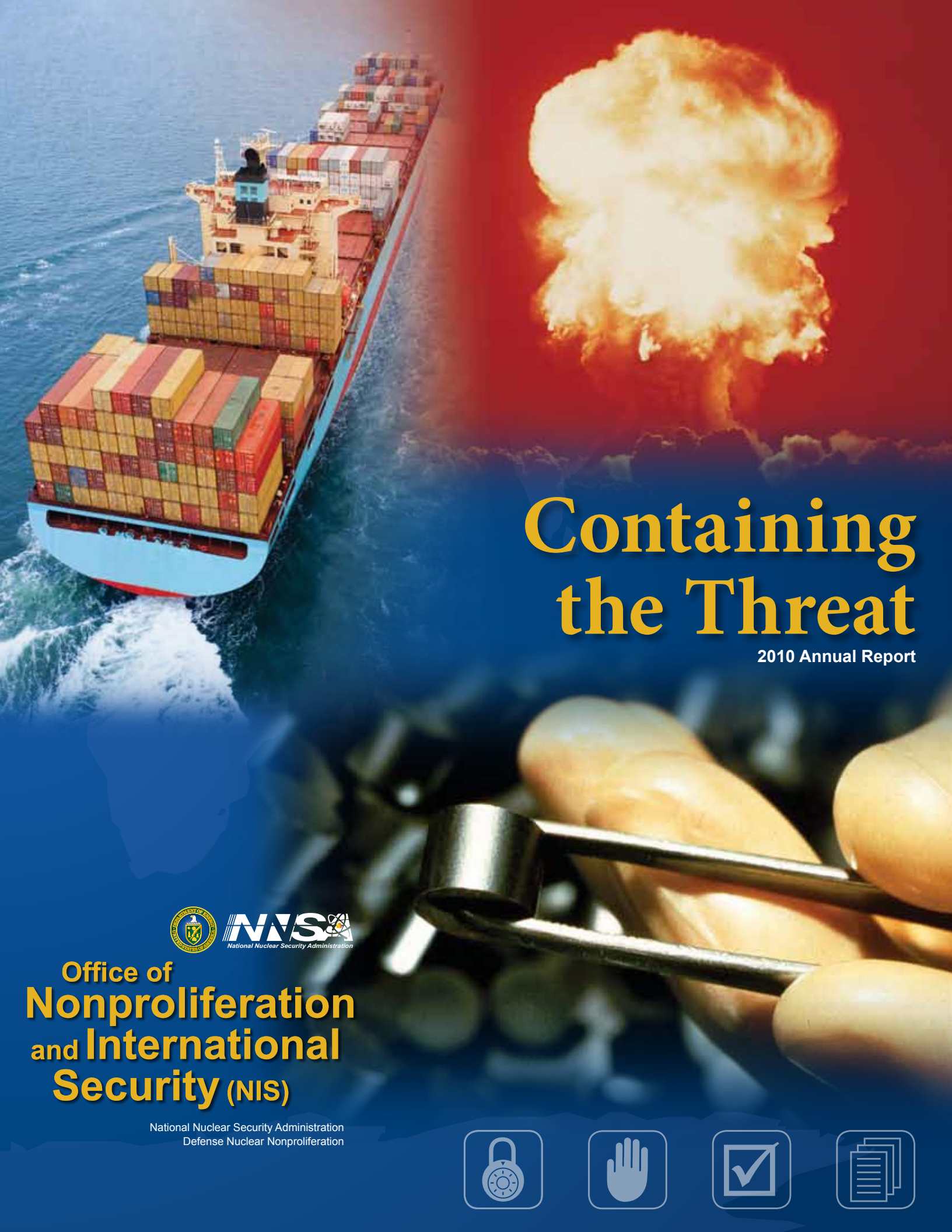

Containing the Threat

2010 Annual Report

National Nuclear Security Administration

Office of Nonproliferation and International Security (NIS)

National Nuclear Security Administration
Defense Nuclear Nonproliferation

The mission of the National Nuclear Security Administration's Office of Nonproliferation and International Security is to prevent the proliferation of WMD by strengthening the nonproliferation, nuclear security and arms control regime.

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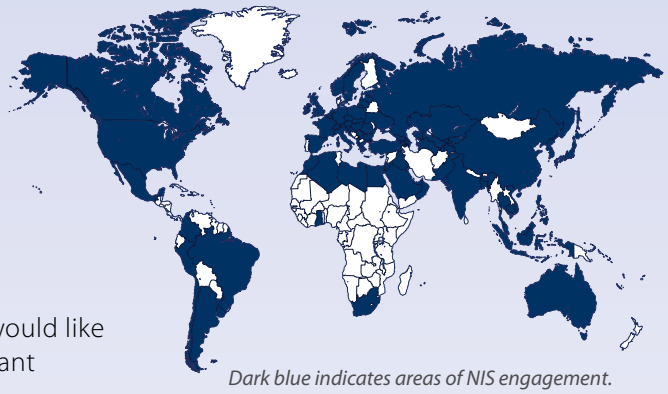
Executive Message



Dark blue indicates areas of NIS engagement.

