U.S. DEPARTMENT OF ENERGY

# Nuclear Materials Management

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## Savannah River Site Information Pods

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# What do we mean by nuclear materials?

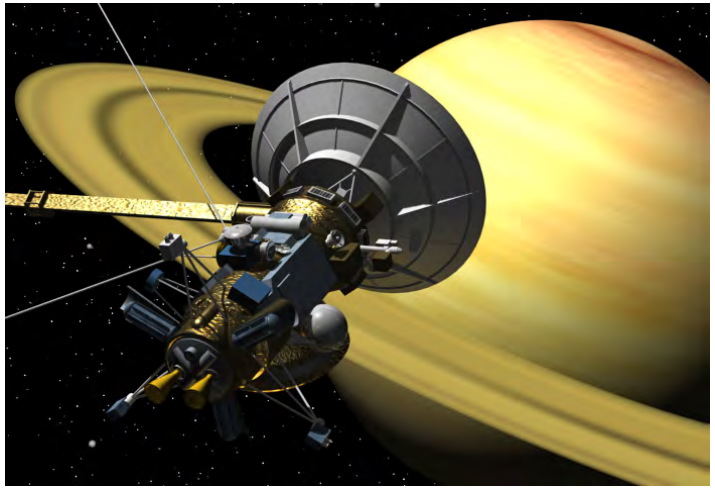
- **Radioactive isotopes**
  - Occur naturally and can be produced artificially (in a nuclear reactor)
- **Fissile materials**
  - Isotopes of plutonium and uranium, capable of a self-sustaining nuclear chain reaction
- **Tritium**
  - Isotope of hydrogen used in nuclear weapons
- **Used nuclear fuel**
  - Fuel that has been withdrawn from a nuclear reactor following irradiation

Commercial nuclear power plant

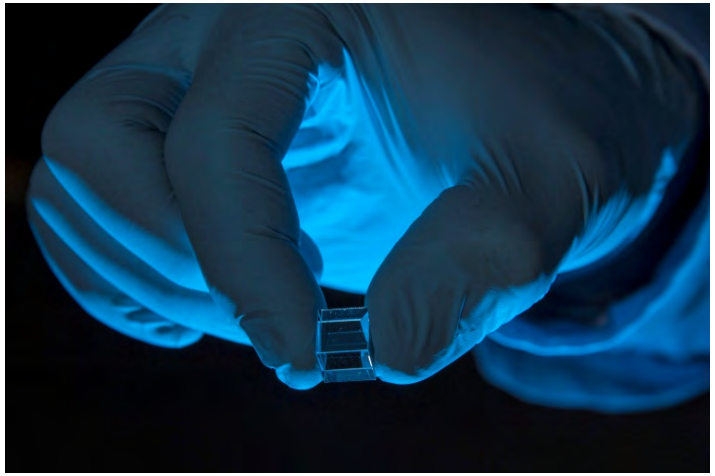
Used nuclear fuel at SRS

# How are nuclear materials used?

- Agriculture (insect control, food preservation)
- Archaeology (age measurements)
- Consumer products (smoke detectors, nonstick pans)
- Energy (20% of U.S. electricity)
- Industry (tracers, radiography)
- Medicine (diagnostics and treatment)
- Science (research)
- Security (detection of concealed material)
- Space exploration (energy source for spacecraft)
- Weapons (nuclear deterrent)



Powered with SRS plutonium-238



Radiation detector crystal

# Nuclear Materials Management: Challenges and the SRS Role

| | Challenges of Nuclear Materials Management | SRS Role in Nuclear Materials Management |
|---|---|---|
| Reliable nuclear deterrent | Tritium gas, used in nuclear weapons, must be periodically replenished due to decay | SRS prepares the nation's only tritium supply for the U.S. nuclear weapons program |
| Legacy nuclear materials | Cold War production left behind nuclear materials and waste products at SRS and across the country | SRS processes nuclear materials into valuable assets and stable waste forms |
| Global Nonproliferation | Proliferant nuclear materials exist worldwide under varying safety and security conditions | SRS secures nuclear materials to prevent international terrorism and proliferation |
| Commercial applications | Increasing dependence on foreign sources of radioactive isotopes | SRS produces valuable isotopes and fuel for commerce |

