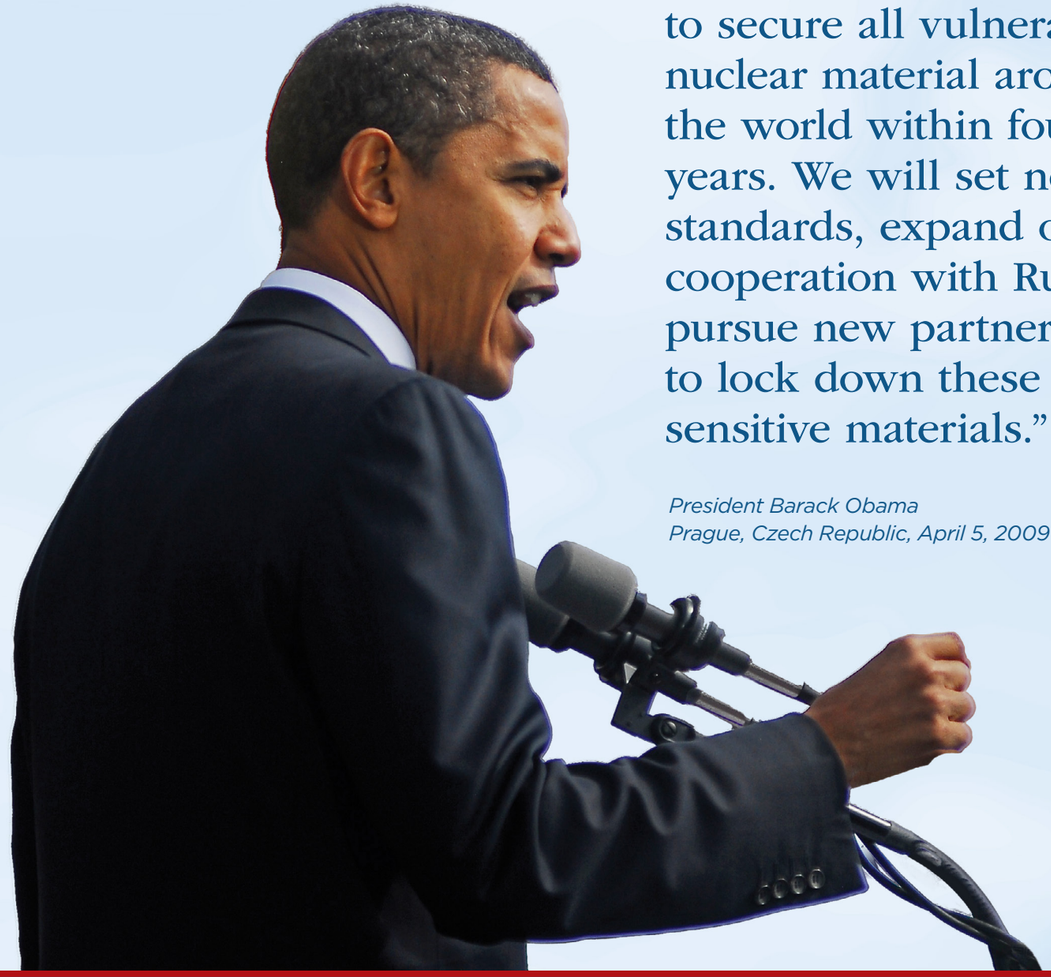
THE FOUR-YEAR EFFORT

President Barack Obama, Prague, Czech Republic, April 5, 2009

Contributions of the **Global Threat Reduction Initiative** to secure the world's most vulnerable nuclear material by December 2013



"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, pursue new partnerships to lock down these sensitive materials."

President Barack Obama
Prague, Czech Republic, April 5, 2009

Global Threat Reduction Initiative

Securing vulnerable nuclear and radiological material at civilian sites worldwide

NNSA Leads the Implementation of the Four-Year Effort

President Obama's nuclear security agenda, laid out in his historic speech in Prague on April 5, 2009, included a vision of a world free of nuclear weapons, ending the production of fissile materials intended for use in state nuclear weapons and ensuring that terrorists never acquire a nuclear weapon. In support of that last goal, the Department of Energy's (DOE) National Nuclear Security Administration (NNSA) led the United States' effort to implement President Obama's call to secure all vulnerable nuclear material around the world within four years, set new security standards, expand our partnership with Russia, and pursue new partnerships to lock down sensitive materials.

This effort was supported by NNSA's international partners who convened two Nuclear Security Summits, bringing countries together based on a shared recognition—at the highest levels of government—of the dangers of nuclear and radiological proliferation. The summits reinforced the importance of the global nuclear security architecture and emphasized the importance of securing and, when possible, eliminating nuclear and radiological materials. These unprecedented gatherings of world leaders recognized that nuclear and radiological terrorism continues to be a grave threat and that defeating this threat requires strong national measures and international cooperation.

NNSA's Office of Defense Nuclear Nonproliferation (DNN) has, for more than a decade, significantly reduced the danger of nuclear terrorism. NNSA's efforts have focused on preventing terrorists from acquiring the most dangerous of nuclear materials, namely highly enriched uranium (HEU) and plutonium. Even small amounts of these materials could be used to create a catastrophic nuclear weapon with the ability to kill hundreds of thousands of people. In support of President Obama's Four-Year Effort to secure the world's most vulnerable nuclear material, DNN completed security upgrades at 32 sites in Russia (for a total of 218 sites), removed more than 5,060 kilograms of nuclear material, removed all HEU from 12 countries/locations, completed 24 bilateral physical protection assessments of foreign facilities holding U.S.–obligated nuclear material, and provided physical protection training to nearly 2,500 foreign officials either bilaterally with partnering countries or multilaterally with the International Atomic Energy Agency (IAEA).

Despite these successes, there also have been challenges, which is why we need to continue to bring both the scientific tools and political commitment to bear on addressing the nonproliferation issues that continue to face the global community.

