U.S. DEPARTMENT OF ENERGY | OFFICE OF ENVIRONMENTAL MANAGEMENT

K Area Overview/Update

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Citizens Advisory Board
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Purpose

- To provide information on K-Area and Plutonium storage which fulfills a Nuclear Materials Program work plan item.

Acronyms

CCO – Criticality Container Over-pack

DOE – Department of Energy

DE – Destructive examination

FGE – Fissile Gram Equivalent

KIS – K Interim Surveillance

LANL – Los Alamos National Laboratory

LLNL – Lawrence Livermore National Laboratory

MIS – Materials Identification and Surveillance

NDA – Non-destructive assay

NDE – Non-destructive examination

PSI – Pounds per square inch
(gas pressure above atmospheric)

Pu – Plutonium

RFETS – Rocky Flats Environmental Technology Site

SRS – Savannah River Site

SRNL – Savannah River National Laboratory

SWMF – Solid Waste Management Facility

WIPP – Waste Isolation Pilot Plant

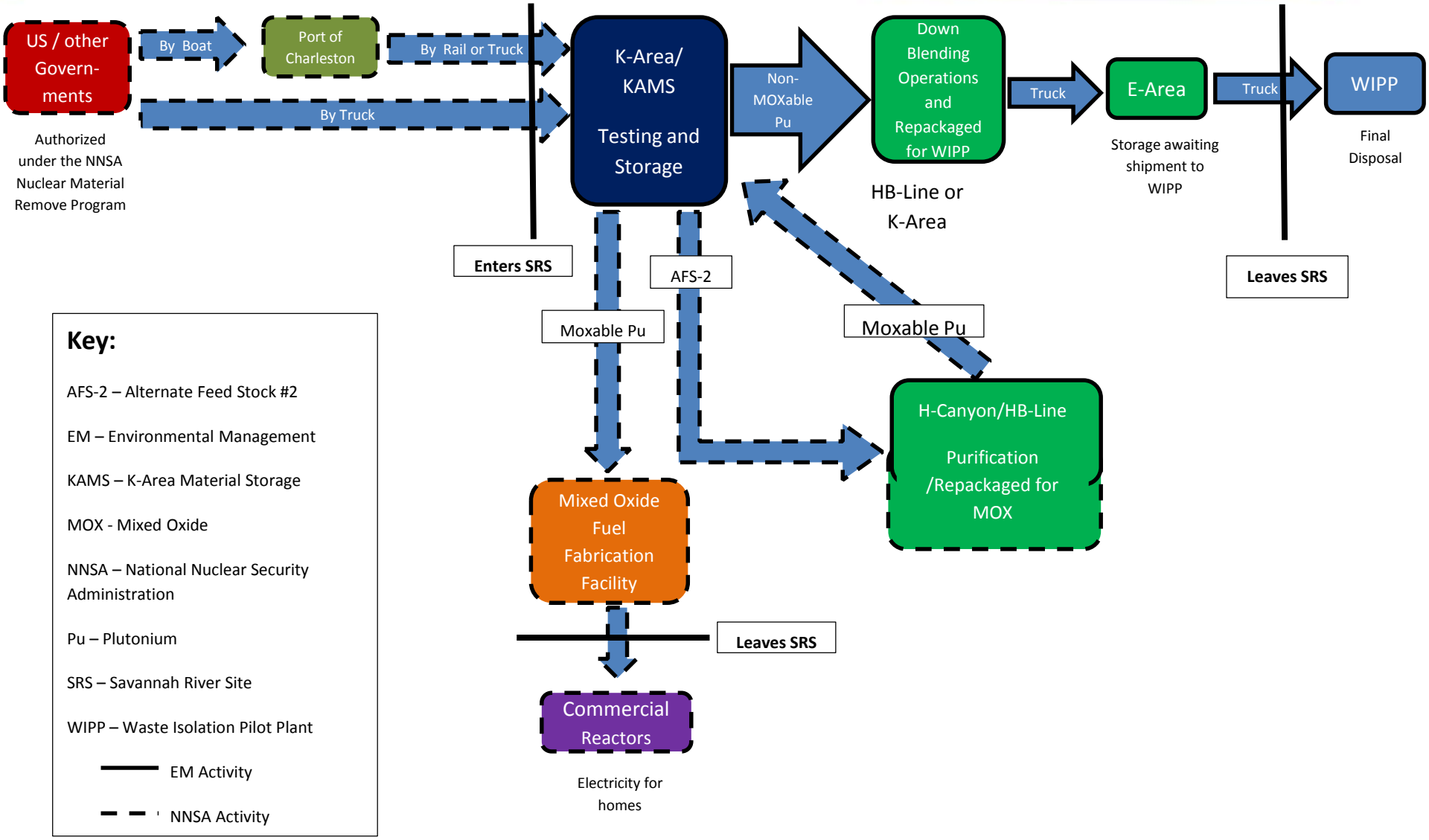
Pu Stabilization and Packaging for Storage

