



Global Threat Reduction Initiative



GTRI Removal Program Overview

December 3, 2014



GTRI Removal Program Overview

- GTRI's mission is to reduce and protect vulnerable nuclear and radiological materials at civilian sites around the world that could be used by terrorists to make an improvised nuclear device or radiological dispersal device
- As part of DOE's overall highly enriched uranium (HEU) minimization strategy, removal efforts began in 1994 and focused on the removal of U.S.-origin HEU and low enriched uranium (LEU) to encourage countries to convert their research reactors from HEU to LEU
- The removal program has expanded and accelerated over the last 20 years to address additional forms of nuclear material that could be used to make a nuclear weapon
- GTRI has removed or eliminated over 5,000 kilograms of HEU since 1994 – enough material for approximately 200 nuclear weapons
- Despite programmatic successes, challenges remain as there are several metric tons of HEU and plutonium that need to be addressed



Mission Accelerators

Presidential Speech in Prague – April 5, 2009

“Today, I am announcing a new international effort to secure all vulnerable nuclear material around the world within four years. We will set new standards, expand our cooperation with Russia, and pursue new partnerships to lock down these sensitive materials.”



Washington Nuclear Security Summit (NSS) – April 12-13, 2010



We recognize that highly enriched uranium and separated plutonium require special precautions and agree to promote measures to secure, account for, and consolidate these materials, as appropriate.

- Key Deliverables included removal of all HEU from Chile and Turkey



Mission Accelerators, cont.

Seoul Nuclear Security Summit – March 2012

*Recognizing that highly enriched uranium (HEU) and separated plutonium require special precautions, we reemphasize the importance of appropriately securing, accounting for and consolidating these materials. **We also encourage States to consider the safe, secure and timely removal and disposition of nuclear materials from facilities no longer using them.***

- Key Deliverables included removal of all HEU from Serbia, Ukraine and Mexico, all plutonium from Sweden



The Hague Nuclear Security Summit – March 2014

- Key Deliverables included removal of all HEU from Czech Republic, Vietnam, and Hungary, and all excess HEU and plutonium from Italy and Belgium

United States Nuclear Security Summit – 2016

- Key Deliverables could include removal of all HEU from Japan's FCA facility, removal of all excess plutonium from two European countries



Removal Programs

- U.S.-Origin Return Program
 - Return U.S.-origin HEU and LEU to the United States for disposition to encourage countries to convert research reactors from HEU to LEU
 - Program began in 1996
 - Progress: Removed 1,264 kilograms of HEU
 - Goal: Remove an additional 447 kilograms of HEU by 2019
- Russian-Origin Return Program
 - Return Russian-origin HEU to Russia for disposition
 - Program began in 2003
 - Progress: Removed 2,121 kilograms of HEU
 - Goal: Remove an additional 404 kilograms of HEU by 2020
- Gap Material Program
 - Program began in 2004 to address weapons usable materials not covered under the U.S. or Russian-origin programs
 - Progress: Removed 1,825 kilograms of HEU and plutonium
 - Goal: Remove an additional 1,431 kilograms of HEU and Pu by 2022



Gap Removals

- Program initiated in 2004 to facilitate the disposition of high risk, vulnerable nuclear material not covered by other removal efforts. The materials could include:
 - U.S.-origin fresh and spent nuclear fuel not covered by the existing U.S.-origin fuel return program
 - Non-U.S.-origin HEU fresh and spent fuel
 - Separated plutonium
- Bringing the material into the United States requires environmental and legal reviews per the National Environmental Policy Act (NEPA)
 - Reviews complete in August 2006 for HEU fresh fuel shipments to Y-12
 - Reviews completed in January 2009 for HEU spent fuel shipments to Savannah River Site
 - Reviews completed in May 2010 for plutonium shipments to Savannah River Site



HEU Fresh Fuel
Stainless Steel



HEU Spent Fuel



HEU Fresh Fuel
Aluminum



Additional Requirements

- If the material is to be sent to the United States for disposition, it must also:
 - pose a threat to national security
 - be susceptible to use in an improvised nuclear device
 - present a high risk of terrorist threat and
 - have no other reasonable pathway to assure security from theft or diversion
- Acceptance of Gap Material SNF can also only occur if the material complies with the acceptance criteria of the Savannah River Site facility receiving the Gap Material SNF and provided sufficient storage capacity exists at the facility.