GTRI and the Four-Year Effort

DOE/NNSA's Global Threat Reduction Initiative (GTRI) reduces and protects 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. GTRI executes its mission by converting research reactors and isotope-production facilities from using HEU to using low-enriched uranium (LEU) fuel/targets, removing and/or dispositioning excess nuclear and radiological materials, and protecting nuclear and radiological materials from theft. As such, GTRI was at the forefront of implementing the Four-Year Effort. Under the effort, GTRI accomplished the following major tasks:

- Removed and/or dispositioned nearly 3,000 kilograms of HEU and plutonium, bringing the lifetime total to more than 5,060 kilograms—enough material to produce more than 200 nuclear weapons.
- Secured more than 10 metric tons of HEU and 3 metric tons of weapons-grade plutonium from Kazakhstan's BN-350 reactor and transferred the material to long-term storage.
- Removed all HEU material from 11 countries plus Taiwan, bringing the lifetime total to 27 locations: Austria, Brazil, Bulgaria, Chile, Colombia, Czech Republic, Denmark, Georgia, Greece, Hungary, Iraq, Latvia, Libya, Mexico, Philippines, Portugal, Romania, Serbia, Slovenia, South Korea, Spain, Sweden, Taiwan, Thailand, Turkey, Ukraine, and Vietnam.

Completion of this monumental effort required the hard work and dedication of hundreds of individuals from DOE, other U.S. government organizations (the White House; the departments of State, Defense, and Transportation; the Nuclear Regulatory Commission; and multiple U.S. embassies abroad), the U.S. national laboratories (including Argonne National Laboratory, Idaho National Laboratory, Oak Ridge National Laboratory, the Savannah River National Laboratory, the Savannah River Site, and the Y-12 National Security Complex), law enforcement, the IAEA, and international partners in 27 countries.

The completion of a typical nuclear material removal or elimination project includes a variety of political, technical, and regulatory activities, including negotiating government-to-government agreements, converting reactors and isotope-production facilities from using HEU to LEU fuel/targets, providing upgrades to reactor facilities and physical protection systems, stabilizing and processing material, packaging material, obtaining certifications and permits for packaging and transport, transporting the material to its final destination, and downblending HEU to LEU. Throughout this effort, GTRI and its partners overcame several significant technical obstacles.

The program's noteworthy technical achievements included the first international transport of spent fuel by air, the first transport of both separated plutonium and non-U.S.–origin spent fuel to the United States, the first known reuse of previously irradiated research reactor fuel, the development of new processes and procedures to stabilize plutonium and convert uranium solutions to oxide, the first international validation of a U.S DOE–designed Type B nuclear materials package for plutonium, and the development of the first Type C cask to be used for the air transport of spent nuclear fuel. These achievements allowed GTRI to address additional forms of nuclear material and accelerate activities to remove material more quickly.

In addition, the program had to overcome numerous bureaucratic obstacles (often before or during a shipment), including having a shipment canceled by the foreign government after the spent fuel had been packaged and was ready for transport, having overflight permits canceled at the last minute, and having a transit permit canceled while a shipment was ongoing. In each case, GTRI and its partners were able to quickly implement contingency plans to ensure shipments were completed successfully.

Finally, GTRI and its partners overcame environmental impediments, such as an earthquake in Chile three days before a shipment, a blizzard in Russia that closed airports, and a typhoon that jeopardized a shipment from Vietnam.

In all cases, to make the President's words reality, the task required the technical expertise, creativity, flexibility, perseverance, teamwork, and dedication of the hundreds of people who worked across the globe on the Four-Year Effort. The world now is a safer place because of their contributions. An account of their remarkable efforts over the past four years follows, mission by mission—Argentina through Vietnam.

Global Material Removals

Locations from which HEU or plutonium (Pu) have been removed

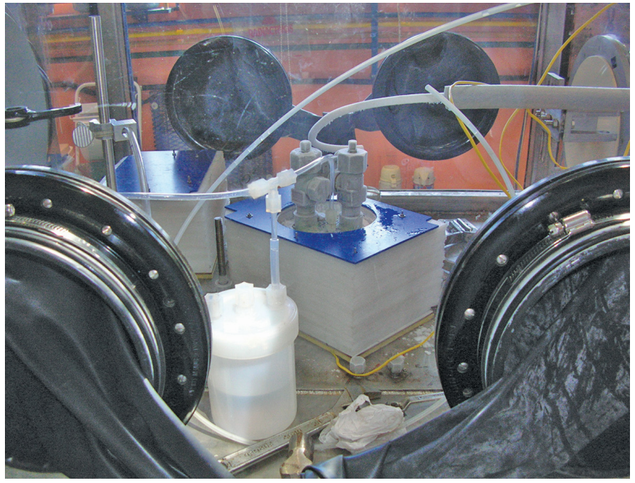
- Locations from which all HEU or Pu have been removed
- Locations from which some HEU or Pu have been removed as part of four-year effort

Argentina · Australia · Austria · Belarus · Belgium · Brazil · Bulgaria · Canada · Chile · Colombia · Czech Republic · Denmark · France · Georgia

Greece · Hungary · Iraq · Israel · Italy · Japan · Kazakhstan · Latvia · Libya · Mexico · Philippines · Poland · Portugal · Romania

Serbia · Slovenia · South Africa · South Korea · Spain · Sweden · Taiwan · Thailand · Turkey · Ukraine · United Kingdom · United States · Uzbekistan · Vietnam

Nondestructive assay measurement of a UF_6 cylinder.



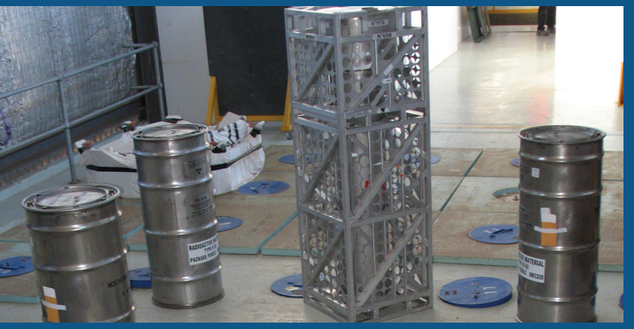
UF_6 cylinder in a glovebox for HEU removal and downblending.

In April 2013, GTRI worked with Argentina's National Commission for Atomic Energy (CNEA) to downblend the remaining fresh HEU in Argentina (1.4 kilograms of fresh HEU located at the Atomic Center of Constituyentes). GTRI and its predecessor programs have been working with Argentina to eliminate its stocks of HEU since 2001, when we jointly removed 30 kilograms of HEU spent fuel from Argentina's RA-3 reactor. Since the beginning of the removal programs, more than 40 kilograms of HEU have been eliminated from Argentina.

ARGENTINA

AUSTRALIA

In August 2012, GTRI successfully removed 2.3 kilograms of fresh HEU from the Australian Nuclear Science and Technology Organization site. Also as part of the Four-Year Effort, GTRI successfully repatriated 14.5 kilograms of U.S.–origin HEU spent fuel from Australia in 2009. With these shipments, more than 100 kilograms of HEU have been removed from Australia—more than enough material to produce four nuclear weapons.

