dry Cask Loadings resulting from moving Spent Fuel into Dry Storage after 5 years

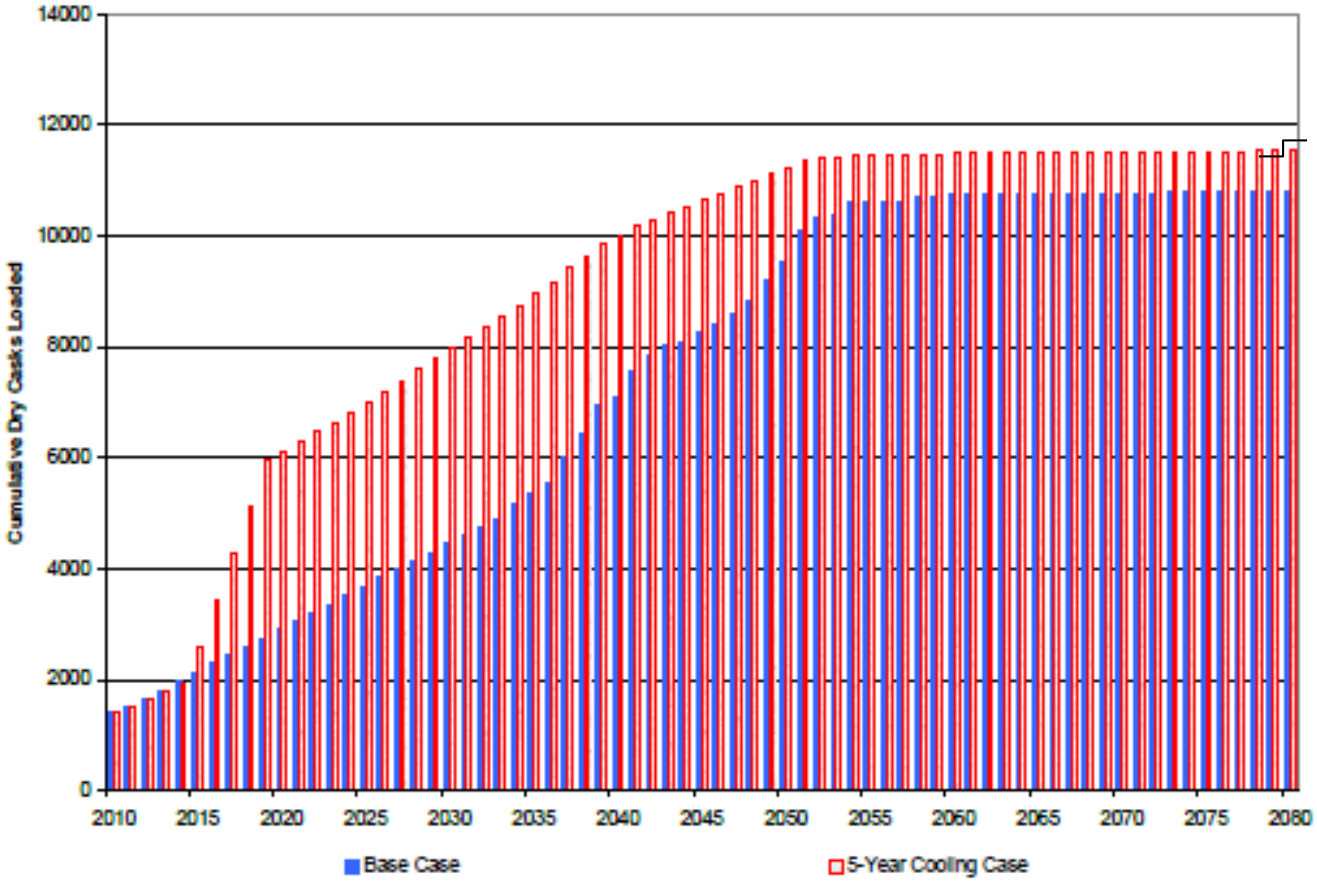


Figure 4-2
Cumulative Dry Storage Systems Loaded Under the Industry Base Case and the Industry 5-Year Cooled SNF Case

