Transportation, Aging, and Disposal (TAD) Canisters for Used Nuclear Fuel

The Bridge to System Integration

U.S. Nuclear Waste Technical Review Board

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Nuclear Facts

- 104 commercial nuclear plants at 64 sites in 31 states
- Most plants have received or are pursuing 20 year license extension
- Provide 20% of U.S. electricity generation, emits no controlled pollutants
- Average Production Costs – 1.68 cents/kWh, Coal – 1.9 cents, Oil – 5.39 cents, Natural Gas – 5.87 cents
- One uranium pellet equals 17,000 cubic feet of NG, 1,780 lbs. of coal or 149 gal. of oil
Used Nuclear Fuel Storage

- **Current used fuel inventory**
  - Approximately 56,000 MTU

- **Current dry storage inventory**
  - 9,600 MTU
  - 877 casks/canisters loaded
  - At 39 sites (6 add’l licensed)

- **Future dry storage inventory by 2017**
  - Estimating 22,300 MTU of 76,600 MTU total
  - 2,000 casks/canisters loaded
  - At 66 sites for 108 plants
Transportation Aging & Disposal (TAD) Canisters

- Industry supports DOE’s TAD initiative
  - Reduces fuel handling @ repository,
    - Simplifies design & improves licensability
  - Reduces disposal and waste acceptance uncertainty
  - Increases stakeholder confidence that on-site storage is *temporary*

- TADs are the first step towards integrating the overall used nuclear fuel management system
An Integrated Used Fuel Management System

- Pool storage
- On-site dry storage
- Transportation
- Centralized off-site storage?
- Recycling facilities?
- Final disposal

Load → Store → Ship

Standardization
DOE Acceptance
Lessons Learned

Approved for repository

TAD
21-PWR
44-BWR
TADs - What have we accomplished?

- Technical issues resolved
  - Extensive dialogue set foundation of integration process

- TAD specification completed
  - DOE able to produce quality product on schedule

- Proof-of-concept designs completed
  - Design feedback addressed in specification

- NRC review of TAD specification completed
  - Issues to be addressed in license applications identified
TAD Milestones

- **DOE/Industry interactions on TADs have been successful**
  - First significant Industry/DOE interaction, 1/06
  - DOE qualified vendors to design TADs, 4/06
  - DOE published TAD performance specification, 11/06
  - Vendors completed proof-of-concept designs, 2/07
  - DOE finalized performance specification, 6/07
    - Performance Specification is a key input to license application
  - DOE issued procurement for demonstration TADs, 7/07
    - Vendor proposals submitted on 8/24/07
    - Vendors to obtain NRC storage/transport licenses by 12/10
    - TAD demonstration to be complete by 7/12

- **Industry, DOE, and NRC agree on licensing path forward**
  - Need to effectively manage Part 63, 71, 72, 50 cross-cutting issues
TADs – What remains to be done?

- DOE must move quickly to begin TAD development
- DOE must provide incentives sufficient to address additional TAD costs and marketplace priorities
- Utilities must commit to buying TADs
- TAD license applications must be developed, submitted, and reviewed
- TADs must be built, loaded and deployed
- Further system integration must occur (w/TADs as key input)
- TAD designs must continue to evolve to meet industry needs
Yucca Mountain Licensing Process

(With TADs)

DOE PREPARES QUALITY LICENSE APPLICATION

NRC STAFF REVIEW

NRC LICENSING HEARINGS

VENDORS BUILD & REACTOR OPERATORS LOAD TADS

10 CFR PART 71/72 LICENSING

APPROVALS

NON TAD FUEL

DOE SUBMITS LICENSE APPLICATION

NRC DOCKETS APPLICATION

3-4 YEAR TIME LIMIT

ADDITIONAL NRC STAFF REVIEW /HEARINGS

DOE BUILDS REPOSITORY

USED FUEL SHIPPED TO YUCCA MOUNTAIN

DOE ISSUES TAD PERFORMANCE REQUIREMENTS 11/06

DOE ISSUES COMMERCIAL INCENTIVES?

DOE FINALIZES TAD PERFORMANCE REQUIREMENTS 6/07

VENDOR FINAL DESIGNS

VENDOR PROOF-OF-CONCEPT DESIGNS

DOE PREPARES QUALITY LICENSE APPLICATION

LSN RECERTIFICATION

US COURT OF APPEALS DECISION VACATING EPA STANDARD

PROPOSED EPA STD

FINAL EPA STD

FINAL NRC RULE

NRC CONSTRUCTION AUTHORIZATION

NRC LICENSE TO RECEIVE AND POSSESS

RULE - MAKING

US TRANSPORT COUNCIL

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TADs – who will do what?

- **Vendors**
  - Design TADs
  - Apply for Part 71 & 72 TAD licenses
  - Build TADs

- **Utilities**
  - Buy TADs
  - Load TADs and store on-site

- **NRC**
  - License TADs directly to Part 71, and 72 requirements
  - Review TADs as part of repository in Part 63 licensing
  - Regulate safe TAD deployment, transport, and disposal

- **DOE**
  - Specify TADs
  - Procure TAD Demonstrations
  - Include TAD specification in initial Part 63 license application
  - Address additional costs and marketplace priorities with appropriate incentives
  - Review and approve TAD designs
  - Incorporate TAD designs into Part 63 license/license application as available
  - Accept TADs and remove them from reactor sites
  - Age TADs at repository or interim storage/recycling facility
  - Dispose of TADs
Specific Utility TAD Perspectives

- TADs must be compatible with existing systems
- TADs will require more storage space at utility sites
- TAD deployment must recognize that procurement decisions are made 5 years in advance
  - Long range business planning windows even longer
- TADs must be backed by proven design & manufacturing capabilities
- TAD operations must maintain radiation exposures ALARA
- Cost to utilities must be comparable with existing systems – support sound business decision-making
- TAD design will need to continue to evolve to meet customer needs
Specific Vendor TAD Perspectives

- DOE has been responsive to suggested changes
  - Ni/Gd, Carbon Steel, Length, etc.
- Large amount of work must be done in a short time
  - Increased NRC workload mustn't hamper existing applications
- DOE review time must be reasonable
  - Start/stop of vendor process must be avoided
- Lead times must be recognized
- Material suppliers must be engaged
  - Multiple material suppliers are needed
- Lessons learned have been valuable
  - Additional lessons learned will be gained from demonstrations
- Additional seismic requirements will be a challenge
- Licensable TAD design is achievable
- Transport/storage applications to NRC by Fall 2008 are achievable if contracts issued immediately
TAD Transportability

- TAD physical dimensions are very similar to existing Dual Purpose Canister (DPC) dimensions
- Transportation cask designs will be similar
- Minimal burnup credit will be necessary for transportation due to reduced capacity
- TADs will require approximately 50% casks shipped, but not necessarily more shipments, than would existing DPCs
  - Consolidation would minimize shipments
  - Transportation risk is minimal
  - This is not seen as a major barrier to TAD implementation
- No truckable TAD design exists
  - Consistent with DOE’s “Mostly Rail” transportation decision
  - Could be developed as later addition
Summary

- The TAD is an important initiative and the NWTRB’s continued focus on this key component of the Yucca Mountain program is most welcome.
- The TAD’s potential to contribute to simplifying and integrating fuel cycle management – and increasing stakeholder confidence – remains considerable.
- Tangible progress has been made in unleashing this potential by laying a solid foundation for design, licensing, and development of the TAD.
- Much remains to be done and the clock is ticking.
Conclusion

Status Quo

Integrated Used Fuel Management