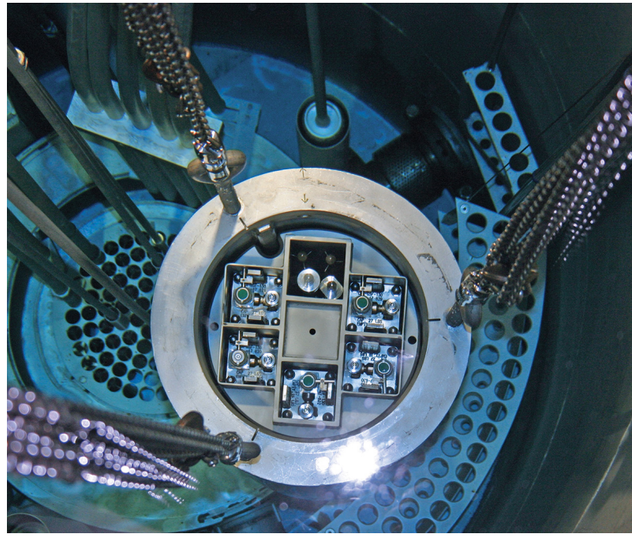


HEU ready for transport.

Examining the HIFAR core before decommissioning and removal of all HEU.

In December 2012, GTRI and Austria worked together to return all remaining HEU reactor fuel from Austria to the United States. Austria was the ninth country to work with GTRI to remove all HEU as part of the Four-Year Effort and the 24th country overall.

The project was initiated in September 2011 when the United States and Austria signed a memorandum of understanding (MOU) to work together to supply LEU fuel to fully convert the TRIGA reactor at the Vienna University of Technology and to return the remaining 1.2 kilograms of HEU to the United States by the end of 2013. GTRI worked closely with the Vienna reactor staff and the government of Austria to implement the steps laid out in the MOU and completed the project one year ahead of schedule. Together, both sides ensured this project minimized any interruption to the use of the reactor for research and training. In addition to enabling important scientific research work, the Vienna reactor plays an essential role in supporting the critical mission of the IAEA, including instrument calibration, IAEA safeguards inspector training, and other IAEA–supported training. Previously, GTRI and Austria partnered to remove all HEU from the ASTRA and SAR-Graz research reactors.



Preparing HEU fuel rods for removal from the reactor before loading into shipping casks.

AUSTRIA

BELARUS

In October and November 2010, GTRI worked with Belarus, Russia, and the IAEA to remove 41 kilograms of HEU spent fuel and 47 kilograms of HEU fresh fuel from the Pamir Reactor at the Joint Institute for Power and Nuclear Research in Sosny. The material was sent to secure facilities in Russia for storage pending downblending to LEU. GTRI continues to work with Belarus to eliminate its remaining stocks of HEU.

Loading HEU into specially designed casks for return to Russia.

In October 2010, GTRI cooperated to remove 12.7 kilograms of Belgian-owned excess fresh HEU from the CERCA facility in Romans, France. GTRI is working closely with Belgium to convert the BR-2 reactor. GTRI continues to work with Belgium to meet our joint commitments from the 2012 Nuclear Security Summit in Seoul, South Korea, to eliminate excess HEU and plutonium from Belgium by the 2014 Nuclear Security Summit in The Hague, Netherlands.

Inside the BR-2 reactor, one of the most powerful research reactors in the world.

The United States has been cooperating with Canada to reduce its HEU inventories since 1996. During that time, 67 kilograms of HEU have been removed from Canada—7.5 kilograms since the President's Prague speech. By early 2014, we expect that another 189 kilograms of fresh HEU will have been transferred to NNSA. GTRI continues to work with Canada on HEU reactor conversion efforts and disposition issues.

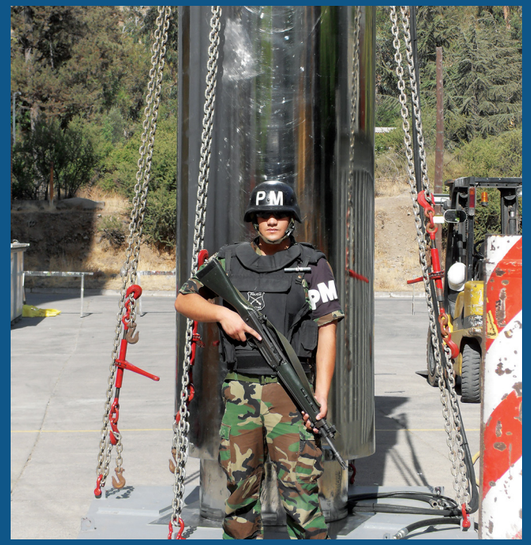
Inside the National Research Universal (NRU) reactor (left), an HEU SLOWPOKE reactor core is transported for disposal (below).

Loaded shipping containers being transferred to the United States.

BELGIUM

CANADA

CHILE



In April 2010, shortly before the first Nuclear Security Summit, which was held in Washington, D.C., GTRI completed the removal of the final 18 kilograms of HEU from Chile. That marked the 20th country to remove all of its HEU. The operation in Chile was completed successfully, despite a massive earthquake on February 27 and numerous aftershocks during the operation.

During shipment preparations, an 8.8-magnitude earthquake occurred off the Chilean coast, causing widespread damage to surrounding areas. The Chilean Commission of Nuclear Energy (CCHEN) and GTRI officials immediately began working on contingency plans to ensure the shipment would not be significantly delayed. Because of the flexibility and cooperative spirit of the joint U.S.–

Chilean Military Police stand guard in front of an HEU spent fuel transportation cask at the La Reina Nuclear Center.

CHILE

Chile team, the shipment occurred with minimal delay, and the material is now securely stored at a facility in the United States.

Despite this unprecedented national emergency, GTRI and CCHEN removed the remaining kilograms of HEU from the La Reina Nuclear Center in downtown Santiago and from the Lo Aguirre Nuclear Center, located 40 kilometers west of Santiago, as well as more than 400 U.S.–origin radiological sources.

GTRI and CCHEN have a long track record of working together on nuclear nonproliferation issues. This history includes the return of all U.S.–origin HEU spent fuel to the United States in 2001, the conversion of the RECH-1 research reactor in Santiago from using HEU to LEU fuel in 2006, and the implementation of physical protection at both reactors in 2007.

