



U.S. Department of Energy  
Office of Civilian Radioactive Waste Management



# Waste Management Planning and Integration

Presented to:  
**Nuclear Waste Technical Review Board**

Presented by:  
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# Waste Management Planning and Integration

- **Status of Transportation, Aging, and Disposal (TAD) Canister Development**
- **Operational Integration from Receipt to Emplacement**
- **Total System Model Analysis**



# TAD Background

- **DOE announced incorporation of a TAD canistered system approach in October, 2005**
- **TAD system is to :**
  - **Support the standardization of SNF storage, transportation, aging and disposal packaging, allowing integration of SNF handling operations**
  - **Utilize utility fuel handling experience in loading SNF**
  - **Simplify DOE operations and minimize redundant handling of individual SNF assemblies at the repository**
  - **Reduce low-level waste production and worker radiation exposure at DOE facilities**
  - **Reduce complexity and cost of DOE facilities**



# TAD Background

(Continued)

- **TAD canisters will be the key interface component that facilitates system functions for temporary storage of spent nuclear fuel at utility sites, transport to the repository, aging at the repository and ultimate disposal**
- **TAD canister system will comply with regulatory requirements of 10 CFR 71 – Transportation, 10 CFR 72 – Storage, and 10 CFR 63 – Disposal**



# TAD Implementation Strategy

- **Development philosophy of the TAD approach is to use proven industry practices, guidance and experience**
- **The Nuclear Waste Policy Act directs the DOE to use private industry to the fullest extent possible for transportation related activities**
- **Based on prior experience with a canister-based approach DOE decided to include available industry expertise through the use of a TAD performance specification**
- **Development of the TAD specification received substantial input from the industry and the transportation and repository components of the program**



# TAD Implementation Strategy

(Continued)

- DOE issued the TAD system performance specification on the OCRWM web site [www.ocrwm.doe.gov](http://www.ocrwm.doe.gov) on November 29, 2006
- Qualified vendors currently developing TAD proof-of-concept designs:
  - Energy Solutions
  - Holtec International
  - NAC International
  - Transnuclear



# TAD Implementation Strategy

(Continued)

- **After the proof-of-concept phase, DOE will initiate the procurement with successful vendors for the development of complete TAD system designs and Safety Analysis Reports (SARs) for NRC certification under 10 CFR 71 and 10 CFR 72**
- **Prior to submission to the NRC, DOE will review the final TAD system designs to ensure continued compliance with DOE requirements**
- **Vendors will submit DOE-reviewed TAD systems SARs to NRC for review and approval for 10 CFR Parts 71 and 72**



# TAD Implementation Strategy

(Continued)

- **DOE will monitor the NRC process**
- **Cask vendors will notify DOE if modifications of TAD designs resulting from the NRC review result in non-compliance with DOE requirements**
- **After NRC completes SAR reviews and issues 10 CFR 71 & 72 Certificates of Compliance for the vendors' TAD system, DOE will continue to review the fabrication and deployment process to ensure continued compliance with DOE performance specifications**





# TAD Performance Specification

- **The TAD specification delineates the requirements that DOE will rely upon in the repository License Application to demonstrate compliance of the TAD system with 10 CFR 63, both pre-closure and post-closure**
- **The specification includes other requirements that are expected to improve the efficiency of TAD system operations at the repository**



# TAD Canister Specification Highlights

- **Capacity – 21 PWR's or 44 BWR's**
- **Length (including lifting feature) 212.0 inches**
- **Diameter 66.5 inches**
- **Maximum Weight – 54.25 tons**
- **Maximum average dose rate from top – 800 mr/hr**
- **Borated Stainless Steel is the required neutron absorber for disposal**
- **TAD canisters to be seal welded**
- **TAD canisters, transportation overpack lid and aging overpack lid will have a common lifting fixture**
- **Handling and aging at repository in vertical orientation**
- **Organic, pyrophoric, and RCRA materials prohibited**



# Status of Operational Integration from Receipt to Emplacement

- **Development of the TAD specification received substantial input from the industry and the transportation and repository components of the program**
- **The integration of the requirements within the TAD specification ensures compliance with the regulatory and operational requirements from receipt to emplacement**
- **Pre-closure and post-closure safety analysis and design requirements incorporated into the TAD specification requirements**



# Status of Operational Integration from Receipt to Emplacement

- **Thermal, size and handling requirements incorporated into the TAD specification**
- **Transportation planning for cask procurement acquisition incorporates TAD canisters**
- **Analyses using the Total System Model validate the ability for utility sites, transportation and the repository to load SNF into TADs for permanent emplacement**



# Total System Model Overview

- **The Total System Model system analysis incorporates the TAD canister approach:**
  - **Waste Acceptance - Impact on throughput, acceptance rates, and thermal characteristics**
  - **Transportation - Cask fleet size and composition, cask fleet purchase, resources needed, routing impacts**
  - **Repository - Throughputs, cask turnaround time, repository site aging requirements (pad size, aging cask needs, return to processing), waste package needs and emplacement rates, individual waste package thermal output versus emplacement drift thermal loading**



# Total System Model -TAD System Studies

- **In FY 2005, demonstrated that a primarily TAD canister-based system is a viable alternative:**
  - Required acceptance rates can be achieved
  - Repository aging pad capacity limit not exceeded
  - Emplacement operations can be completed within 50 years
  - TAD waste package processing can meet 1.45 kW/m subsurface thermal line load