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Regulatory Needs

- Waste Confidence Decision
  - Updated in 2010 for licensed life plus 60 years
  - Commission directed staff to prepare separate long-term update for beyond life plus 60 years
- Extended Storage and Transportation (EST)
  - Potential changes to regulations and guidance
  - Opportunity to improve integration of storage and transportation regulations and guidance
  - Technical needs
  - Risk informing

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Technical Basis for EST

- Technical Gap Assessment
  - Component performance
  - System performance
- Implications for Aging Management
- Implications for Transportation and Disposal (or Reprocessing) after Extended Storage
- Coordination with Analysis of Environmental Impacts for Long-term Update of Waste Confidence Decision

PWR Assembly Decay Heat Curve

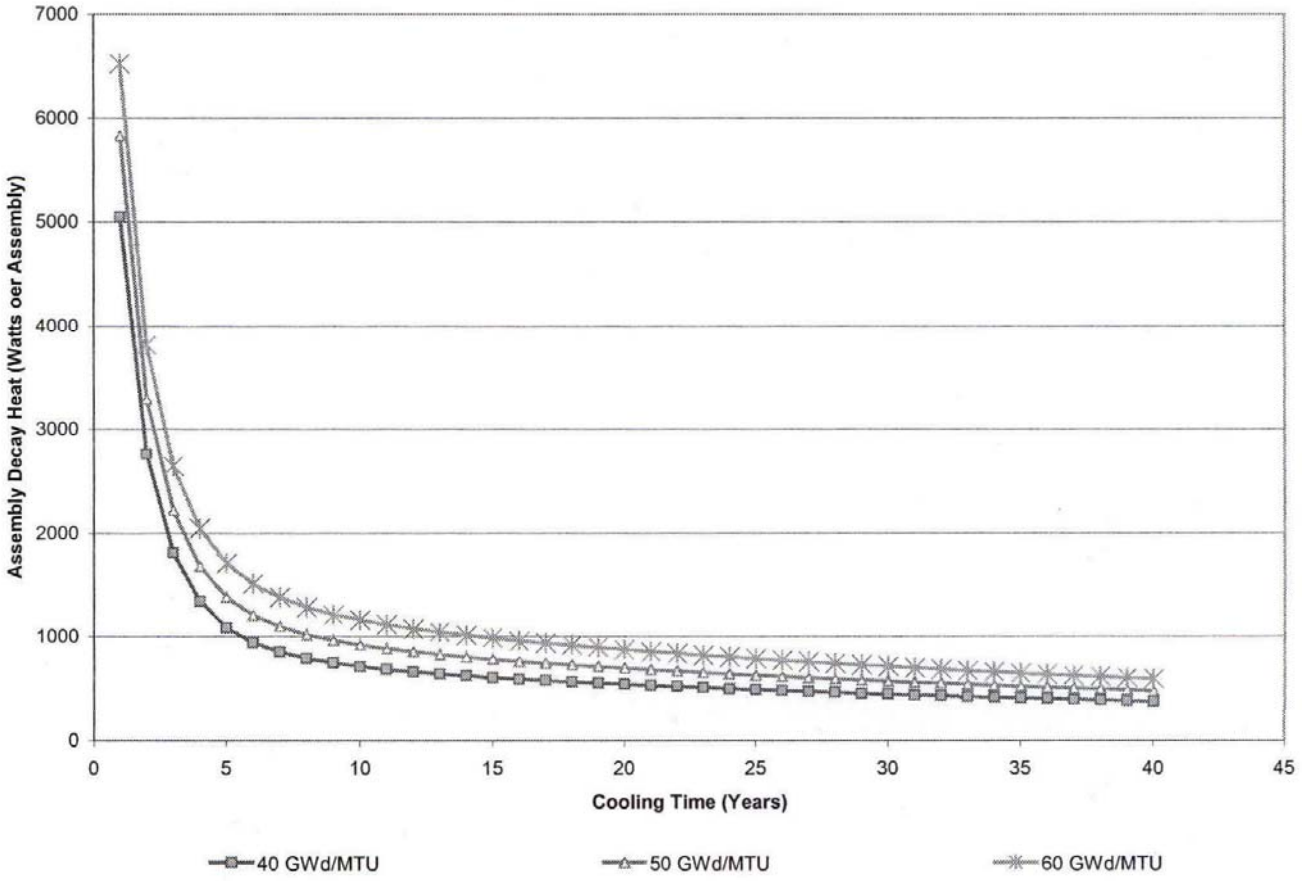

Figure 2-2
PWR SNF Assembly Decay Heat as a Function of Burnup and Cooling Time [BSC 2001, DOE 1992]