GTRI representatives inspect a transportation route following a massive 8.8-magnitude earthquake.

On the eve of the fourth anniversary of President Obama's 2009 Prague speech, GTRI and the Czech Republic's Nuclear Research Institute (NRI) completed the successful removal of the final 68 kilograms of HEU from NRI in Rez. With this shipment, the Czech Republic became the 25th country to give up all of its HEU.

The Czech Republic's HEU was securely transported by truck, rail, and ship to Russia, where it will be downblended to LEU for use in power reactors. This complex operation was the culmination of a multi-year effort by GTRI, NRI, the Russian Federation, and the IAEA.

GTRI shares a long history of cooperation with the Czech Republic on nuclear security issues. This was the sixth GTRI shipment from the Czech Republic since 2004 and marked the complete removal of a total of 180 kilograms of HEU from the country. A key step, in April 2011, that enabled the removal of the fuel was the

Casks containing the final kilograms of HEU being loaded onto a truck at NRI in Rez, Czech Republic.

Reloading an overpack container at a railway station.

successful conversion of the Czech Republic's second research reactor from using HEU to LEU fuel. GTRI also worked with NRI to install physical protection upgrades.

Overpack containers of HEU being loaded onto a ship in the Port of Gydnia, Poland, for transport to Russia for disposition.

CZECH REPUBLIC
FRANCE

Since the President's April 2009 speech in Prague, GTRI has worked with France to identify excess HEU for transport to the United States for permanent disposition. To date, GTRI has completed two shipments of fresh HEU from France, totaling approximately 120 kilograms. In both cases, the material was packaged in secure transportation casks and transported by U.S. military aircraft to the United States. GTRI continues to work with France to identify excess HEU for disposition.

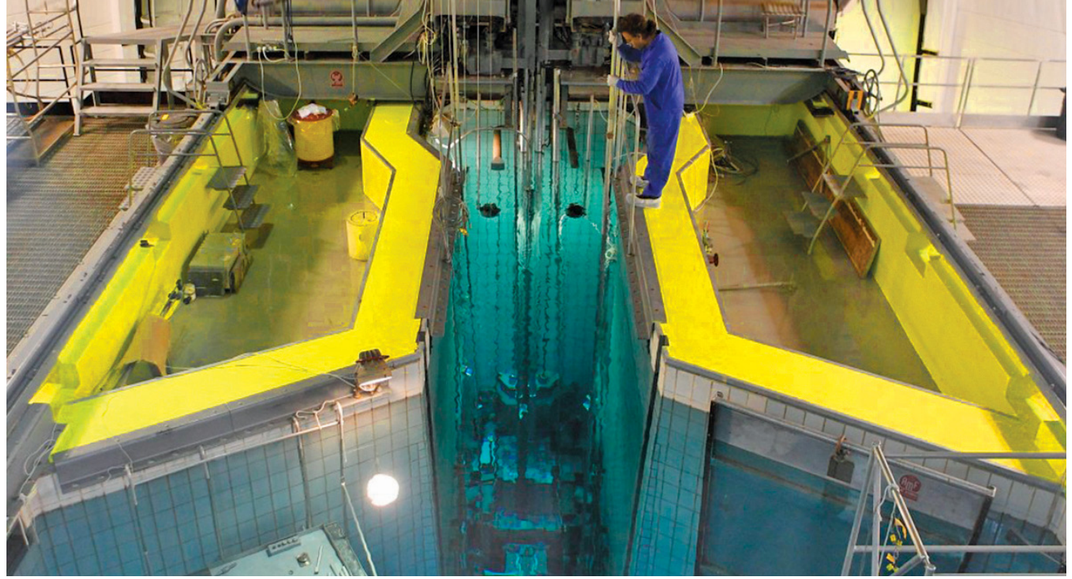
Packaged U.S.–origin fresh HEU (left) being loaded onto a U.S. Air Force C-17 for transport to the United States (above).

CZECH REPUBLIC
HUNGARY

In November 2013, GTRI and Hungary announced the completion of the final shipment of HEU from Hungary back to Russia, making Hungary the 27th country to be cleaned out of all HEU. It was the 12th and final country cleaned out, as part of the Four-Year Effort, to secure the world's most vulnerable material by December 2013.

The removal of Hungary's HEU caps a multi-year international effort among Hungary, the United States, the Russian Federation, and the IAEA to secure and remove this weapons-usable nuclear material. Previously, the four participants removed 190 kilograms of HEU from Hungary via three shipments—in 2008, 2009, and 2012. These operations were some of the more complex conducted by GTRI and involved transport by truck, rail, air, and ship as well as transit of three land borders before arriving in Russia. The final 49.2 kilograms were removed over a series of three secure air shipments to Russia, where they will be downblended to LEU for use in nuclear power reactors. The September 2009 conversion of Hungary's research reactor, from using HEU to LEU fuel, was a key step that enabled success with this country's activities.

Loading HEU into specially designed casks for return to Russia.



In January 2010, GTRI removed 12.4 kilograms of U.S.–origin HEU spent fuel from the Israel Research Reactor in Soreq. The material was packaged into secure transportation containers and transported by ship to the United States, along with the last remaining HEU from Turkey.

