



# National Nuclear Security Administration

## Isotope Inventory, Production, and Requirements

*1<sup>st</sup> Workshop on Isotope Federal Supply and Demand*  
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# NNSA Nuclear Security Mission

- Defense Programs
- Nuclear Nonproliferation
- Naval Reactors
- Emergency Operations
- Safeguards and Security



# Accountable Nuclear Material

- Uranium -- Depleted and Natural
- Uranium -- Enriched and Uranium-233
- Plutonium – Isotopes 238-239, and 240-242-244
- Americium -- 241 and 243
- Californium, Curium, Neptunium
- Deuterium
- Enriched Lithium (Lithium-6)
- Thorium
- Tritium



# Defense Programs

- Plutonium-239 and Uranium-235
- Plutonium-238
- Tritium
- Heavy Water
- Enriched Lithium (Lithium-6)
- Other Heavy Actinide Isotopes



# Nonproliferation Program

## **Fissile Material Disposition**

- Plutonium to MOX Fuel Fabrication
- HEU Blend-down to LEU for Reactor Fuel

## **Spent Research Reactor Fuel Returns**

- Domestic and Foreign Research Reactors
- To INL and SRS for Fuel Disposition

## **Other Material Recovery**

- Selected Actinides and Fission Products
- Recovered for Disposal Only



# Current Inventories

## Plutonium

- Defense Programs Recycle and Reuse
- MOX Fuel Fabrication
- Other Disposition

## Plutonium-238

- Defense Programs Recycle and Reuse
- Naval Reactors Startup Neutron Sources
- Sources Being Evaluated for U-234 Extraction



# Current Inventories

## Enriched Uranium

- Defense Programs Recycle and Reuse
- Fuel Production for Naval Propulsion
- Blend-down to Reactor Fuel

## Uranium-233

- Specific Needs Being Assessed DOE-Wide
- Most is Slated for Processing for Disposal
- Thorium Extraction is Not Planned



# Current Inventories

## Mk-18 and Mk-42 Targets

- Pu/Am/Cm Targets Used for Heavy Isotope Production
- In Storage Awaiting Disposition



Isotope	Mass (grams)
Pu-240	288
Pu-241	6
Pu-242	5,000
Pu-244	20
Am-243	30
Cm	820
Cf	milligrams



# Current Inventories

## Americium-241

- 48 kg Extraction and Sales
- Little Material in Inventory
- High Demand
- Low-Kilogram Quantities in Pu Processing Residues
- High-Kilogram Quantities In-grown in Pu Stockpile
- Several Plutonium Disposition Processes Planned that Could Accommodate Americium-241 Extraction





# Current Inventories

## Californium-252

- Used Largely for Nondestructive Assay
- Source Fabrication at ORNL
- Defense Programs Loan-Lease
- Loans Discontinued in 2010
- Retired Loans Stored at ORNL





# Current Inventories

## Curium Isotopes

- 820 Grams Largely Remains in Unprocessed Pu Targets
- Limited Extractions From Targets and Fission Products Under Way
- Excess Cm-244 DP Inventory Supplied to Other DOE Programs in 2011

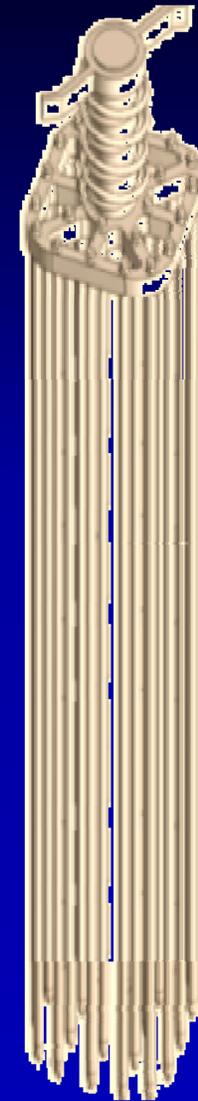




# Current Inventories

## Tritium

- Defense Programs Recycle and Reuse
- Further Production Requires Uranium Fuel Unencumbered by Peaceful-Use Restrictions





# Current Inventories

## Lithium

### Enriched Lithium (Lithium-6)

- Defense Programs Recycling
- 8,000 Kilograms Reserves for Neutron Detector R&D
- Projected Inventory Adequate to Meet Demand

### Lithium-7

- Defense Production Residue
- Mostly Disposed Of
- Supports Sales for TLD Manufacturing
- Inadequate Supply for Nuclear Power Industry Demand



# Current Inventories

## Deuterium – Heavy Water

- No DOE Production Since 1982
- Existing Inventory Adequate to Meet DOE's Foreseen Scientific and National Security Demand
- Mostly Planned for Use In:
  - ✓ Inertial Confinement Fusion Research
  - ✓ Spallation Neutron Source
- Long-term Availability is Uncertain





# Isotope Needs

## NNSA Labs

(Emergency Ops, Nonproliferation R&D, Forensics)

Mostly Needed as Sealed Sources For:

- Spectrometry
- Calibration
- Instrument Testing
- Safeguards R&D
- Safeguards Training
- Tracers

Isotope	Mass
Pu-236, Pu-244, Np-236, Cf-252	100's Milligrams
Th-229, U-233, Am-241, Am-243, Cm-248,	Grams
U-235, U-238	Grams - Kilograms
Pu-238, Pu-239, Pu-240, Pu-242	Low Kilograms



# Isotope Needs

## NNSA Defense Production

### Long-Term Needs for Unencumbered Material:

- LEU Fuels for Defense Applications
- Tritium