- 1994 Department decided to stabilize, package and store excess plutonium until final disposition

- 1994 Department issued Standard DOE-STD-3013, "Stabilization, Packaging, and Storage of Plutonium-Bearing Materials"
  - 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

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)

Cross Sectional of 9975 Shipping Container

3013 Surveillance Program

- 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

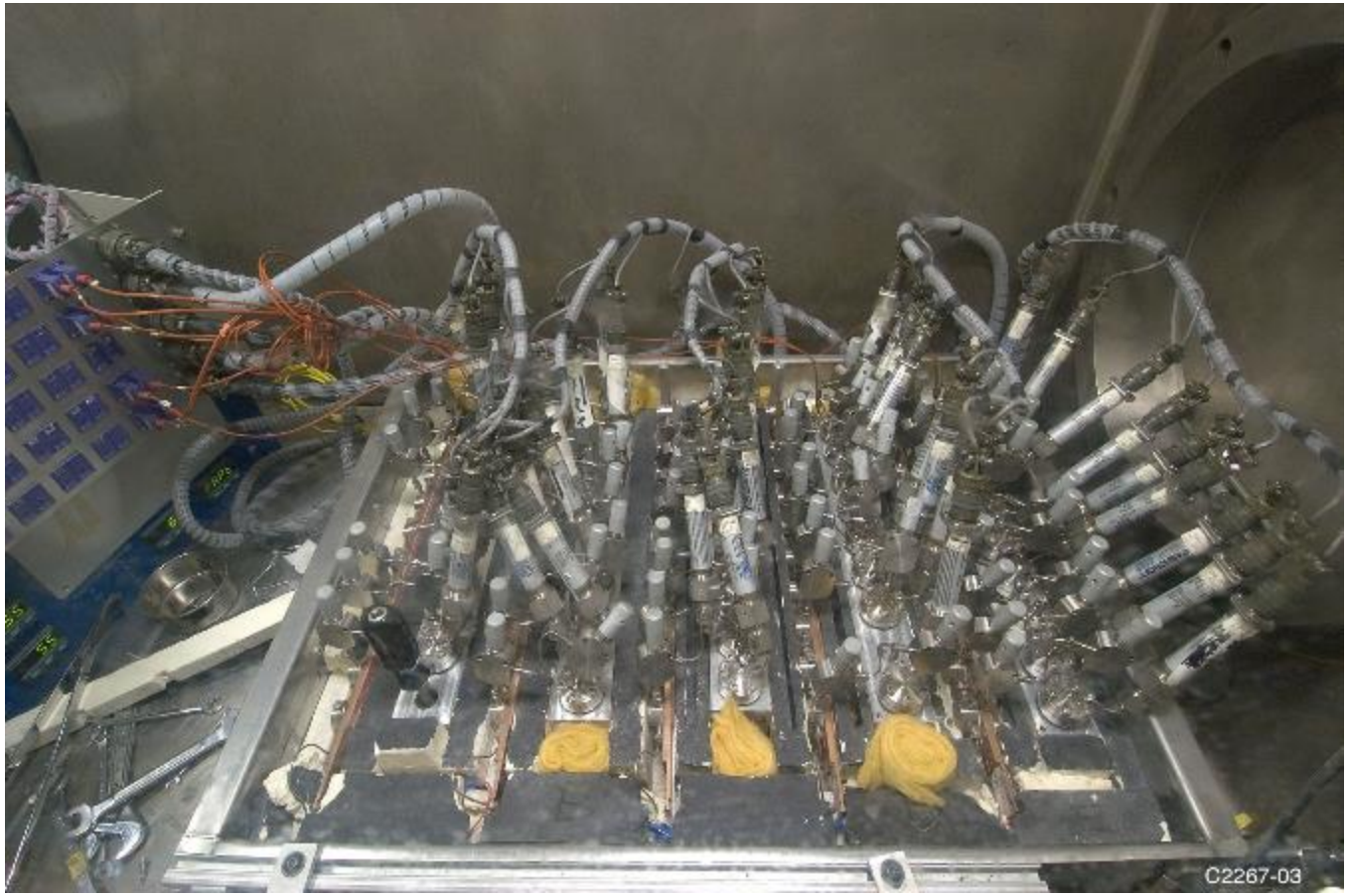
3013 Surveillance Program (cont.)