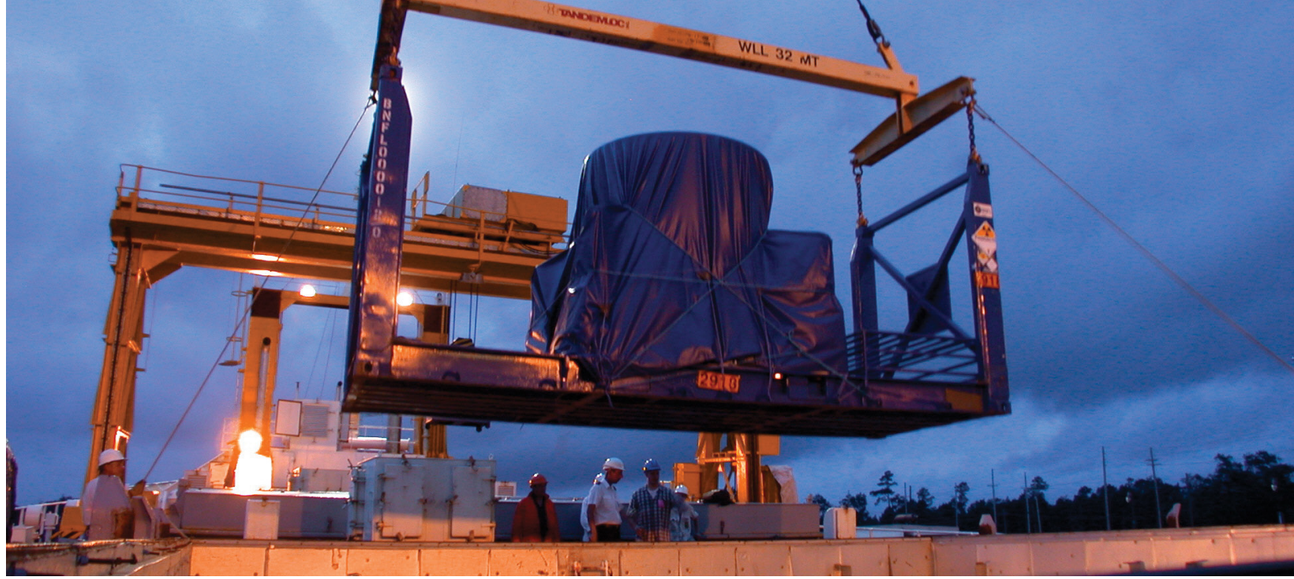
Inside the Soreq nuclear reactor (photo credit: Yaakov Naumi/Flash90).

ISRAEL

ITALY

In July 2013, GTRI cooperated with Italy to remove 10.5 kilograms of excess fresh HEU from three sites—Saluggia, Casaccia, and Trisaia. Before this shipment, GTRI and its predecessor programs worked with Italy to remove almost 23 kilograms of U.S.–origin HEU spent fuel in five shipments, beginning in 1997. GTRI continues to work with Italy to meet our joint commitment from the 2012 Nuclear Security Summit in Seoul to eliminate excess HEU and plutonium from Italy by the 2014 Nuclear Security Summit in The Hague, Netherlands.

Technicians prepare HEU oxide for packaging and shipment back to the United States (left). Casks, loaded with HEU, are transferred to a USAF C-17 for shipment back to the United States (above).



The United States has been cooperating with Japan to eliminate its HEU spent fuel since 1998. GTRI has removed 696 kilograms of HEU from that country, with 5 kilograms being removed since the President's 2009 Prague speech. Also since the President's speech, GTRI worked closely with Japan to convert the Kyoto University Research Reactor from using HEU to LEU fuel, which was accomplished in March 2010. GTRI continues to work with Japan on HEU disposition issues and additional reactor conversions.

HEU, packaged into secure containers, being transferred to a shipping vessel for transport back to the United States.

JAPAN

KAZAKHSTAN

GTRI completed two key HEU–elimination efforts with Kazakhstan since the Prague speech. In April 2009, GTRI removed 73.7 kilograms of HEU spent fuel from the Institute of Nuclear Physics (INP). This operation was conducted in close cooperation with the Russian Federation. In September 2011, GTRI and Kazakhstan cooperated to downblend the last remaining 33 kilograms of HEU fresh fuel in that country. The material was downblended at the Ulba Metallurgical Facility in Ust-Kamenogorsk. GTRI also assisted Kazakhstan with the conversion of the INP critical assembly and continues to work with the country to convert the balance of its reactors and to eliminate all remaining HEU research reactor fuel.

HEU packaged into specially designed casks (left) for shipment by rail (below) to Russia, where the HEU will be downblended to LEU.

Casks containing HEU being packaged at the Tajoura Research Center.

Overpack container ready for transport.

In December 2009, after converting the Tajoura reactor to use LEU fuel in 2006, the final 5 kilograms of Russian-origin HEU were removed from Libya with support from the IAEA and the Russian Federation. The HEU spent fuel was safely and securely returned to Russia from Libya's Tajoura research reactor. In two previous shipments, GTRI removed nearly 20 kilograms of fresh HEU via multiple air shipments. With the December 2009 shipment, Libya became the 18th country to be cleaned out of all HEU and the third country cleaned out as part of the Four-Year Effort.

Since renouncing its nuclear weapons program in 2003, Libya has cooperated with the United States on a wide range of nonproliferation activities. The latest shipment was part of a multi-step project to remove all Russian-origin HEU material from Libya.

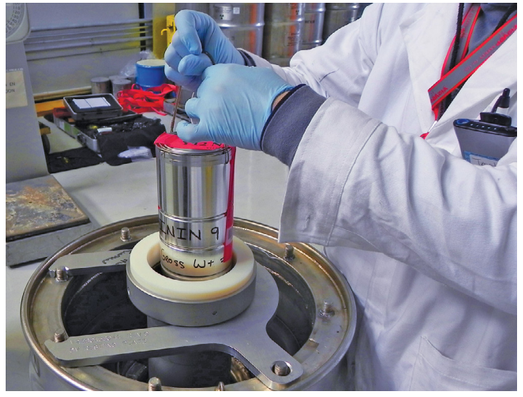
LIBYA

POLAND

In September 2012, the United States and Poland announced the removal of more than 88 kilograms of HEU from Poland's Maria Research Reactor at the National Center for Nuclear Research. The removal, conducted in two shipments, was made possible following GTRI's successful conversion of the Maria Research Reactor in Otwock—from using HEU to LEU fuel. GTRI worked in close partnership with National Center for Nuclear Research to convert the Maria reactor through the provision of technical, analytical, and licensing support.

Before this shipment, GTRI had successfully removed more than 500 kilograms of HEU in seven shipments from Poland, including the largest single shipment of HEU spent fuel (187 kilograms),

Technicians at the Maria Research Reactor prepare for the removal of HEU.



HEU packaged at ININ for shipment.

HEU being loaded onto a USAF C-17 for return to the United States.

At the 2012 Nuclear Security Summit, the United States and Mexico announced the removal of the remaining 10 kilograms of HEU from Mexico's National Institute for Nuclear Research (ININ). The removal followed the full conversion of the research reactor at ININ—from using HEU to LEU fuel—and was made possible by funding from the government of Canada.

To support this effort, GTRI supplied ININ with replacement LEU via an agreement through the IAEA. In early 2012, these exchanges were completed, and the final amounts of HEU were transported to the United States to be dispositioned. With these shipments, Mexico became the 22nd country to be free of all HEU, and the seventh country cleaned out as part of the Four-Year Effort. GTRI also worked with ININ to install physical protection upgrades at the reactor site.

