Dilute and Dispose Approach

- The dilute and dispose approach, also referred to as plutonium down-blending, utilizes a multicomponent inhibitor to dry blend with plutonium oxide for disposal at a geologic repository.
- Dilute and dispose has been successfully demonstrated with disposition of more than 4.8 MT of plutonium at the Waste Isolation Pilot Plant (WIPP).
- The U.S. Department of Energy (DOE) is currently using dilute and dispose to disposition 6 MT of surplus plutonium.
- DOE is completing preconceptual planning and development tasks required to expand operations for future disposition of 34MT surplus plutonium.
Dilute and Dispose Flowsheet

- **Glovebox Processing**
  - Open PuO₂ Container (Drill & Cut)
  - Prepare PuO₂ for Dilute Process (Grind & Sieve)
  - Add PuO₂ to Blend Cans (Repeat)
  - Stage Blend Cans in Glovebox
  - Transfer Blend Cans to Glovebox

- **Adulterant Preparation and Blend Can Processing**
  - Weigh & Mix Blend Cans (Repeat)
  - Remove Blend Cans from Glovebox
  - Add Radiological Barrier (Can/Bag/Can)
  - Perform Non-Destructive Assay (NDA)
  - Load Blend Cans with Adulterant

- **PuO₂ Inventory Management and Preparation**
  - Open & Remove PuO₂ Container from Package
  - Move PuO₂ Package from Vault

- **Dilute Processing Operations and Packaging**
  - Receipt and Verification of PuO₂ Packages
  - Transfer Blend Cans to Glovebox
  - Add Radiological Barrier (Can/Bag/Can)
  - Perform Non-Destructive Assay (NDA)
  - Load Blend Cans with Adulterant

- **Dispose Processing Operations and Shipping**
  - Add Radiological Barrier (Can/Bag/Can)
  - Perform Non-Destructive Assay (NDA)
  - Load Criticality Control Overpack (CCO)

- **Emplace Dilute PuO₂ Materials in Repository**
- **Ship Dilute Surplus PuO₂ to Repository**
- **Load CCOs into TRUPACT-II Shipping Casks**
- **Configure CCOs for Shipment (7 Packs)**
- **Characterization of CCOs (NDA & X-Ray)**
- **Transfer CCOs to Waste Storage**
- **Stage CCOs**
Adulterant Preparation and Blend Can Processing

K-Area Storage Facility

Prepare Adulterant Mixture

Load Blend Cans with Adulterant

Transfer Blend Cans to Glovebox

Stage Blend Cans in Glovebox

K-Area Dilute Process Glovebox

Down-Blend Can for Dilute Process
PuO₂ Inventory Management and Preparation

- Receipt and Verification of PuO₂ Packages
- Move PuO₂ Package from Vault
- Open & Remove PuO₂ Container from Package
- Transfer PuO₂ Container to Glovebox
- Open PuO₂ Container (Drill & Cut)
- Prepare PuO₂ for Dilute Process (Grind & Sieve)

K-Area Nuclear Materials Storage

Cross-Section of 9975 Shipping Container

Plutonium Oxide Convenience Container
PuO$_2$ Dilute Processing Operations

K-Area Down-Blend Mock-Up / Training Facility
Load and Stage CCOs

- Load Criticality Control Overpack (CCO)
- Stage CCOs
- Transfer CCOs to Waste Storage
- Perform Non-Destructive Assay (NDA)
- Add Radiological Barrier (Can/Bag/Can)

Example of Can/Bag/Can Packaging (Training Use Only)

3-D Illustration of CCO

CCO Internal Components View
Characterize and Package CCOs

Characterization of CCOs (NDA & X-Ray)

Configure CCOs for Shipment (7 Packs)

Load CCOs Into TRUPACT-II Shipping Casks

Real Time Radiography
Ship and Emplace Dilute PuO$_2$ in Repository

TRUPACT-II Transporter

Ship Dilute Surplus PuO$_2$ to Repository

Emplace Dilute PuO$_2$ Materials in Repository

WIPP Waste Emplacement – 7 Pack Configuration
WIPP - Geologic Repository

- U.S. Department of Energy facility
- Designed for permanent disposal of transuranic radioactive waste
- 2,150 feet deep

WIPP Repository – Facility Layout

Waste Emplacement – Various Payload Configurations
Summary

- DOE is actively pursuing activities required to disposition surplus plutonium (i.e., 6MT non-MOX materials) using the dilute and dispose approach.
- DOE is currently performing preconceptual planning and development scope to increase the dilute and dispose capability.
- DOE is also planning to establish additional container characterization, storage and shipping capability to support dilute and dispose operations.