At SRS, SRNL develops and deploys highly innovative approaches to address nuclear materials challenges

## Nuclear Deterrent: SRS is sole provider of tritium for national defense

- Operates nation's only full-scale tritium processing facilities
- Recycles and purifies tritium from dismantled weapons
- Extracts new tritium from irradiated target rods
- Replenishes tritium reservoirs for use in existing weapons
- Ships to Department of Defense
- Supplies helium-3 gas, used in radiation detectors
- Performs reliability testing on gas transfer systems
- SRNL recognized as world leader in tritium science /technology

Tritium Facilities at SRS

# Legacy Nuclear Materials: SRS provides interim storage and processing

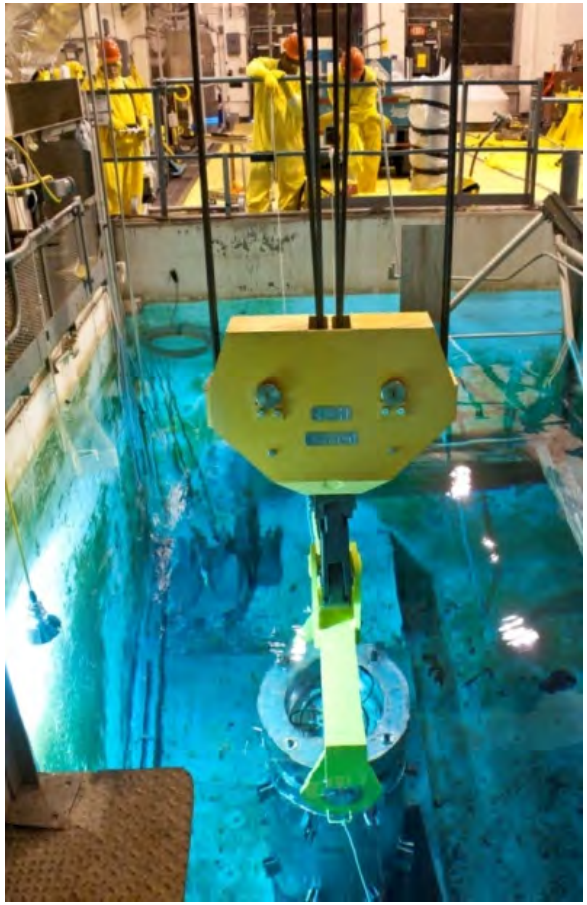
- **Savannah River Site role**
  - Material receipts and secure interim storage in robust hardened facilities
    - *Surplus plutonium*
    - *Defense Used Nuclear Fuel (UNF)*
  - Operation of nation's only large scale radiochemical processing and waste facilities
    - *Prepare surplus Pu for disposition*
    - *Dissolve UNF, recover uranium and blend down for commercial fuel*
  - SRNL provides innovative approaches for processing legacy materials and high-level waste