- 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

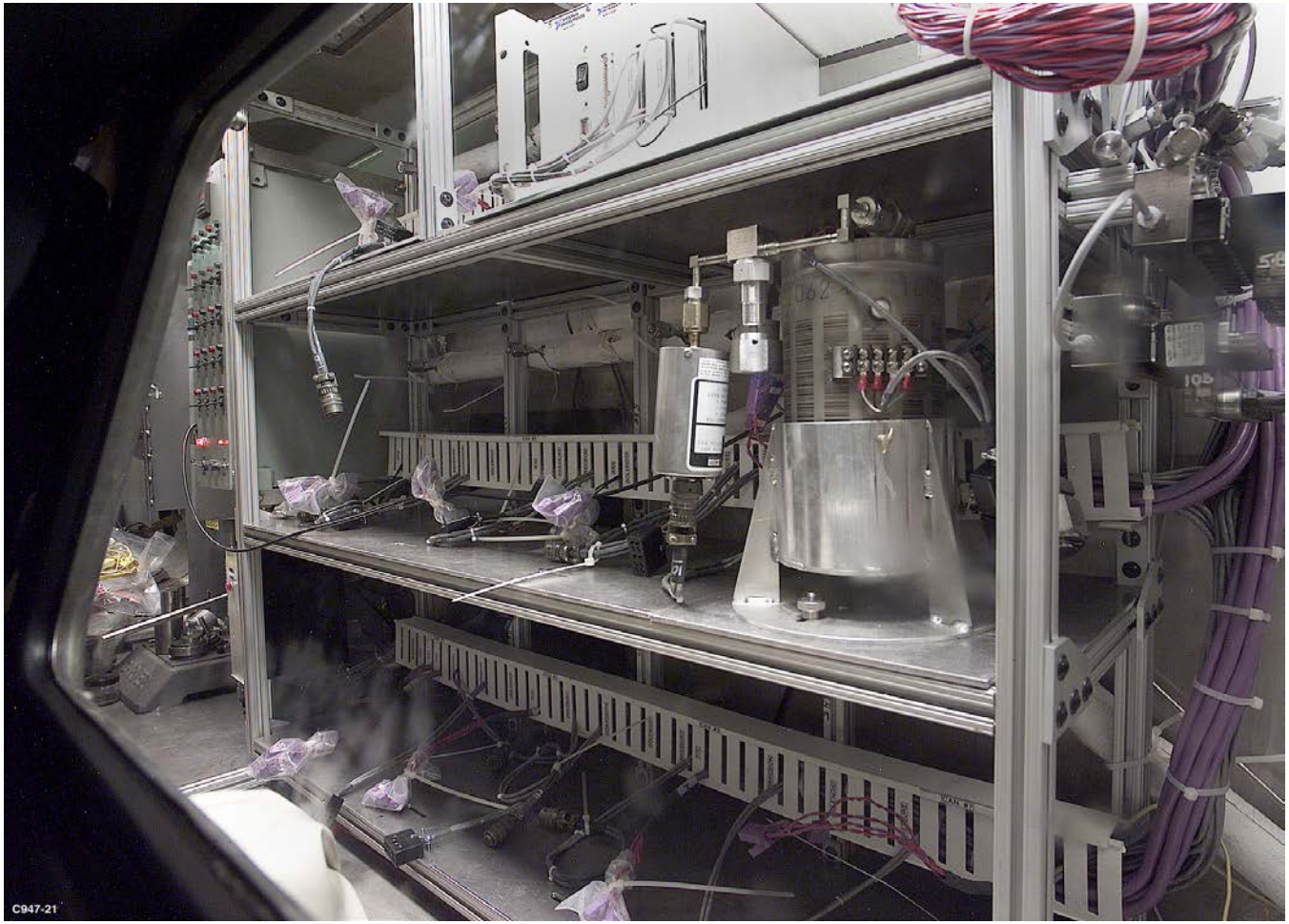
- DE started in 2007
  - Analyzes gas composition and measures gas pressure
  - Metallurgical examination of containers for evidence of corrosion
  - Chemical and physical analyses of the material
  - Currently examining 6 containers per year
  - Scheduled to complete randomly selected containers in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