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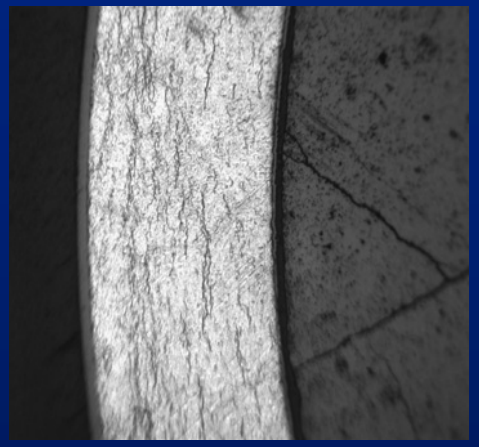
Example: Cladding Integrity

- Safety Functions
  - Primary fission product barrier
  - Geometry control
  - Defense in Depth
- Technical Challenges
  - Higher burnup levels
  - Temperature effects
  - New cladding types
  - In-situ monitoring in sealed canisters



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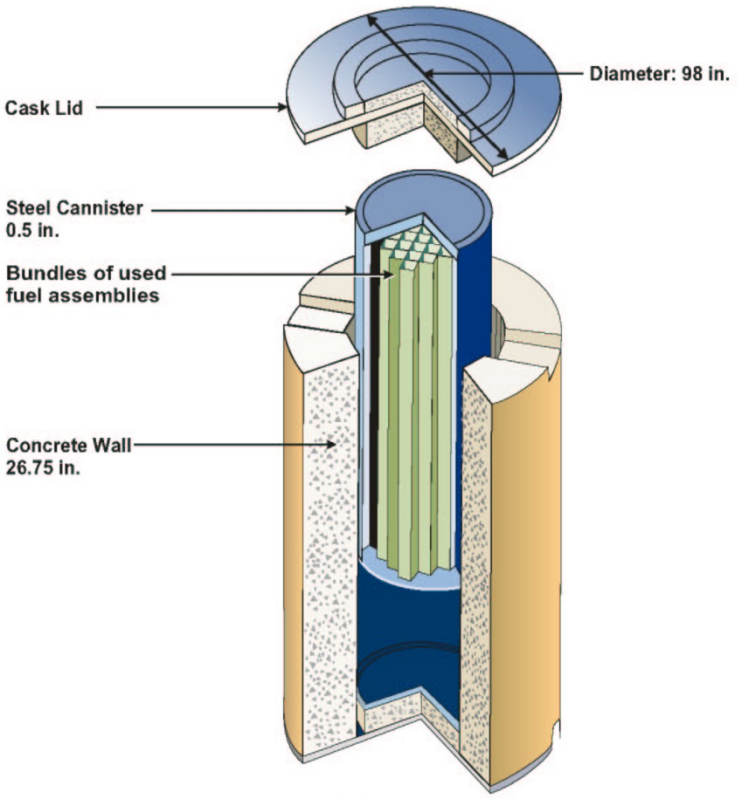
Spent Fuel Storage Casks