Interim used fuel storage

Stable waste form

# SRS maintains unique assets to manage legacy nuclear materials

## Unique large scale secure interim storage facilities



L Basin

K Area

ARP/MCU

# SRS maintains unique assets to manage legacy nuclear materials

## Nation's only large-scale nuclear materials separations facilities: H Canyon and HB Line

H Canyon

HB Line

# SRS maintains unique assets to manage legacy nuclear materials

## Nation's only large-scale waste vitrification facility: Defense Waste Processing Facility

DWPF canisters

DWPF

# Global Nonproliferation: SRS secures international nuclear materials

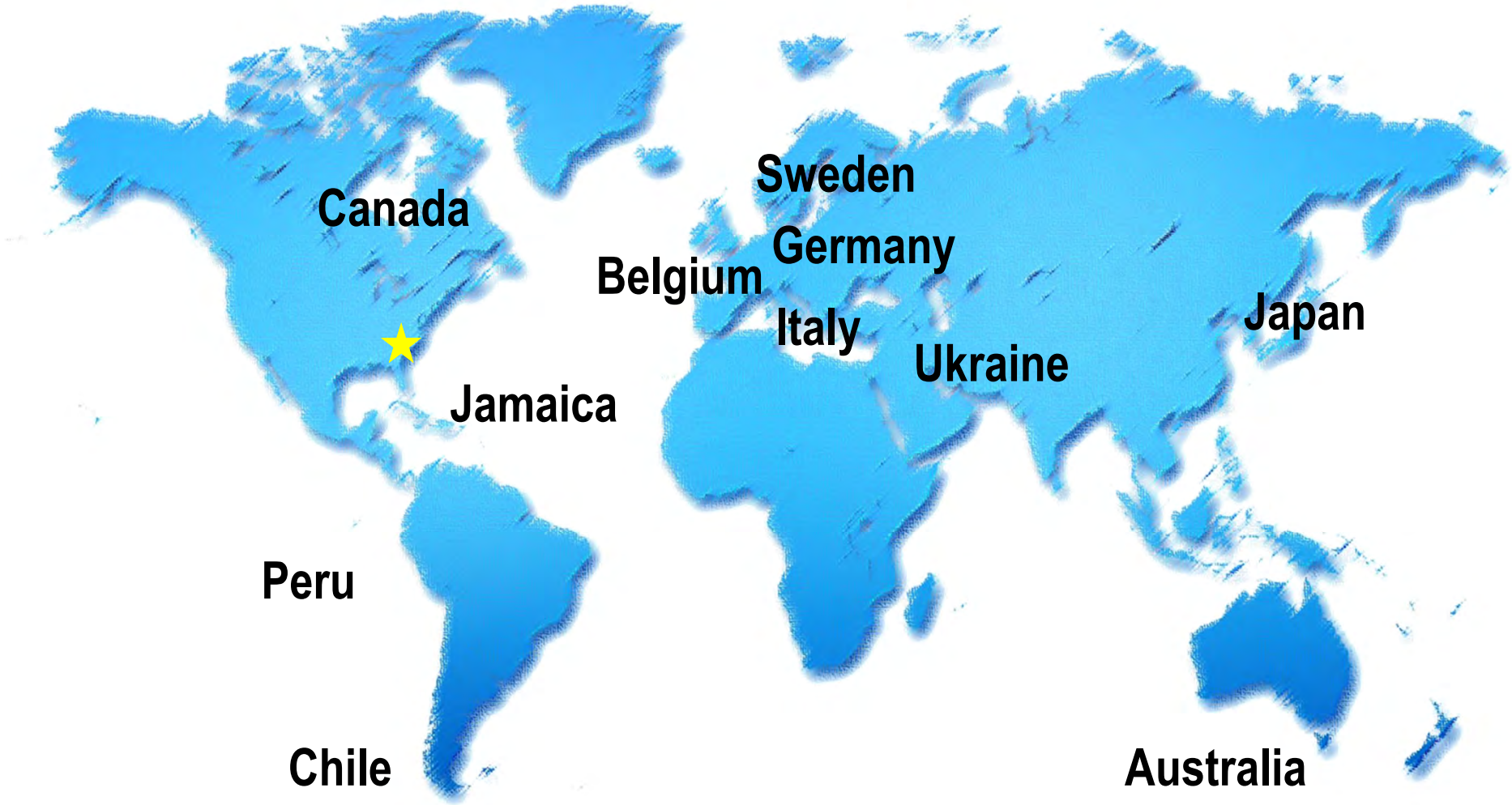
- Operation of unique large scale secure interim storage facilities
- Secure vulnerable materials worldwide
- Deploy response teams to quickly recover nuclear materials
- SRNL provides nuclear forensics, detection and collections capabilities

