



The Role of International Cooperation Programs in International HEU Minimization



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GTRI Program Goals

DOE STRATEGIC GOAL

2.2

Prevent the acquisition of nuclear and radiological materials for use in weapons of mass destruction and other acts of terrorism

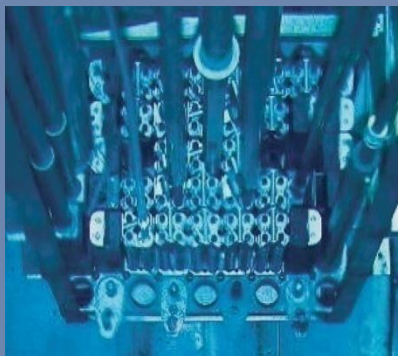
GTRI MISSION

Reduce and protect vulnerable nuclear and radiological material located at civilian sites worldwide.

GTRI is:

- ❑ A part of President Obama's comprehensive strategy to prevent nuclear terrorism; and
- ❑ The key organization responsible for implementing the U.S. HEU minimization policy.

Convert



Convert research reactors and isotope production facilities from the use of highly enriched uranium (HEU) to low enriched uranium (LEU)

These efforts result in permanent threat reduction by minimizing and, to the extent possible, eliminating the need for HEU in civilian applications – each reactor converted or shut down eliminates a source of bomb material.

Remove



Remove and dispose of excess nuclear and radiological materials; and

These efforts result in permanent threat reduction by eliminating bomb material at civilian sites – each kilogram or curie of this dangerous material that is removed reduces the risk of a terrorist bomb.

Protect



Protect high priority nuclear and radiological materials from theft and sabotage

These efforts result in threat reduction by improving security on the bomb material remaining at civilian sites – each vulnerable building that is protected reduces the risk until a permanent threat reduction solution can be implemented



Accomplishments in HEU Minimization

Reactor Conversion:

- 77 out of approximately 200 HEU-fueled facilities worldwide have been converted or verified as shutdown.
 - All U.S. HEU research reactors that can convert with existing LEU fuels have now been successfully converted to the use of LEU fuel.
 - The Czech Republic's Rez research reactor was the most recent conversion.



HEU Fuel Removals:

- 3125 kilograms out of approximately 4800 kilograms of HEU and pu have been removed or downblended (65%)
 - All HEU material has been removed from **19 locations:**
 - Brazil, Bulgaria, Chile, Colombia, Denmark, Greece, Latvia, Libya, Philippines, Portugal, Romania, Serbia, Slovenia, South Korea, Spain, Sweden, Taiwan, Thailand, and Turkey

Preparing HEU for removal from a research reactor core to allow for conversion to LEU

Mo-99:

- First LEU-based Mo-99 approved for use in the United States, from South Africa, in December 2010
- Signed four Cooperative Agreements with commercial partners to accelerate development of a commercial, non-HEU-based U.S. domestic Mo-99 supply



Casks of HEU spent nuclear fuel being loaded for transportation from Latvia back to Russia



GTRI's role in HEU Minimization

- **Political**: Engage international partners to advance U.S. and international efforts to minimize, and where possible eliminate, the use of HEU in civilian applications.
- **Technical**: Apply, in a collaborative manner, U.S. technical expertise to reactor conversion, Mo-99, and fuel removal projects; develop new LEU fuel and Mo-99 production technologies.
- **Financial**: Provide funding for domestic and international HEU minimization projects where appropriate and support the development of new LEU fuel and Mo-99 production technologies.
- **Three models for GTRI HEU Minimization Cooperation:**
 - Bi-lateral
 - Multi-lateral with international organizations
 - Government/industry partnerships



Bi-lateral Cooperation

- NNSA – Rosatom reactor conversion feasibility studies



- Implementing Agreement signed by DOE Deputy Secretary Poneman and Rosatom Director General Kiriyenko in December 2010 to conduct 6 Russian reactor conversion feasibility studies
- First formal bi-lateral U.S.-Russia cooperation on Russian domestic reactor conversion issues.
- NNSA-Rosatom Joint Working Group established to oversee conduct of feasibility studies, verify studies' results, and recommend next steps to high-level officials.
- Bi-lateral cooperation reflects unique roles and responsibilities of U.S. and Russia in nuclear security and HEU minimization.



- **IAEA/U.S./Russia/Czech Republic/Serbia joint project to remove HEU spent fuel from Vinca**
 - Jointly removed 13 kilograms highly enriched uranium (HEU) spent fuel and 2.5 metric tons of low enriched uranium spent fuel from Serbia
 - Sent by secure rail and truck transport through Hungary to a port in Slovenia and by ship to Russia
 - Eliminated all remaining HEU in Serbia
 - Required the coordination and cooperation of over 100 people in 4 countries and the IAEA
- **IAEA-led MNSR Reactor Conversion efforts**
 - 7 MNSRs located in 6 countries – China, Ghana, Nigeria, Pakistan, Syria, and Iran
 - IAEA-led CRP has established conversion feasibility
 - IAEA-led Conversion working group now looking at shipping, fuel procurement, and technical conversion issues
 - U.S. contributes funding and technical support.
 - Due to unique nature of this project, IAEA leadership is essential to its success.



Government/Industry Partnerships

- U.S. Monolithic U-Mo LEU fuel development program
 - Developing cutting-edge high-density LEU fuel to convert remaining 6 U.S. high-power reactors
 - GTRI coordinates effort which includes 6 U.S. national laboratories, U.S. universities, and Babcock & Wilcox.
 - HEU minimization imperative drives this effort, so government leadership is critical
 - Certain critical capabilities (e.g., fuel fabrication) only exist in private sector, thus government/industry partnership is vital.
- U.S. development of non-HEU-based Mo-99 production
 - GTRI has signed cooperative agreements with 4 commercial entities to support development of a reliable, commercial, non-HEU-based U.S. Mo-99 supply.
 - 50/50 cost-sharing arrangement with commercial partners to accelerate their entrance into the market.
 - Objective is for the U.S. Government to accelerate establishment of this capability, but not to enter the Mo-99 isotope market.



Summary Observations

- HEU Minimization will become more difficult, not easier, over time:
- Significant progress has been made on the “easy” projects.
- We are now turning to the most technically challenging and costly HEU minimization projects that do not have quick, simple solutions.
- Thus, sustained political and financial commitment from governments and creative problem solving by the international community will be vital to future success.
- **To succeed, we must take the unique moment we are in now and make it the norm.**