MEXICO

POLAND

Polish military personnel stand guard as HEU is loaded for transport.

which involved the entire fleet of 36 spent fuel casks GTRI uses for the transportation of Russian-origin HEU. During each of the nine shipments, the material was packaged into specially designed transportation casks, secured in shipping containers, and transported in an armed convoy from the site to a nearby rail station. Then, the material was transported by rail to a Polish seaport, where it was loaded onto a vessel and transported to the Russian Federation.

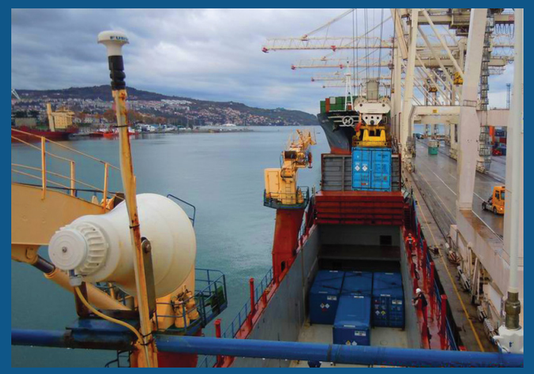
ROMANIA

In June 2009, GTRI completed the final shipments of Russian-origin HEU from Romania. The material was removed and returned by air to Russia, where it will be downblended to LEU for use in power reactors. Romania was the first country to remove all HEU under the Four-Year Effort; it was the 16th overall. This also was the first time GTRI shipped HEU spent fuel by airplane, a development that greatly helped GTRI accelerate its efforts to meet the President's objective.

In the first shipment of this final campaign, 23.7 kilograms of HEU spent fuel stored at a research reactor in Magurele were packaged into Russian TUK-19 specialized transportation casks and secured in shipping containers. Then, the material was transported in an armed convoy from the reactor site to a nearby airport, loaded onto an An-124 cargo plane, and flown to a secure facility in Russia. The second shipment involved 30 kilograms of fresh HEU from a reactor in Pitesti, 180 kilometers northwest of Bucharest.

HEU, loaded into specially designed casks, fastened into overpack containers for transport to Russia.

SERBIA

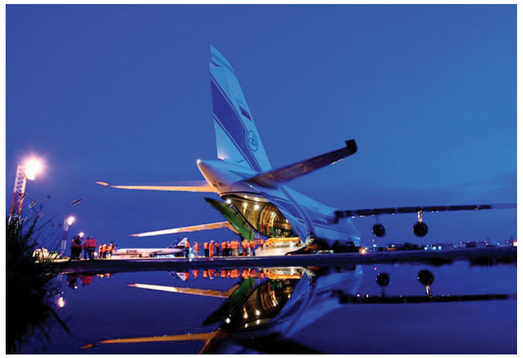


Overpack containers, holding the last of Serbia's HEU, are carefully loaded onto a specially designed shipping vessel at the port for transport to Russia.

In December 2010, GTRI completed the final removal of HEU from Serbia—13 kilograms of Russian-origin HEU spent fuel from the Vinca Institute of Nuclear Sciences. The shipment was the culmination of an eight-year effort to remove all HEU from Serbia. It was the sixth country to eliminate all of its HEU as part of the Four-Year Effort and the 21st overall.

On this mission, GTRI worked in partnership under a cost-sharing arrangement with the Republic of Serbia, the IAEA, the Nuclear Threat Initiative, the Czech Republic, the Russian Federation, and the European Union. In addition to the 13 kilograms of HEU spent fuel, the shipment also included approximately 2.5 metric tons of LEU spent fuel.

The material was packaged into specially designed transportation casks, secured in specialized



Overpack containers of HEU being transferred to an An-124 for transport to Russia for final disposition. This shipment marked the first time GTRI shipped HEU spent fuel by air, allowing GTRI to greatly accelerate the pace of removals.

Overpack containers of HEU inside the An-124.

The HEU was shipped by air to a separate secure Russian facility.

The shipments follow previous shipments by GTRI, including the 2008 removal of all U.S.–origin HEU from Romania. Altogether, GTRI, working closely with Romania, Russia, and the IAEA, removed more than 88 kilograms of HEU—more than enough material to produce three nuclear weapons.

ROMANIA

SERBIA

shipping containers, and transported in an armed convoy from the site to a nearby rail station. The material then was transported by rail to a Slovenian seaport, where it was loaded onto a vessel and transported to the Russian Federation for secure storage and disposition.

The United States and Serbia share a long history of cooperation on nuclear nonproliferation issues. Cooperation at the Vinca Institute began in August 2002, when the United States government, Russia, and the IAEA returned 48.4 kilograms of HEU fresh fuel to Russia. GTRI also has worked with the Vinca Institute to install physical security enhancements at the spent fuel storage building and other buildings that use and store radiological sources.

A specially designed overpack container loaded with spent HEU arrives at the port for transport to Russia.

SOUTH AFRICA

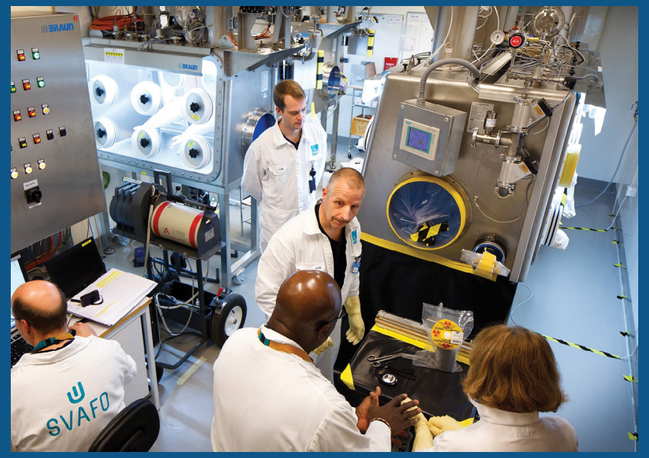
In August 2011, GTRI removed all U.S.–origin HEU (5.8 kilograms) from South Africa. It was a complex operation that required close collaboration among GTRI, the government of South Africa, and the South African Nuclear Energy Corporation. The material was transported by ship to the United States in secure containers. GTRI continues to work with South Africa to eliminate excess HEU.

Technicians work to remove HEU fuel elements from the SAFARI-1 research reactor in Pelindaba, South Africa.