Shelf-Life Testing at LANL



Small Scale Test Rack
(shown during installation)

Shelf-Life Testing at LANL

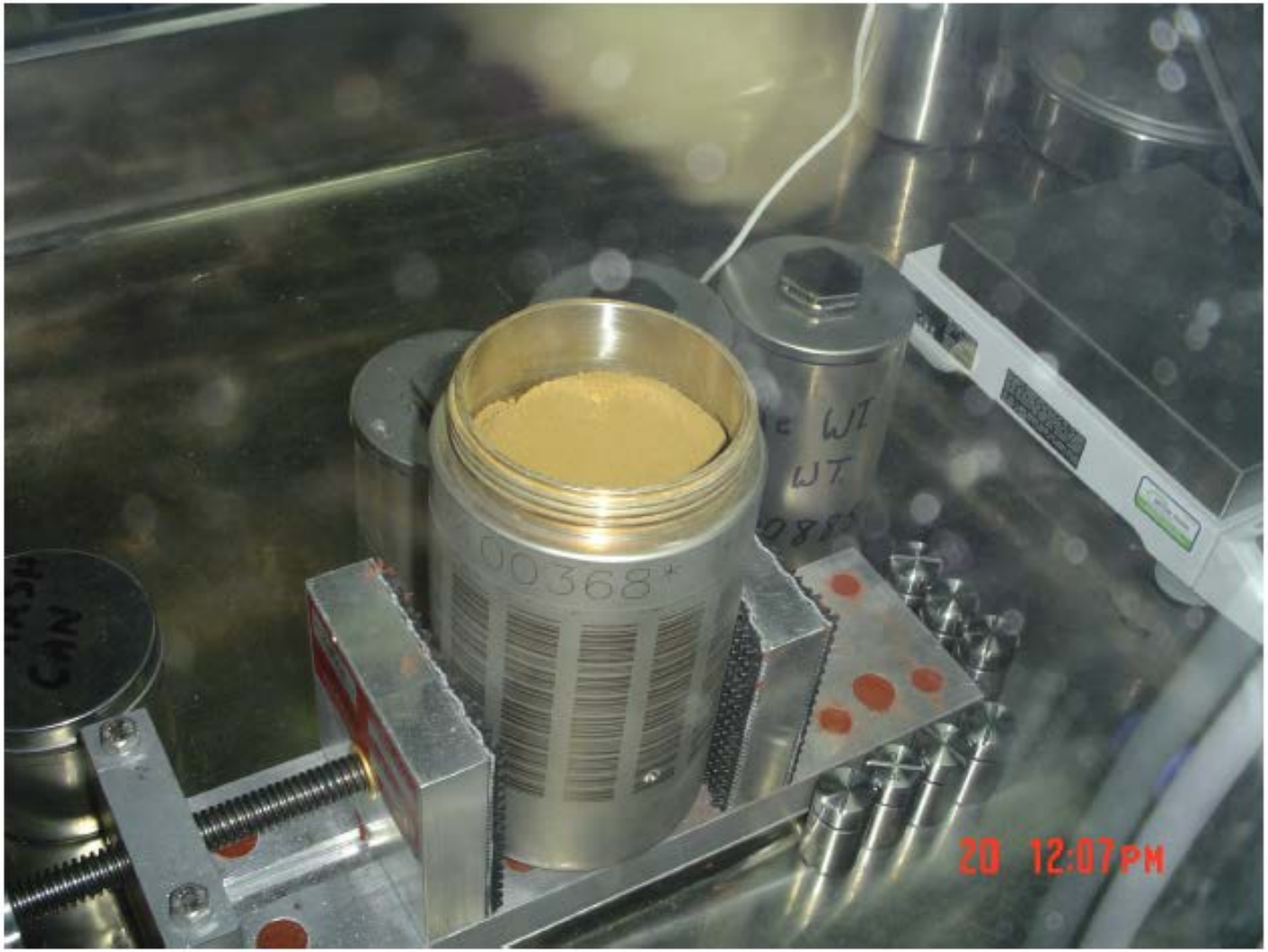


Full Scale Test Rack
(shown during installation)