2010 has been a productive and important year for the U.S. Department of Energy/National Nuclear Security Administration's (DOE/NNSA) Office of Nonproliferation and International Security (NIS). As the year comes to a close, I would like to take a moment to reflect upon some of NIS' most significant accomplishments and changes.

President Obama recognized nuclear security as one of his principal mandates and called for the negotiation of a New Strategic Arms Reduction Treaty (New START), the strengthening of the Nuclear Non-Proliferation Treaty (NPT) as a basis for cooperation, the entry into force of the 1996 Comprehensive Nuclear-Test-Ban Treaty (CTBT), the negotiation of a verifiable Fissile Material Cut-Off Treaty (FMCT), and provision of additional resources and authority for the international safeguards and security community. Throughout 2010, NIS applied its unique technical and policy expertise to support the implementation of these initiatives important to the Administration's approach to reducing nuclear dangers and creating a world without nuclear weapons. In particular, NIS accomplished the following significant items in 2010:

- Provided technical and policy support to the Nuclear Security Summit that was held in April 2010 in Washington, D.C. and successfully led the U.S. Government and international efforts to achieve one of the first Nuclear Security Summit goals—revision of the International Atomic Energy Agency (IAEA) Recommendations on the Physical Protection of Nuclear Material and Nuclear Facilities (Information Circular [INFCIRC]/225/Rev.5).
- Led the DOE/NNSA technical and policy team that participated in the negotiation and signature of the New START Treaty between the United States and Russia.
- Implemented the 3rd year of the Next Generation Safeguards Initiative (NGSI) resulting in the development of several new safeguards technologies, an increase in safeguards engagement in Southeast Asia and the Middle East, and further development of the safeguards human capital base.
- Conducted an Expertise Proliferation Reassessment to better align NIS programs to address this critical threat to international security. NNSA commissioned this study to reassess the relevance of its scientist engagement efforts under the Global Initiatives for Proliferation Prevention (GIPP) program in the context of the current and projected security environment.
- Played an active role in shaping the Export Control Reform Initiative. The Initiative significantly restructures the U.S. export control system to make export controls easier to understand and enhances U.S. industry competitiveness on the international market while maintaining high national security standards.
- Monitored the conversion of 30 metric tons (MT) of highly enriched uranium (HEU) from dismantled Russian nuclear weapons into nuclear fuel used to generate nearly 10 percent of all electricity in the United States; more than 400 MT of Russian HEU have been eliminated to date, the equivalent of over 16,000 nuclear weapons.
- Finalized a Strategic Implementation Plan designed to guide the office over the next five years.

In addition to these mission-critical initiatives, NIS completed an office reorganization in June 2010 to increase transparency, improve program efficiencies, and better align with the Administration's nonproliferation agenda and priorities. The new organizational structure includes the Office of Nuclear Safeguards and Security, the Office of Nuclear Controls, and the Office of Nuclear Verification. Policy development and negotiation responsibilities, a key role of NIS within the broader organization, department and interagency, are located both in the front office and in the technical programs.