Dual Purpose Storage Cask*

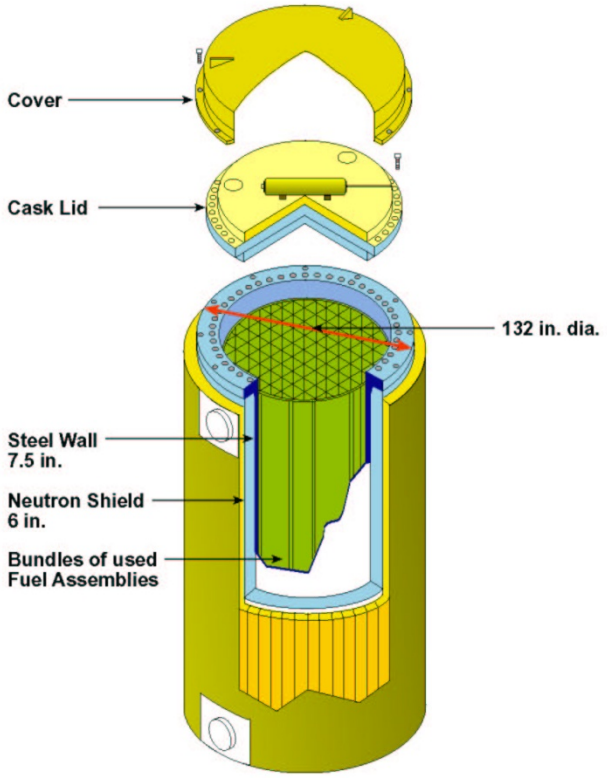


(Holtec International
HI-STORM 100)

Overall Length: 197 to 225 in.
Loaded Weight: 360,000 lbs.
Typical Payload: 24 PWR Bundles

** Storage and Transportation*

Dual Purpose Cask*



(Transnuclear TN-68)

Overall Length: 178 in
Loaded Weight: 240,000 lbs.
Typical Payload: 68 BWR Bundles

Susquehanna Dry Cask Storage

Susquehanna uses a horizontal storage module, a Transnuclear model NUHOMS 52-B. Note the transporter and alignment of the transport cask so that the canister containing the spent nuclear fuel can be pushed into the storage module by a hydraulic ram.

McGuire ISFSI

- Initial loading in 2001
- 10 TN-32 casks loaded under site-specific license
- 26 NAC-UMS casks loaded under general license
- In 2010 began using NAC International's MAGNASTOR system under general license

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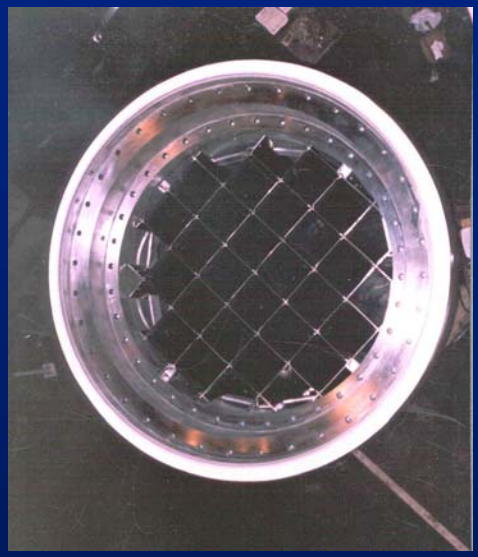
Example: Canister Integrity

- Safety Functions
  - Confinement
  - Inert environment
  - Criticality control
- Technical Challenges
  - Long-term corrosion
  - Basket properties
  - Absorber efficiency
  - Monitoring sealed internals



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Example: Overpack Performance

- Safety Functions
  - Shielding
  - Heat transfer
  - Robustness against severe events
- Technical Challenges
  - Long-term degradation
  - Response to external natural events and external disruption

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Path Forward: Phase 1

- Synthesis of Technical Gap Assessments
  - Draft synthesis report for comment, Fall 2011
  - Final synthesis report, Spring 2012
- Regulatory Plan
  - Integration of EST regulatory needs and Waste Confidence long-term update
  - Research plan to address technical gaps
- Cooperative Research (e.g., ESCP)
- Stakeholder Involvement

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Summary

- NRC is developing a regulatory framework to better support long-term dry storage
- Initial phase
  - Identify technical gaps
  - Define research program of laboratory studies, modeling, and analysis
  - Encourage cooperative research
- Coordinated with environmental impact analysis for long-term update of Waste Confidence
- Opportunities for stakeholder input through public meetings, workshops, and draft reports