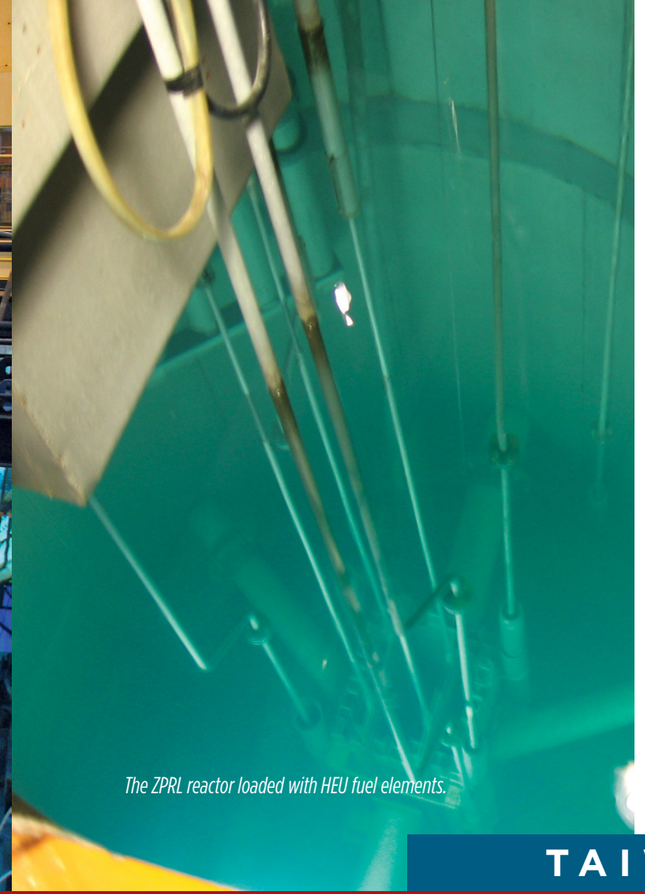
SWEDEN

In March 2012, GTRI and Sweden completed the removal of all plutonium from Sweden. The announcement was made at the 2012 Nuclear Security Summit. It was GTRI's first shipment of separated plutonium to the United States. More than 3 kilograms of plutonium were removed, including Swedish–, U.K.–, and U.S.–origin material, stemming from former research and development activities in that country.

To complete this project, Sweden developed new facilities to stabilize and repackage the plutonium materials. The mission to remove plutonium from Sweden was initiated in 2009 and completed in 2012. GTRI previously worked with Sweden to remove all HEU, completing that effort in 2002. In all, GTRI removed 55 kilograms of HEU and plutonium from Sweden.



Swedish and GTRI experts prepare the plutonium for packaging and removal.

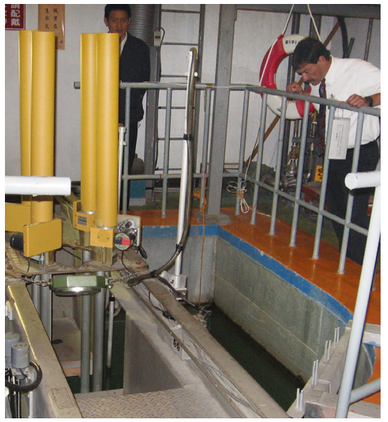


The ZPRL reactor loaded with HEU fuel elements.

TAIWAN

In September 2009, GTRI removed 4.8 kilograms of HEU spent fuel from Taiwan. This marked the removal of all remaining HEU in Taiwan, making it the second country/location to give up all its HEU as part of the Four-Year Effort. The material was transported by ship to the United States for secure storage, pending disposition.

GTRI team inspecting the ZPRL reactor pool.



TURKEY

In January 2010, GTRI removed 5.3 kilograms of HEU spent fuel from Turkey. This work marked the removal of all remaining HEU from Turkey. It was the fourth country cleaned out as part of the Four-Year Effort and the 19th country cleaned out overall. The material was transported by ship to the United States, along with HEU from Israel, and is in storage pending permanent disposition.

A cask containing HEU being transferred to a specially designed shipping container (far left). The shipping container is transferred to a shipping vessel (left) for shipment to the United States.

In March 2012, GTRI completed the removal of all HEU from Ukraine, making it the eighth country to be cleaned out of all HEU as part of the Four-Year Effort and the 23rd country overall. This shipment, containing 128 kilograms of HEU, fulfilled the commitments, made by presidents Obama and Yanukovych at the 2010 Nuclear Security Summit, to remove all of Ukraine's HEU by the 2012 Nuclear Security Summit.

Implementation of the pledge made by presidents Obama and Yanukovych required six separate secure operations and unprecedented cooperation among the United States, Ukraine, Russia, and the IAEA to successfully remove a total of 234 kilograms over a two-year period. The first shipment to remove 56 kilograms of HEU spent fuel from the Kiev Institute of Nuclear Research (KINR) took place in May 2010. It was followed by three shipments—all in late December 2010—to remove 16 kilograms of fresh HEU from the Kharkiv Institute of Physics and Technology (KIPT), 25 kilograms of fresh HEU from Sevastopol University, and 10 kilograms of fresh HEU from KINR. The HEU was returned to Russia, where it will be downblended to LEU.

Technicians load fresh HEU into specially designed casks for transport to Russia.

Technicians prepare HEU for transport to Russia.

In exchange, the United States agreed to provide Ukraine with replacement LEU fuel as well as a state-of-the-art neutron source facility (NSF) at KIPT. The NSF will be equipped with the most up-to-date technology to operate at the highest safety standards and will provide Ukraine with new research capabilities and the ability to produce more than 50 different industrial and medical isotopes to benefit the Ukrainian people.

Ukraine has a long, significant history of supporting nuclear nonproliferation. In the early 1990s, following the breakup of the Soviet Union, Ukraine voluntarily gave up the nuclear weapons left on its territory and joined the Nuclear Nonproliferation Treaty as a nonnuclear weapon state.

The last remaining HEU in Ukraine being loaded for transport to Russia.

UKRAINE
UNITED KINGDOM

Fresh HEU, packaged in secure casks, prepared for loading onto U.S. military transport (right) for return to the United States.

In August 2010, GTRI removed 3.7 kilograms of legacy HEU material from the U.K. The material was transported to the United States, by U.S. military aircraft, for eventual downblending to LEU. In addition, the U.K. confirmed, through the HEU Reconciliation effort, that it has downblended more than 1,240 kilograms of U.S.–origin HEU in the U.K.