Radiological Evidence Examination Facility

Russian fuel return

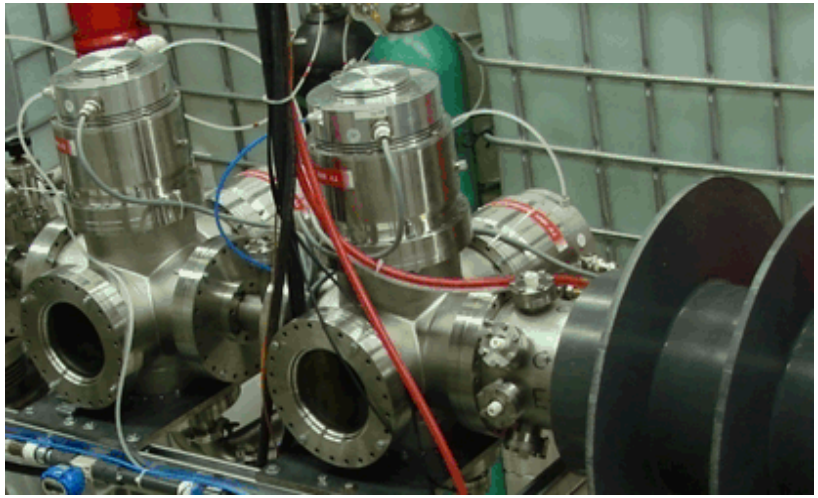
SRS Mobile Plutonium Facility

# Providing international support for U. S. nonproliferation objectives



## Commercial Applications: SRS produces valuable isotopes and fuel for commerce

- **Interim storage of legacy nuclear materials capable of producing rare isotopes**
- **Transformation of surplus weapons material into clean fuel for commercial power generation**
- **SRNL provides expertise in isotope production, clean energy storage and fuel cycle R&D**

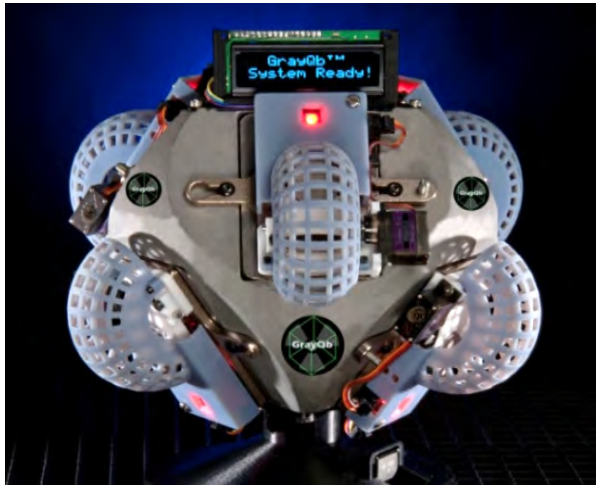


Medical isotope production

Hydrogen and natural gas storage, based on tritium technologies

# Savannah River National Laboratory: Providing nuclear materials innovation

- DOE's National Laboratory for complex-wide environmental management
- Provides innovative approaches for processing legacy materials and high-level waste
- Recognized as world leader in tritium science and technology
- Provides nuclear forensics, detection and collections capabilities
- Provides expertise in isotope production, clean energy storage and fuel cycle R&D
- Supports customers at SRS, throughout DOE, at other federal agencies, across the country and the world




GrayQb™ nuclear materials mapping technology

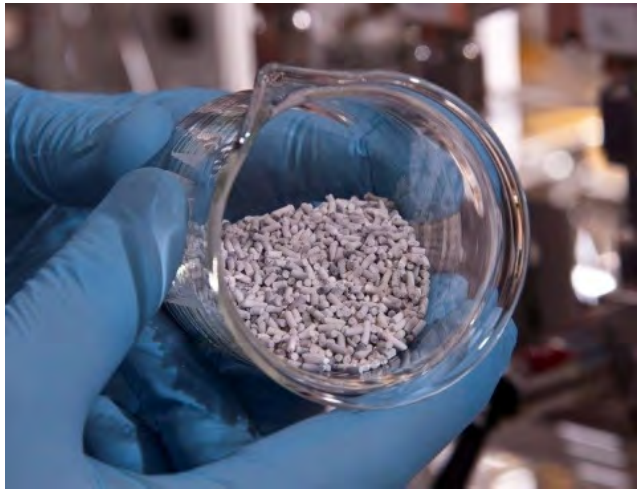
Natural gas storage based on tritium technologies

# Safety at SRS is our highest priority

- Protection of workers, public and environment is our objective
- Employ world's premier nuclear safety experts
- One of safest industrial complexes in the world (top 5 percent)
- Safest site in the DOE Complex
- Most secure site in the country

# What is effective nuclear materials management?

- Ensuring materials are safely handled and securely stored
- Providing robust interim storage under all credible scenarios
- Advancing disposition and risk reduction of unwanted materials
- Developing new technologies to reduce costs, accelerate risk reduction
- Securing vulnerable materials
- Ensuring a reliable supply of materials to meet national needs



Metal hydride based technologies

Safe/secure materials packaging and transportation