Removal Program Successes

- GTRI has been very successful in accelerating efforts to remove and dispose of HEU and plutonium
- Have removed or confirmed the disposition of over 5,100 kilograms of HEU and plutonium – enough material for more than 200 nuclear weapons
- Exceeded Agency Performance Goal of eliminating 4,353 kilograms by the end of 2013
- 26 countries plus Taiwan no longer possess HEU
- Have addressed additional forms of material via the Gap program
 - First shipment of spent fuel to the U.S. that was not U.S.-origin
 - First shipment of separated plutonium
- Have developed new tools and technologies
 - Development of first “Type C” cask to transport spent fuel by air to Russia
 - Development of new processes to stabilize plutonium
 - Development of new processes to convert uranium solutions to oxide
 - First international validation of a U.S. “Type B” package for transport of plutonium



Vietnam Shipment 2013
First use of New Type “C” Cask



Future Program Opportunities

- Although the 4 year effort is completed, GTRI removal activities will continue, focusing on the most attractive nuclear materials and those that are the most vulnerable to theft
- Threats still remain:
 - Thousands of additional kilograms of civilian HEU need to be addressed either by removal or downblending
 - World-wide civilian separated plutonium inventories have topped 300 metric tons and continue to rise
 - Weapons-usable material remains in several countries that have been difficult to engage (Belarus, South Africa, Pakistan, DPRK, Iran, etc.)



HEU removal in Romania,
July 2009



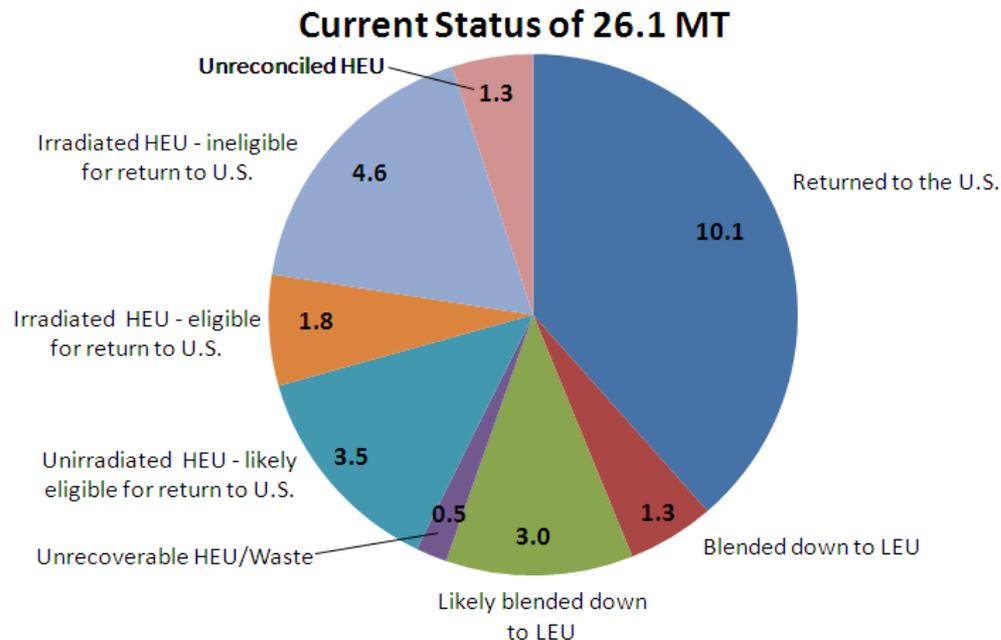
HEU fuel removal in Chile,
April 2010



U.S.- Origin HEU Removal Future Opportunities

U.S.-origin HEU

- GTRI recently completed a five-year study to identify the current locations and forms of all U.S.-origin HEU that has been exported
- Of the 26.1 metric tons of U.S.-origin HEU that has been exported, over 14 metric tons has been returned to the United States or downblended to LEU
- GTRI is currently prioritizing the remaining material for potential removal or disposition (5.3 MT of eligible fresh and spent HEU material – incl. Mo-99)





Russia/Gap HEU Removal Future Opportunities

Russian-origin HEU

- New Russian HEU minimization working group established to consolidate or eliminate thousands of kilograms of HEU across the Russian Federation
- Combining three separate DNN programs into a single working group to consolidate special nuclear material to fewer facilities in Russia
- Have identified first pilot site for implementation this year
- Potential to significantly reduce risk, as well as future security costs for Russia, and to be a benchmark for cooperation with other weapons states
- Success dependent upon significant investment by Russian partners