UKRAINE
UZBEKISTAN

GTRI has worked with Uzbekistan for nearly 10 years to eliminate its HEU material. In October 2012, GTRI completed the removal of the last remaining 36.4 kilograms of HEU from the Institute of Nuclear Physics (INP) near Tashkent. This complex operation included seven separate shipments, totaling nearly 140 kilograms. All HEU was sent to Russia for permanent disposition. GTRI also assisted INP with the conversion of the INP reactor and continues to work with Uzbekistan to eliminate its last few kilograms of HEU in Uzbekistan.

Fresh HEU, packaged in secure casks, being loaded into specially designed rail cars for shipment back to Russia, where it will be downblended to LEU.

Special casks, containing the last of Vietnam's HEU, are loaded onto an An-124 for transport to Russia.

VIETNAM

In July 2013, GTRI and Vietnam's Ministry of Science and Technology, in a joint operation with the Russian Federation, successfully completed the removal of 11 kilograms of HEU from the Dalat Nuclear Research Institute (DNRI). With this shipment, the Socialist Republic of Vietnam became the 11th country from which all HEU was removed as part of the Four-Year Effort. Vietnam was the 26th country overall to be cleaned out.

The removal was executed in close coordination with the Russian Federation. The HEU from Vietnam was securely transported by truck from DNRI to a military airport outside Ho Chi Minh City and then was flown, by a Russian An-124 cargo plane, to Russia, where it will be downblended to LEU for use in power reactors. This complex operation was the culmination of a multi-year effort by NNSA; MOST, Vietnam's Ministry of Science and Technology; Rosatom; and the IAEA. Financial support was provided by the Canadian government..

GTRI shares a long history of cooperation with Vietnam on nuclear and radiological security issues. This was the second GTRI shipment from Vietnam and marks the complete removal of all HEU from the country. GTRI also worked with the DNRI to convert its research reactor from using HEU fuel to LEU and to install physical protection upgrades at facilities storing or using both nuclear and radiological materials.

The final HEU being transported from the Dalat Research Reactor to Ho Chi Minh City for transport to Russia.

Other GTRI Efforts Supporting Nuclear Security

In November 2010, GTRI completed a 10-year campaign to provide secure long-term storage for more than 10 metric tons of HEU and 3 metric tons of weapons-grade plutonium in Kazakhstan—enough material to make 775 nuclear weapons. The final phase of the campaign involved 12 shipments from the BN-350 reactor in Aktau to a new secure storage facility in Eastern Kazakhstan—traveling by train and road more than 3,000 kilometers (or 1,800 miles).

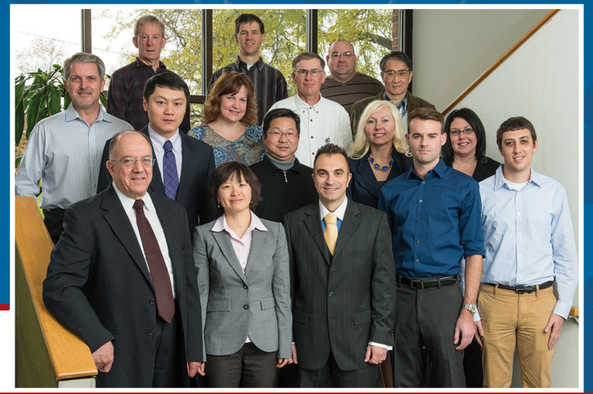
As part of its mission, GTRI's Convert Program works globally to implement the U.S policy to minimize and eliminate the use of HEU in civilian applications by converting research and test reactors and isotope-production facilities to the use of LEU. Over the last four years, GTRI has converted or verified the shutdown of 25 research reactors and isotope-production facilities. Taken together with GTRI's efforts to secure and remove nuclear material, the Convert Program made significant contributions in conjunction with the Four-Year Effort, eliminating the need for hundreds of kilograms of HEU.

As part of its mission, GTRI's Protect Program works globally at sites—such as hospitals, universities, and industry—to provide voluntary security enhancements to prevent terrorists from acquiring radiological materials. There are thousands of civilian sites around the world where radiological materials are used for legitimate and beneficial commercial, medical, and research purposes. While beneficial, these high-activity sources are attractive to terrorists or other adversaries for use in a radiological dispersal device or so-called dirty bomb. Taken together with the President's commitment to secure high-priority nuclear material around the world, GTRI's Protect Program has made significant contributions to global security in conjunction with the Four-Year Effort, securing hundreds of thousands of curies of radiological materials.

Global Threat Reduction Initiative Teams

DOE HEADQUARTERS

SAVANNAH RIVER NATIONAL LABORATORY



ARGONNE NATIONAL LABORATORY

IDAHO NATIONAL LABORATORY

OAK RIDGE NATIONAL LABORATORY AND Y-12 NATIONAL SECURITY COMPLEX

SAVANNAH RIVER SITE

Beyond Prague

The Mikhail Dudin makes its way through the East Siberian Sea (following the Icebreaker Yamal) on its way to the Czech Republic, carrying spent-fuel loading equipment used to complete Vietnam's removal efforts in 2013.

Since 2009, NNSA and GTRI have led an accelerated international effort to secure vulnerable nuclear materials across the globe. As a result, the world today is unquestionably more secure from the threat of nuclear terrorism than it was four years ago. While it is important to highlight the substantial nuclear security achievements of the last several years, it is imperative to acknowledge that there is much work left to be done. HEU still exists in too many places, and global inventories of plutonium are steadily rising. Terrorists continue to seek the often-poorly-secured radioactive materials in medical, industrial, and research devices. While the technical and political challenges are substantial, they are not insurmountable. NNSA and GTRI will continue to eliminate and secure high-risk materials to ensure that terrorists can never acquire a nuclear weapon.

Contributing DOE/NNSA Laboratories

Argonne National Laboratory provided support for GTRI's Russian-origin nuclear material removal efforts.

Idaho National Laboratory provided support for GTRI's Russian-origin and U.S.-origin nuclear material removal efforts.

Oak Ridge National Laboratory provided support for GTRI's Russian-origin nuclear material removal efforts.

Savannah River National Laboratory and Savannah River Site provided support for GTRI's Russian-origin, U.S.-origin, and Gap nuclear material removal efforts.

Y-12 National Security Complex provided support for GTRI's U.S.–origin and Gap nuclear material removal efforts.

Securing the world's most vulnerable nuclear material within four years by setting new standards, expanding cooperation with Russia, and pursuing new partnerships to lock down sensitive materials

THE FOUR-YEAR EFFORT AND THE Global Threat Reduction Initiative

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

YGG 13-0337