K Area Overview/Update

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Citizens Advisory Board
July 25, 2017
• To provide information on K-Area and Plutonium storage which fulfills a Nuclear Materials Program work plan item.
<table>
<thead>
<tr>
<th>Acronyms</th>
<th>Description</th>
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<tr>
<td>CCO</td>
<td>Criticality Container Over-pack</td>
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<tr>
<td>DOE</td>
<td>Department of Energy</td>
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<tr>
<td>DE</td>
<td>Destructive examination</td>
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<tr>
<td>FGE</td>
<td>Fissile Gram Equivalent</td>
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<tr>
<td>KIS</td>
<td>K Interim Surveillance</td>
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<tr>
<td>LANL</td>
<td>Los Alamos National Laboratory</td>
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<tr>
<td>LLNL</td>
<td>Lawrence Livermore National Laboratory</td>
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<tr>
<td>MIS</td>
<td>Materials Identification and Surveillance</td>
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<tr>
<td>NDA</td>
<td>Non-destructive assay</td>
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<tr>
<td>NDE</td>
<td>Non-destructive examination</td>
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<tr>
<td>PSI</td>
<td>Pounds per square inch (gas pressure above atmospheric)</td>
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<td>Pu</td>
<td>Plutonium</td>
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<tr>
<td>RFETS</td>
<td>Rocky Flats Environmental Technology Site</td>
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<td>SRS</td>
<td>Savannah River Site</td>
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<tr>
<td>SRNL</td>
<td>Savannah River National Laboratory</td>
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<tr>
<td>SWMF</td>
<td>Solid Waste Management Facility</td>
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<tr>
<td>WIPP</td>
<td>Waste Isolation Pilot Plant</td>
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</table>
• 1994 Department decided to stabilize, package and store excess plutonium until final disposition

  • Robust oxide stabilization – at least 950 °C for two hours
  • Robust packaging – two welded, nested stainless steel containers
  • Requires surveillance program to assure there is no long term degradation of containers

• Plutonium stabilization and packaging began in late 2001
  • Rocky Flats Environmental Technology Site (RFETS)
  • Hanford Site
  • Los Alamos National Laboratory (LANL)
  • Lawrence Livermore National Laboratory (LLNL)
  • Savannah River Site (SRS)
SRS Plutonium Flow Path

**Key:**
- AFS-2 – Alternate Feed Stock #2
- EM – Environmental Management
- KAMS – K-Area Material Storage
- MOX - Mixed Oxide
- NNSA – National Nuclear Security Administration
- Pu – Plutonium
- SRS – Savannah River Site
- WIPP – Waste Isolation Pilot Plant

- EM Activity
- NNSA Activity

**Flow Path Diagram:**
- US / other Governments
  - By Boat
  - Port of Charleston
  - By Rail or Truck
  - K-Area / KAMS
  - Testing and Storage
  - By Truck
  - Enters SRS
  - AFS-2
  - Mixed Oxide Fuel Fabrication Facility
  - Commercial Reactors
    - Electricity for homes
  - Leaves SRS
- By Boat
  - K-Area Material Storage
  - KAMS
  - Enters SRS
  - AFS-2
  - Mixed Oxide Fuel Fabrication Facility
  - Commercial Reactors
    - Electricity for homes
  - Leaves SRS
- Down Blending Operations and Repackaged for WIPP
- H-Canyon / HB-Line
  - Purification / Repackaged for MOX
  - Moxable Pu
  - Leaves SRS

- Storage awaiting shipment to WIPP
- WIPP
  - Final Disposal

**Authorized under the NNSA Nuclear Material Remove Program**

**Additional Information:**
- NNSA Activity
- EM Activity
K Area Storage in 2000
K Area Storage in 2009
K Area Storage Configuration

3013 Container
(~30 lbs.)

9975 Shipping Container
(~400 lbs.)
Example 3013 Container Set (SRS)

Outer Container

Inner Container

Convenience Container
Cross Sectional of 9975 Shipping Container
Surveillance and Monitoring Program approved in 2003

Materials Identification and Surveillance (MIS) Working Group provides guidance and performs the technical oversite for the program
- Consists of technical experts from the plutonium processing sites and laboratories (SRS, Hanford, LANL, and LLNL)
- Directs Shelf-Life tests and corrosion tests and evaluates the results
  - Shelf-Life tests at LANL
  - Corrosion tests at LANL and SRNL
- Selects 3013 containers for examination at SRS and evaluates the results
  - Containers selected are a combination of randomly selected containers and ones selected by the MIS based on Shelf-Life and surveillance results

Shelf-Life and corrosion tests
- Containers of plutonium-bearing materials were selected that are representative of all of the different types of materials packaged
- Instrumented tests of “representative” samples that bound the amount of water allowed by the 3013 Standard
  - Small scale (1/50th scale) – 45 test positions
  - Large scale (full scale) – 9 test positions
- Also testing plutonium surrogates that bound the chloride salt and water contents
- Tests bound the gas generation and corrosion that might occur in actual containers
Non-destructive examination (NDE) and destructive examination (DE) of stored 3013 containers are performed at SRS.