Destructive Examination

3013 Container Cut for Oxide Removal and Metallurgical Examination

Convenience Container with Pu Oxide



Pu Oxide Transferred into Pan for Sampling

Surveillance Results

- 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

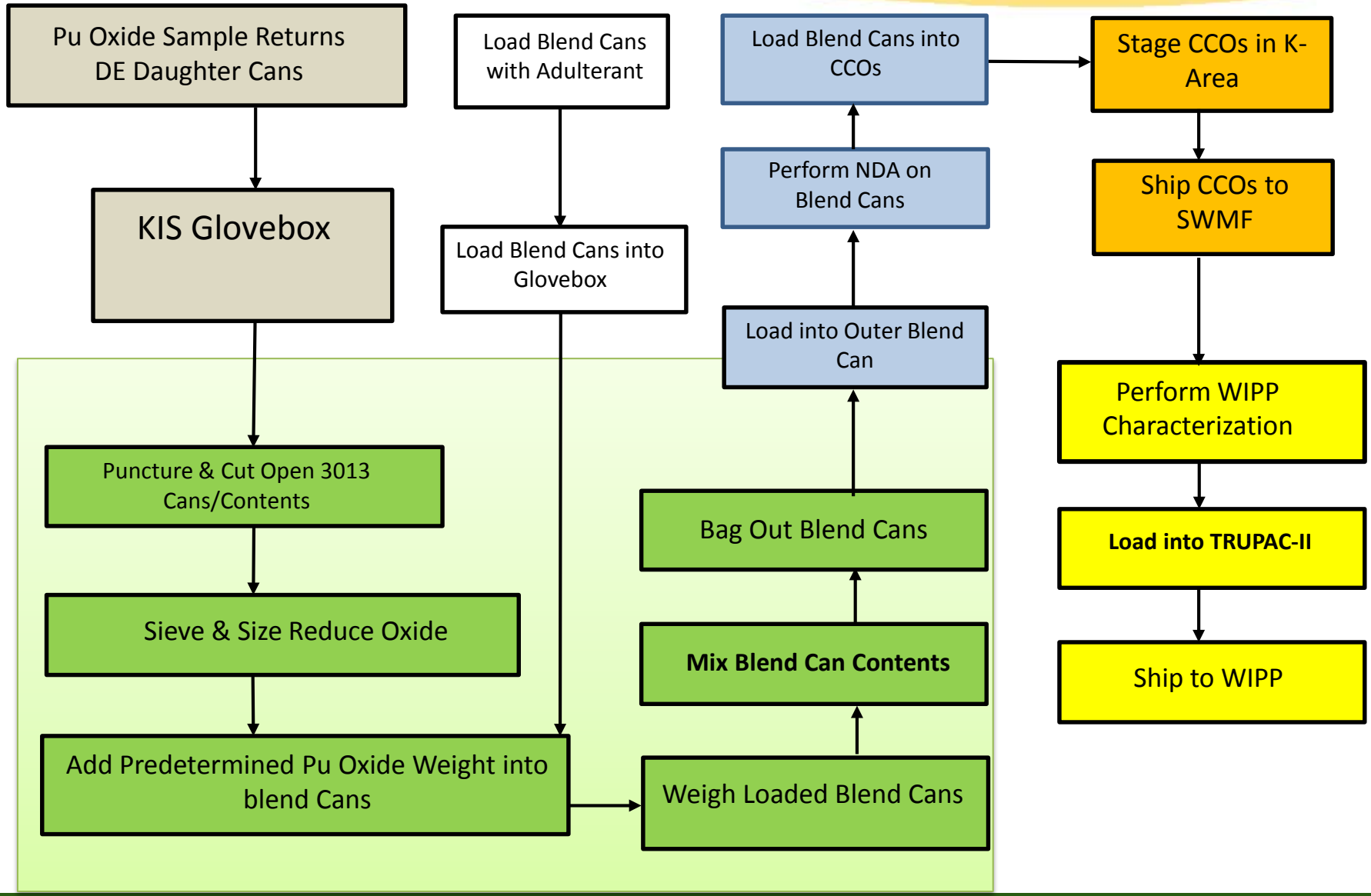
Blend down Program Status

- 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

Blend down Program Status

- 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.

