EPRI | ELECTRIC POWER RESEARCH INSTITUTE

The Case for Long-Term Storage

John Kessler
Manager, Used Fuel and HLW Management Program

WM2012 Session 17: Exploring the Options for Used Nuclear Fuel in Light of U. S. and International Decisions

27 February 2012

Storage is Only an Interim Solution

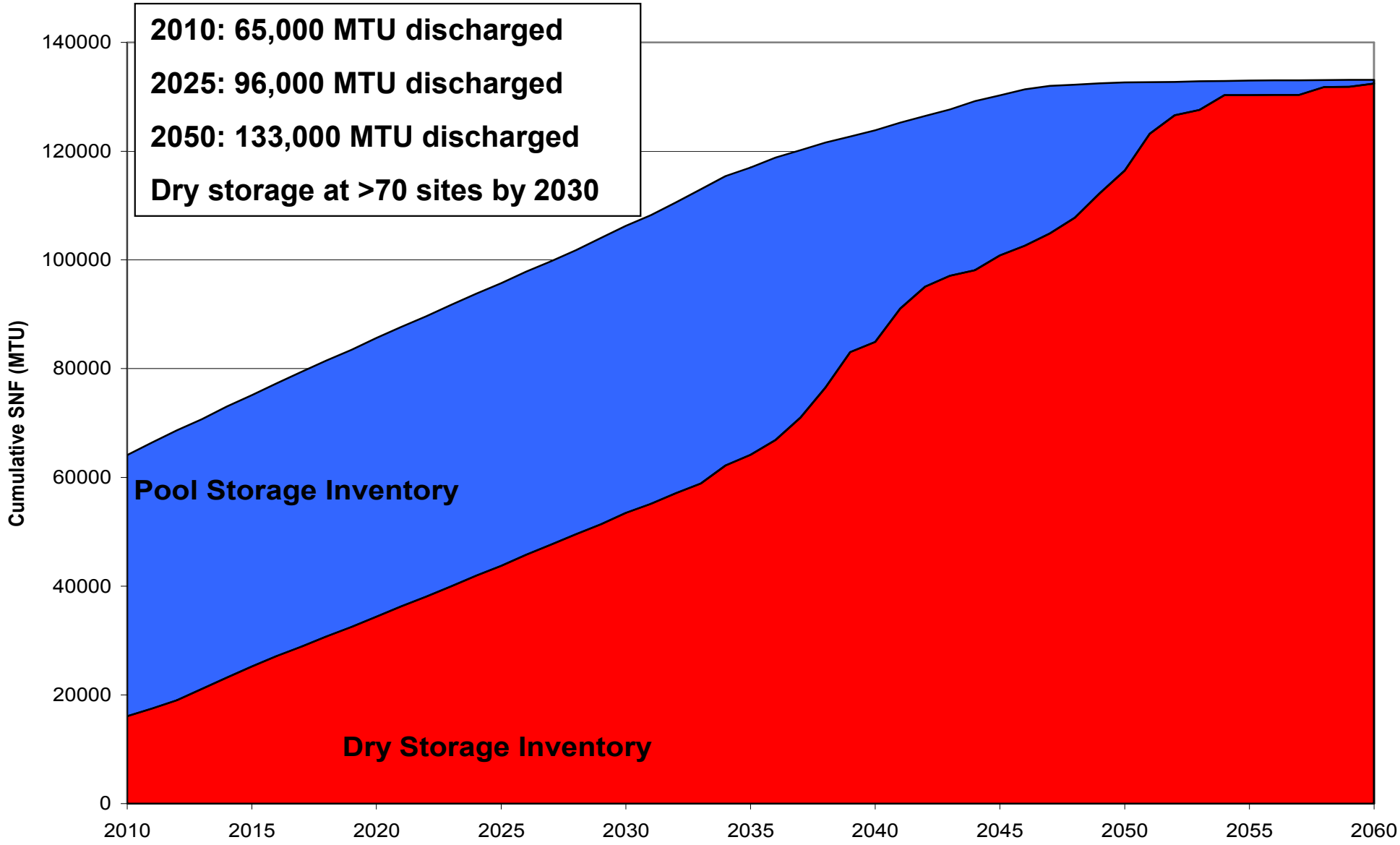
- Disposal will still be needed
  - If once-through fuel cycle: “spent” fuel
  - If advanced fuel cycle:
    - “Used” fuel
    - “Spent” fuel (UOX, MOX, fast reactor, other)
    - HLW
    - GTCC
    - …
- Most countries have no disposal option (yet) and no reprocessing (if ever)
  - Storage may be “extended” (decades, maybe >100 years)

Prolonged On-Site Storage: Industry Options

- "Reracking": denser in-pool storage
  - Industry has reracked about as much as it can
- Move used fuel from pools into dry storage
- Extract more energy per assembly (higher "burnups")
- Build a centralized interim storage site
- Extend the life of existing dry storage systems

Even with options, inventories are building

Cumulative U.S. Commercial Spent Nuclear Fuel Inventories – 2010 to 2060 (assumes no nuclear expansion, 60-year life)



Aug 2010, Energy Resources International, Inc.

Functions of Dry Cask Storage Systems

- Thermal performance
- Radiological protection
- Confinement
- Sub-criticality
- Retrievability

Can existing and future dry casks maintain these functions for decades?

Aging Management R&D Needs

- Near-term: Maximize life of existing systems and ensure transportability
  - Huge investment: ~1500 dry storage systems now, ~100 more annually (~$1 million each)
  - Additional data and analyses of long-term degradation mechanisms
  - Enhanced monitoring and inspection
- Intermediate-term: Evaluate mitigation/design options
- "Eventually" (more costly, higher worker dose)
  - Canning
  - Repackaging
  - Over-packaging
  - Use risk-informed approach to decision making

When is "eventually"?

EPRI Extended Storage Collaboration Program

- Purpose: Provide the technical bases to ensure safe, long-term used fuel storage and future transportability.
- Participants: EPRI, NRC, DOE, NEI, utilities, vendors, international
- Phased approach
  - Phase 1: Review current technical bases and conduct gap analysis for storage systems
  - Phase 2: Conduct experiments, field studies, and additional analyses to address gaps
  - Phase 3: Coordinate research that results in a demonstration of a licensed dry storage system loaded with high burnup fuel (>45 GWd/MTHM)

EPRI's Highest Priority R&D Gap: Dry Storage SS Canister SCC in Marine Environments

- Conditions that may support SCC of SS dry storage canisters
  - Presence of salt on canister surfaces ("marine environments")
  - Particular combination of temperature and relative humidity
    - Lower temperatures for older storage systems
- EPRI and industry initiating in situ SS canister inspections
  - Visual
  - Surface temperatures
  - Salt "swipes"
- Combine with studies by others
- Goal: industry-wide aging management plan

Conclusions

- Used fuel being managed on a plant-by-plant basis
  - Continued use of on-site dry storage systems until:
    - Plant shutdown
    - Centralized storage is available
    - Disposal is available
- Increasingly difficult to add to on-site inventories
  - Space, dose, public concern limitations
  - New security requirements?
  - Shutdown plants: all that is left is the fuel

Used Fuel Storage Must be Integrated at the National Level

Together…Shaping the Future of Electricity