



Multi-Canister Overpack

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

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One Team. One Culture.

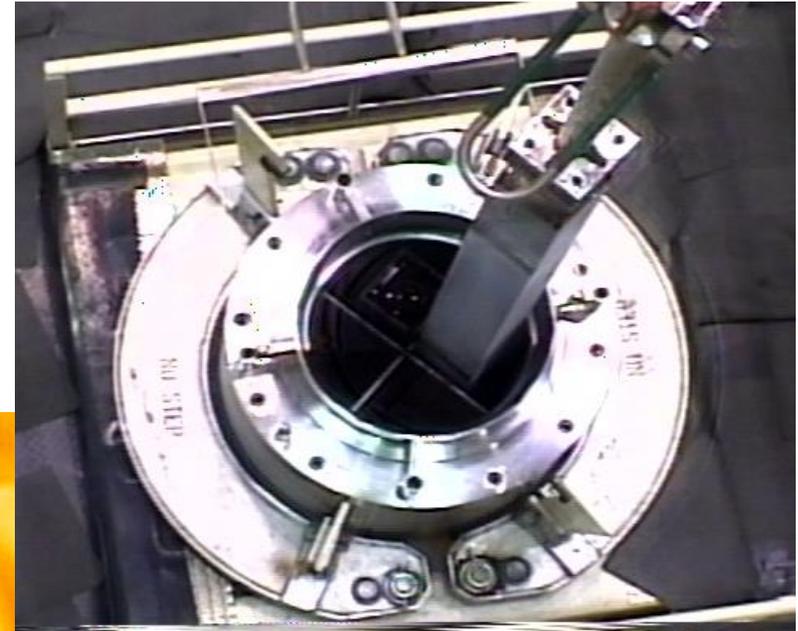
Multi-Canister Overpack Overview

- **Multi-Canister Overpack (MCO) Description**
- **MCO Processing Operations at Hanford**
- **MCO Survivability/Transportability Analyses and Tests**
 - Scoping Analyses
 - Drop Tests
- **Fragility Analysis Status**



Multi-Canister Overpack Description (Fuel Inventories)

- N Reactor Fuel
- Single-Pass Reactor Fuel
- Knock-Out Pot Product Material
- Shippingport Blanket Fuel



Above: Shippingport Blanket Fuel Loading into MCO.



Left: N Reactor Fuel.



Far Left: Single-Pass Reactor Fuel.

Multi-Canister Overpack Description (Basket Configurations)



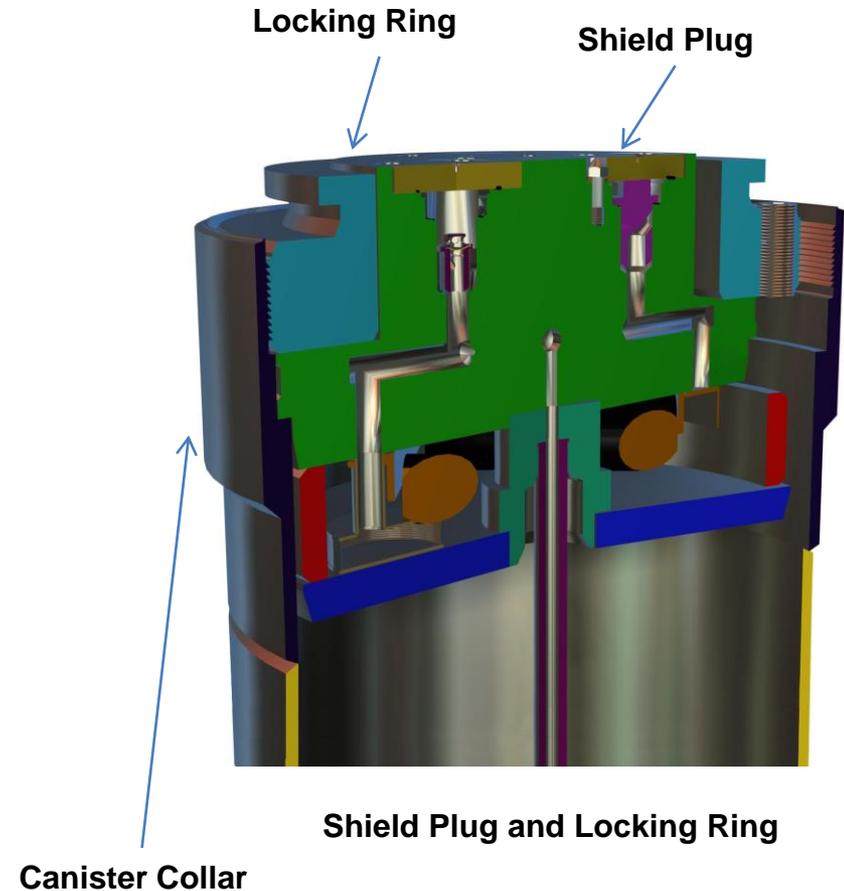
Left: Mark IA Basket and Mark IA Scrap Basket

Below: Single-Pass Reactor Fuel Basket.

