Repository Design Status

Presented to:
Nuclear Waste Technical Review Board

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Introduction

- Update on repository design for License Application
  - Surface facilities, including ITS design features
  - Subsurface facilities, including ITS design features
  - Waste package and associated components design, including ITS design features
Site Plan
Surface Facility Waste Handling Operations
Transportation Casks

- Casks are large, heavy, robust, sealed metal containers
- Multiple layers of radiation shielding
- Cask sizes:
  - Rail casks weigh ~100 to 165 tons and are up to ~27 ft long and ~11 ft in diameter with impact limiters installed
  - Truck casks weigh ~24 tons and are ~16 ft long and ~4 ft in diameter
Surface Facility Description
Preclosure Safety Analysis Process

- Internal and external hazards analyses identify hazards
- Screening and assessment analyses estimate frequency of event sequences
- Consequence analyses estimate doses to public and workers from event sequences
- Classification analyses identify systems, structures, and components that are important to safety (ITS)
- Nuclear safety design basis document captures design requirements
Implementation of Preclosure Safety Analysis in Design

- Repository is designed to prevent event sequences where possible; mitigate those not preventable.

- Structures, systems, and components that prevent or mitigate Category 1 or 2 event sequences are ITS.

- Results show Category 1 event sequences driven by handling large numbers (approximately 221,000) of individual commercial spent nuclear fuel (CSNF) assemblies.

- Category 2 event sequences driven by handling of casks, canisters, and waste packages.
Implementation of Preclosure Safety Analysis in Design  
(Continued)

- **Category 1 Event Sequences**
  - Two event sequences (Fuel Handling Facility [FHF] and Dry Transfer Facility [DTF] only)
    - Drop of individual CSNF assembly
    - Collision of individual CSNF assembly

- **Category 2 Event Sequences**
  - Three event sequences bound about 30 total
    - Drop and breach of transportation cask with 74 boiling water reactor (BWR) or 36 PWR CSNF assemblies
    - Drop and breach of transportation cask with five high-level waste (HLW) canisters
    - Drop and breach of one naval canister
Fuel Handling Facility
Fuel Handling Facility - Sketch
Fuel Handling Facility: Important to Safety Structures, Systems or Components

Mitigation ITS SSCs
- FHF Structure (confinement, shielding)
- HVAC Primary Confinement (confinement, filtration)
- Electrical (support HVAC)

Prevention ITS SSCs
- FHF Structure (hazards protection)
- WP Tilting Machine (drop)
- WP Turntable (drop)
- Trunnion Collar Removal Machine (drop)
- Main Transfer Bridge Crane (drop)
- Trolley, Pedestal, Hold Down Devices (drop)
- Spent Fuel Transfer machine (drop)
- Vestibule Gantry Crane (drop)
Canister Handling Facility
Canister Handling Facility-Sketch

TRANSPORTATION CASK OPERATIONS
1. Remove Impact Limiters and Personnel Barrier
2. Uplend Cask
3. Transfer Cask to Pit
4. Return Cask

WASTE PACKAGE OPERATIONS
5. Receive Empty WP
6. Transfer WP to Pit
7. Transfer WP to WP Trolley
8. Transfer WP to WP Positioning Cell
9. Transfer Welded WP to Survey Station
10. Transfer to Tilt Station and Down End WP onto WP Pallet
11. Remove WP Trunnions (Both Ends)
12. Transfer WP to WP Transporter
13. Transfer WP To Implantation

SITE SPECIFIC CASK OPERATIONS
14. Receive Site Specific Casks
15. Transfer Site Specific Cask to Pit
16. Transfer Loaded Site Specific Casks

THROUGHPUT
Up to 180 waste packages/year

WASTE FORMS
DOE HLW
DOE SNF
Dry Transfer Facility - Sketch

THROUGHPUT
Up to 180 waste packages/year

WASTE FORMS
Bare CSNF
Canistered CSNF (OPC)
DOE SNF
DOE HLW
Remediation

Legend:
1. Loaded transportation cask
2. Loaded waste package not welded
3. Loaded waste package welded
4. Empty waste package
5. Empty site specific cask
6. Unloaded casks & site specific cask
7. Unloaded casks/site specific casks
8. Loaded site specific cask
9. Waste package & pallet to emplacement

Material Flow Path:
- Normal Operations
- Site Specific Cask
Aging Transporter
Aging Pad
Subsurface Configuration

- Panel numbers represent the proposed emplacement sequence
- Sequence:
  - Panel 1, Phase 1 for 2010
    - Develop initial emplacement drifts
  - Panel 1, Phase 2
    - Complete panel 1 drifts (8 total)
  - Panel 2
    - 17 drifts total
- Total emplacement length available is approximately 41 miles (65 km)
- Available contingency of 11 - 13.5 % for the 70,000 MTHM case
Emplacement Drift Transfer Dock
Rail Based Transport

- Transport Locomotive (ITS)
- Trolley Power Supply
- WP Transporter (ITS)
- Transfer Dock
- Waste Package (ITS/ITWI)
- Emplacement Gantry (ITS)
- Ground Control
Emplacement Drift

- 5.5m Diameter Emplacement Drift
- Friction Rock Bolts
- Ground Control Bermold Type Perforated Sheet
- Longitudinal Support Beam (Typical for 3 Across)
- Invert Ballast (ITWI)
- Transverse Support Beam @1500 mm Maximum Spacing (Typical)
- Gantry Rail (135 lb/yard) and Runway Beam (Cap Plate Not Shown for Clarity)
- Stiffener Bracket (Typical)
- Waste Package Emplacement Pallet (ITS/ITWI)
- Drip Shield (ITWI)
Waste Package (ITS/ITWI)
Drip Shield (ITWI)

- Titanium grade 7 plates
- Titanium grade 24 structural supports
- Alloy 22 (UNS N06022) base plates