- NDE started in 2005
  - Radiographic examination for possible pressurization
  - External examination of containers for any evidence of corrosion
  - NDE of the randomly selected containers was completed in FY2010

- DE started in 2007
  - Analyzes gas composition and measures gas pressure
  - Metallurgical examination of containers for evidence of corrosion
  - Chemical and physical analyses of the material
  - Currently examining 6 containers per year
  - Scheduled to complete randomly selected containers in FY2025
  - DE will continue as long as containers are stored at SRS
Shelf-Life Testing at LANL

Small Scale Test Rack
(shown during installation)
Full Scale Test Rack
(shown during installation)
Destructive Examination

3013 Container Cut for Oxide Removal and Metallurgical Examination
Convenience Container with Pu Oxide
Pu Oxide Transferred into Pan for Sampling
• Maximum Pressure inside the 3013 container is less than 10 psi compared to the 699 psi container design pressure
• No flammable gas mixtures (hydrogen with no oxygen)
• Some corrosion seen on the convenience can, usually in the gas space or oxide can interface area
• Minimal corrosion on the inside of the inner can around the weld area
• Surveillance program has not identified any condition that would challenge the 50 year storage life
• Continue to perform Destructive Examinations in K Area and Shelf-Life program at LANL to validate storage life
• BACKGROUND
  • Prior to 2012, SR was dissolving Pu and discarding to high level liquid waste for incorporation into high level waste glass.
  • In FY2012, Savannah River Site changed and began dry down blending with an inert agent in H Area for disposal at the DOE’s Waste Isolation Pilot Plant.
  • Due to conflicting missions and budgets, SRS terminated down blending in H Area in FY2013.
  • SRS was in the middle of shipping the down blended material to WIPP when it was interrupted in early 2014 due to fire/release at WIPP
  • SRS resumed shipments of down blended Pu to WIPP in April 2017 and SRS expects to complete the current campaign in August 2017
**Status**

- The Department issued a Record of Decision for the Supplemental Environmental Impact Statement for the down blend and disposal of up to 6 metric tons of non-Moxable Pu
- Due to reduction in DE surveillance, SRS resumed down blending operations in K Area in FY2016 and SRS continues down blending in FY2017 and beyond, assuming funding remains available.
Pu Oxide Sample Returns
DE Daughter Cans

KIS Glovebox

Load Blend Cans
with Adulterant

Load Blend Cans
into Blend Cans

Load Blend Cans
into CCOs

Puncture & Cut Open 3013 Cans/Contents

Sieve & Size Reduce Oxide

Add Predetermined Pu Oxide Weight into blend Cans

Bag Out Blend Cans

Mix Blend Can Contents

Weigh Loaded Blend Cans

Perform NDA on Blend Cans

Load into Outer Blend Can

Stage CCOs in K-Area

Ship CCOs to SWMF

Perform WIPP Characterization

Load into TRUPAC-II

Ship to WIPP
K-Area Glovebox
Plutonium Oxide in Weighing/Inspection Pan in K-Area Glovebox
Sieving and Oxide Size Reduction

• Size Reduction Tools
K-Area Plutonium Inner Blend Can Mixer
Inner Blend Can Inserted into Outer Blend Can
CCO designed as an improved payload container to the pipe over-pack component

Pipe Over-pack Component (POC) developed by/for RFETS limited to <200 FGE

IC3 design:
- Eliminate unnecessary components (i.e., rigid liner)
- Replace soft Celotex™ dunnage with CDX laminated plywood
- Raise fissile limit: ~380 FGE
Summary

• Pu is safely stored in K-Area

• SRS continues to evaluate storage conditions to ensure safe storage

• SRS has the experienced staff and facility to handle Pu

• SRS is currently and plans to continue down blending non-MOXable Pu for disposal at WIPP (funding dependent)