Gap HEU

- Working with China in third countries to remove Chinese-origin HEU from Miniature Neutron Source Reactors (MNSR)
- HEU exchange with Europe – leverage European requests for additional HEU needed to produce medical isotopes for the removal of additional HEU from Europe



Country Specific Opportunities

- Planning to remove/eliminate all HEU from five additional countries - Argentina, Jamaica, Uzbekistan, Poland, and Switzerland by 2019
- Hoping to remove all HEU from Australia, Belarus and South Africa although some challenges remain
- Removing all HEU from Japan's Fast Critical Assembly (FCA)
- Assisting the IAEA with the removal of its inventories of HEU
- Working with Canada to remove over 350 kilograms of U.S.-origin spent fuel
- Removing HEU from the MNSRs in Iran, Pakistan, Syria, Nigeria, Ghana
- Addressing Mo-99 residue material located in a few countries



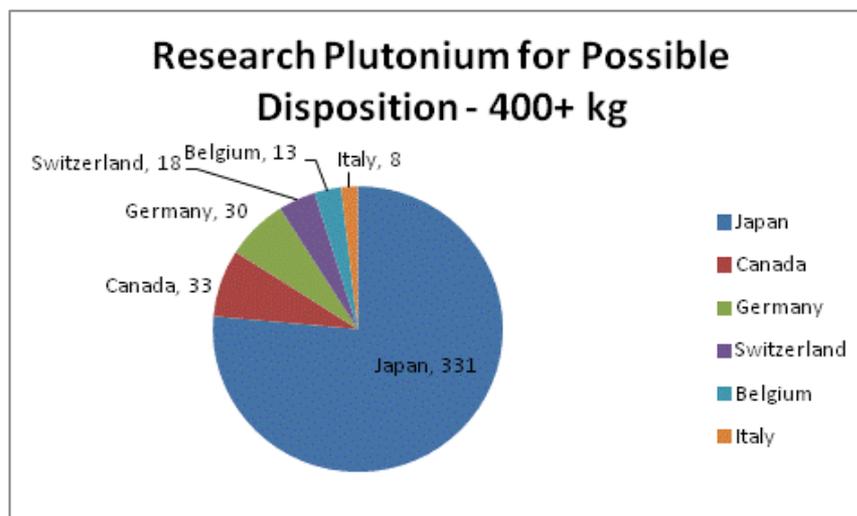
U.S.-Origin Removal Challenges

- U.S.-origin spent fuel return program is scheduled to conclude in May 2019
 - Many countries have asked for an extension including Japan, Germany, and Portugal
 - Have already extended program by 10 years in order to provide countries more time to convert their reactors to LEU and identify alternate disposition options for spent fuel
 - Since most reactors that are covered by the program have now converted, there is no longer any nonproliferation reason to extend the program in its entirety
 - May consider extension on a country-by-country basis if there is a clear nonproliferation reason to do so (e.g., Japan)
- Cask shortages
 - The fabrication and certification of casks is driven by the open market
 - Only three cask suppliers with limited inventories – may not be able to match the demand at the end of the program
- Support from EM, Indian Nations, and local governments (SC, NY) is critical to implementing these shipments
- Lack of disposition pathways limits the amount of HEU that can be returned to the United States



Plutonium Removal Opportunities

- Have identified over 400 kilograms of plutonium from research facilities that need to be addressed
 - This material can be particularly portable and in attractive forms that are readily weaponizable
 - Material management and security can be a challenge
 - Framework exists to remove this type of material to the United States but alternate disposition pathways are also being explored
- Have removed all excess plutonium from Belgium, Italy and Sweden
- Have initial agreement to remove all plutonium from the FCA in Japan, as well as all excess plutonium from two countries in Europe





Plutonium Removal Challenges

- Global civilian plutonium inventories have risen sharply over the last 20 years
- Further international engagement is needed to stop plutonium accumulation and start drawing down inventories
- Need to increase ceiling for the amount of material we can accept in the U.S.
 - NEPA coverage currently limited to 100 kg
 - Increasing limit to 1,400 kg to provide sufficient capacity to address other plutonium materials such as the Japan FCA plutonium
- Potential backlash for increasing inventories at Savannah River when no formal decision on MOX has been announced



Plutonium Packaging in Sweden