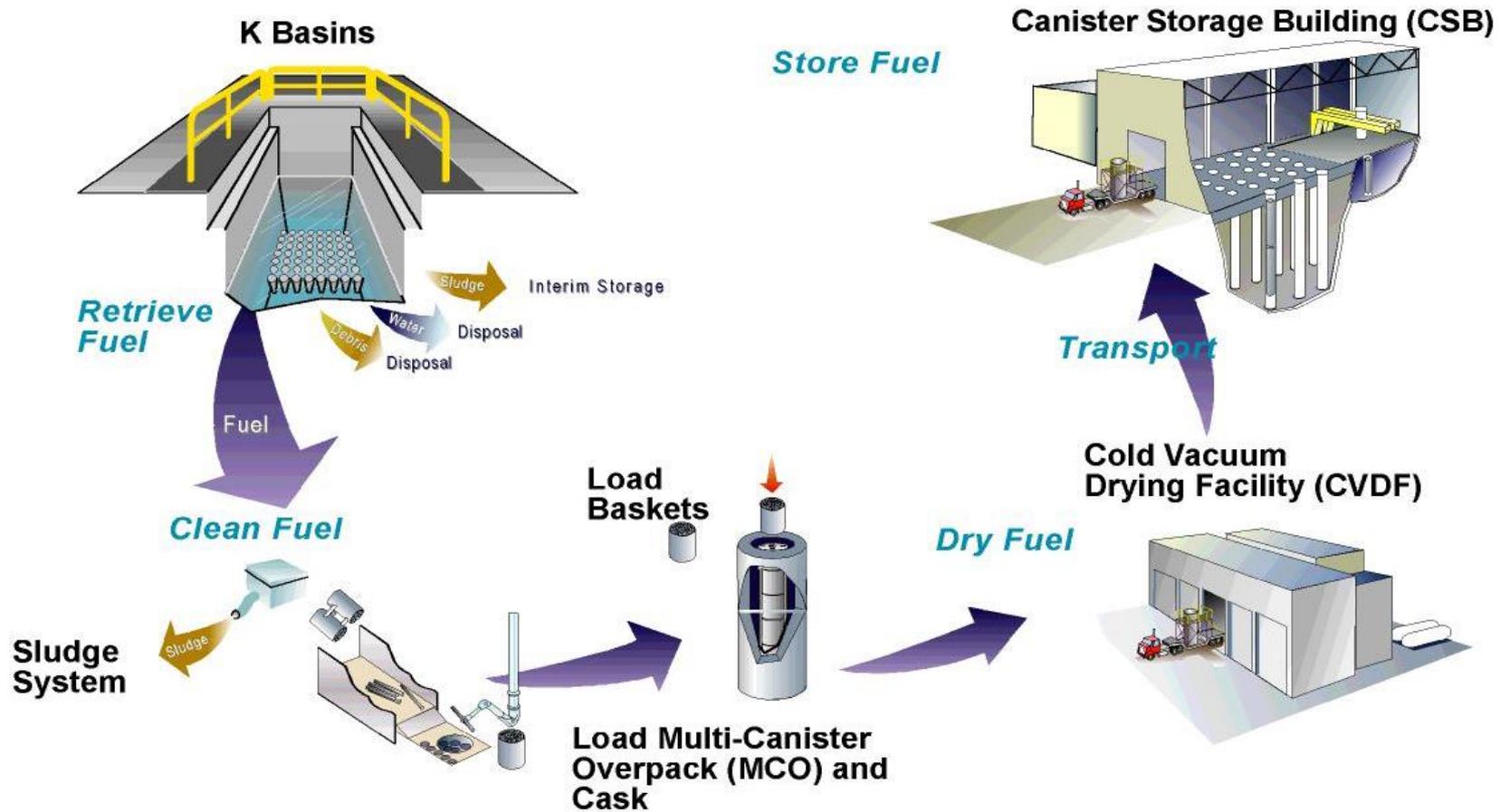


Multi-Canister Overpack Description

- **Dimensions:**
 - Nominal 24-inch shell diameter;
 - 25.31-inch diameter collar and cover cap;
 - Overall length with cover cap is 166 inches
- **ASME B&PV Code, Section III, Division 1, Subsection NB with Code Case N-595-3 for storage containment**
- **Design capacity of 5 Mark IV or 6 Mark IA MCO Baskets**



MCO Process Operations at Hanford (Process Flow)





Left: Empty MCO Loading into Cask at Canister Storage Building.