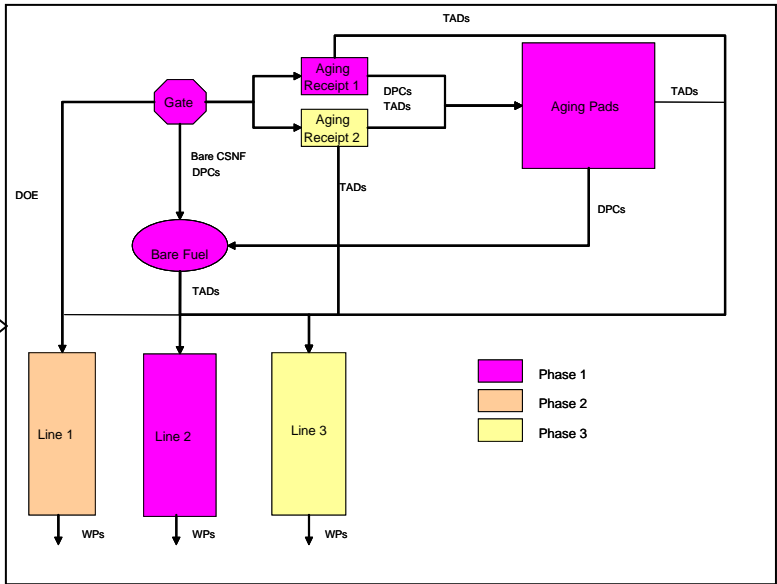
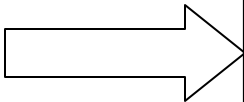
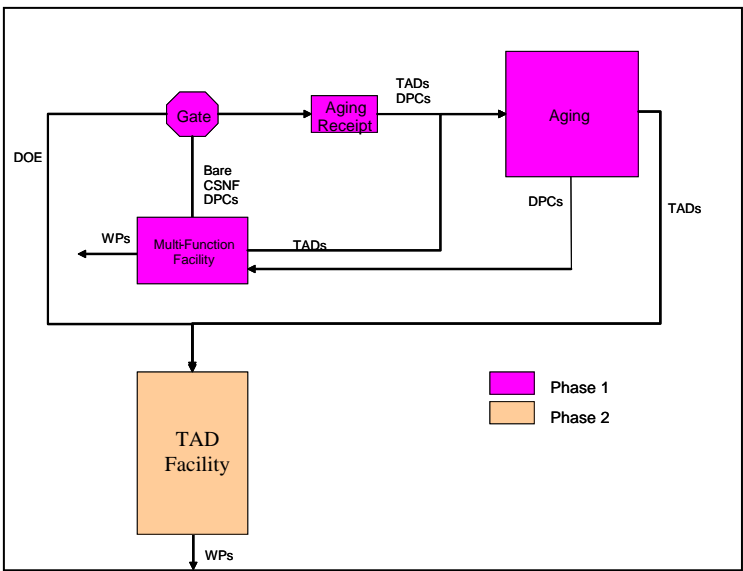


# Total System Model - TAD System Studies

- **In FY 2006, continued analyses to support TAD based approach:**
  - **Evaluated alternative configurations at the repository site**
    - ◆ **Processing facilities (wet and canister)**
    - ◆ **Number of waste package closure cells**
    - ◆ **Fraction of waste stream CSNF in TADs (vs. bare fuel)**



# Total System Model -TAD System Studies



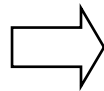
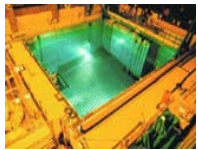
Process Line Approach



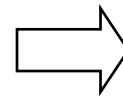
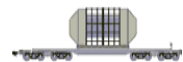


# Total System Model - Thermal Analysis – Ongoing

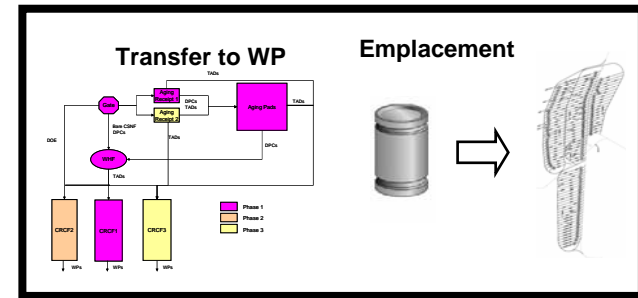
Acceptance at Waste Sites



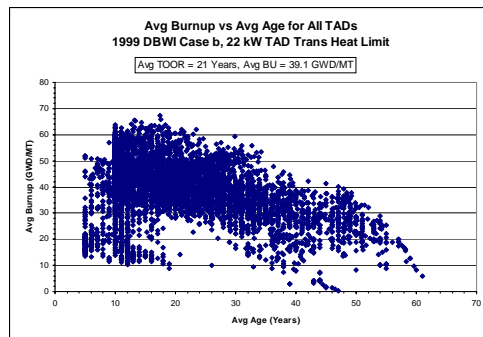
Transportation to Repository



Repository Operations



Pre-closure and post-closure temperature constraints (e.g., 96° C mid-pillar temperature, 200° C drift wall temperature, 350° C clad temperature, etc.)



A broad range of realistic age and burnup properties considering each CSNF assembly



# Total System Model Summary

- **The Total System Model continues to be used as designs are refined to:**
  - **Evaluate alternative system configurations and processing capabilities**
  - **Identify potential disconnects between various components of the waste management system**
  - **Assess ways to minimize size of the aging pads**
  - **Support repository post-closure thermal response**



# Summary

- **TAD canister design development is underway**
- **TAD proof-of-concept design phase will be completed in the March timeframe**
- **TAD canister concept is being incorporated into the License Application**
- **Total System Model continues to be a key program tool for system analysis for the integration of waste acceptance, transportation and repository activities**