K-Area Plutonium Downblending Flowsheet



K-Area Glovebox

Plutonium Oxide in Weighing/Inspection Pan in K-Area Glovebox

K-Area Inner Blend Can

Sieving and Oxide Size Reduction

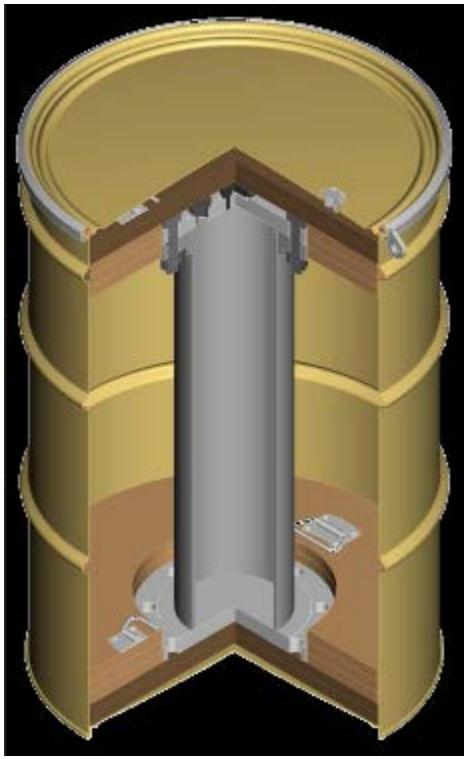
- Size Reduction Tools

K-Area Plutonium Inner Blend Can Mixer

Inner Blend Can Inserted into Outer Blend Can

Criticality Control Over-pack (CCO)

- 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)