Right: MCO Cask Handling at KW Basin.

MCO Process Operations at Hanford (Basket Loading at KW Basin)



Above: Loaded MCO Scrap Basket.

Left: Loaded MCO Fuel Basket.

MCO Process Operations at Hanford (Cold Vacuum Drying Facility)



Above: MCO Transport Cask.

Left: MCO Processing at Cold Vacuum Drying Facility.

Canister Storage Building



MCO Process Operations at Hanford (Current Status)



Above: Installation of MCO Cover Cap Assembly.

- **389 MCOs contain N Reactor and Single-Pass Reactor fuel and scrap loaded at K Basins**
 - 66 contain loaded scrap baskets
 - 3 short-stacked
 - 10 in Monitoring Program
- **5 MCOs contain Knock-out Pot product material**
 - 5 in Monitoring Program
- **18 modified MCOs contain Shippingport Blanket Fuel Assemblies**

MCO Survivability/Transportability (Scoping Analyses)

- **Purpose was to determine potential viability of future off-site shipment of Multi-Canister Overpacks**
 - Performed by National Spent Nuclear Fuel Program
 - Evaluation of hypothetical transportation cask based on performance characteristics of Holtec International HI-STAR 100
- **Scope of transportability analyses included:**
 - Structural Analyses for Transportability of the MCO
 - Steady State Thermal Analysis for Hypothetical MCO Transportation Cask
 - Scoping Analyses for Transportability of a Partially Loaded MCO
 - Criticality Analysis for N-Reactor Fuels in a Rail Transportation Cask

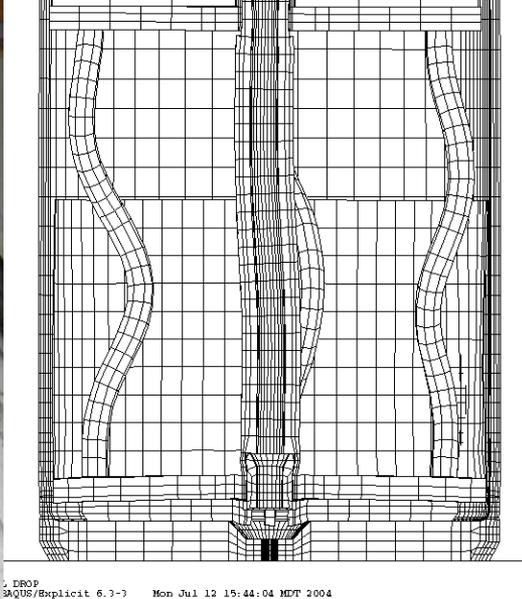
MCO Survivability/Transportability (Drop Tests)

- Drop evaluation performed by National SNF Program
- ABAQUS/EXPLICIT finite element analysis
- Full-scale testing of two production MCOs in 2004 at Sandia drop test facility
 - Completed two drop tests of MCO
 - Drop heights per Waste Acceptance System Requirements Document
 - 23-foot vertical drop onto an essentially unyielding horizontal surface
 - 2-foot worst orientation onto an essentially unyielding horizontal surface producing the highest containment strain
 - Helium leak testing demonstrated leak-tight containment after drops
 - Computer pretest predictions matched actual results

23-ft. Multi-Canister Overpack Drop



Bottom Basket Deformation After 23-ft. Drop



Center: Predicted Bottom-End Deformation (23-ft Drop, MCO in Rebound).

Left: Bottom MCO Fuel Basket with Dummy Fuel Pre-Drop.

Right: Bottom MCO Fuel Basket with Dummy Fuel Post-Drop (MCO Shell Removed).

2-ft. and 60 Degrees MCO Drop



Above: Primary Impact Point.

Left: MCO Prior to Drop.

Below: Deformation Along Length.



Fragility Analysis Status

- **Pre-closure safety strategy for MCO is to demonstrate pre-closure breach not credible (i.e., beyond Category 2 event sequence [BC2])**
- **In 2007 licensing strategy established to use a representative canister approach to evaluate canister drop and breach probabilities using fragility analyses**
- **Due to potential off-vertical drops of MCOs at Geologic Repository Operations Area, breach of MCOs could not be shown to be BC2**
- **MCOs deemed not ready for inclusion in submitted license application**

Fragility Analysis Status (cont.)

- **National Spent Nuclear Fuel Program prepared supplemental analyses, considering potential design features**
 - **Included additional scenarios (dropped objects onto MCO, etc.)**
 - **Yucca Mountain activities terminated prior to review**
 - **Supplemental design/analyses actions identified.**