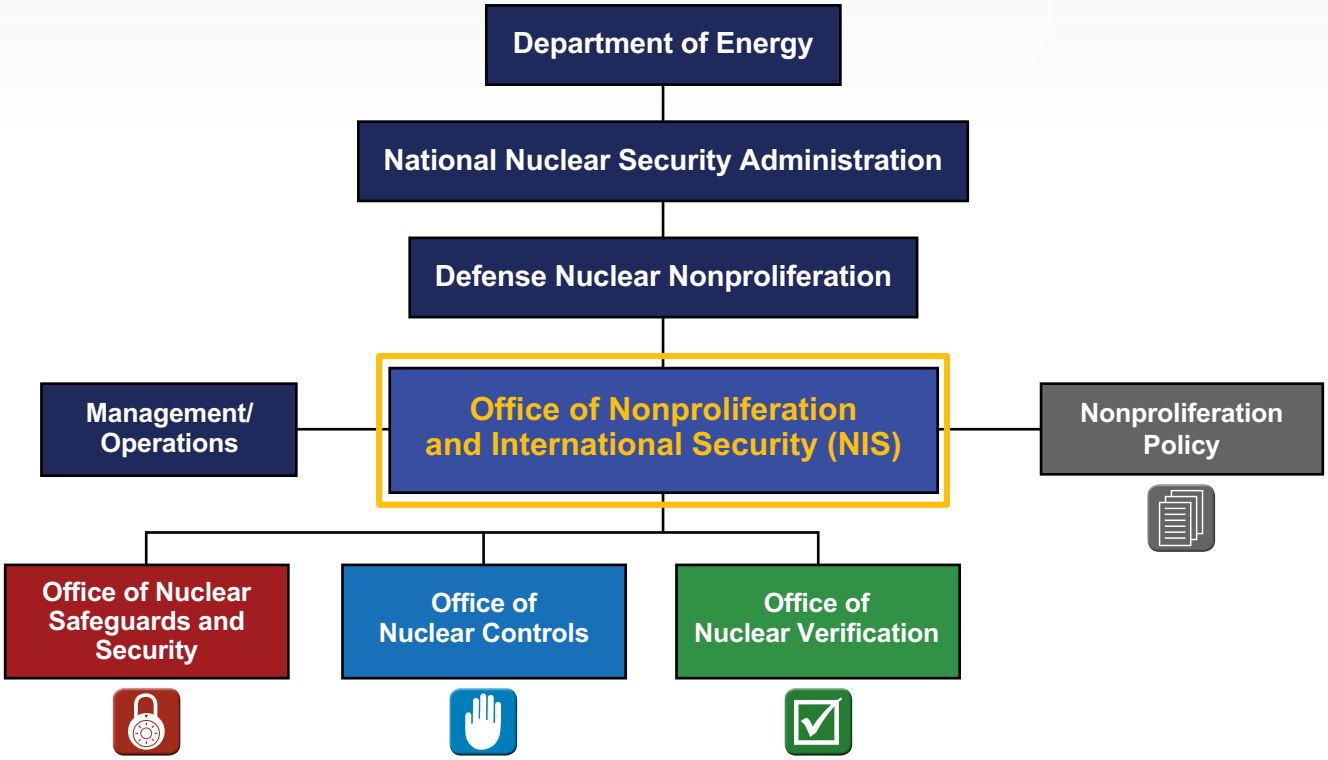
I invite you to read our annual report to learn more about NIS contributions around the globe to strengthen the nonproliferation, nuclear security and arms control regime.

Mark Whitney
Assistant Deputy Administrator
NNSA Office of Nonproliferation and International Security

NIS Responds to Critical National Security Threats

President Obama has characterized the possibility of terrorist weapons of mass destruction (WMD) acquisition as the "most immediate and extreme threat to national security." In his April 2009 speech in Prague, the President laid the foundation for the Administration's approach to reducing nuclear dangers through concrete steps toward a world without nuclear weapons.

Working alongside NNSA's interagency and international partners, NIS provides leadership in the formulation and implementation of governmental nonproliferation strategies to help achieve the Administration's objectives, deploying a distinctive array of technically-based national security programs. To fulfill its role, NIS draws on and contributes to a wide range of technical resources within the U.S. National Laboratory complex and international organizations while working in concert with more than 70 countries.



NIS completed a reorganization in June 2010.

The four main elements of the NIS organization are described below.

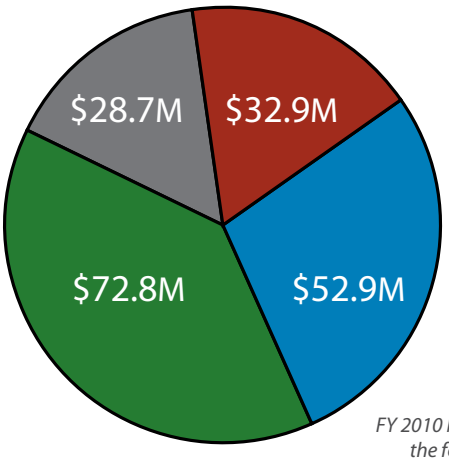
The ***Office of Nuclear Safeguards and Security*** works to prevent the diversion or theft of nuclear materials and sabotage of nuclear facilities through programs that strengthen international safeguards and the security of nuclear materials and facilities worldwide. Specifically, NIS is implementing NGSI, which NIS established to develop the policies, concepts, technologies, expertise, and international safeguards infrastructure necessary to sustain and strengthen the international safeguards system as it evolves to meet new challenges over the next 25 years. These challenges include the growth of nuclear energy, expanding responsibilities of the IAEA, the diffusion of sensitive technology through illicit networks, a retiring safeguards workforce, insufficient research and development funding, and an increased threat of nuclear terrorism. Working in tandem with NGSI, the International Nuclear Security Program is strengthening global physical security norms and practices through its conduct of bilateral physical protection assessments; work with partners to ensure effective and appropriate international physical protection norms and standards; support for the IAEA in its execution of International Physical Protection Advisory Service (IPPAS) and other missions; the conduct of physical protection training for foreign officials; and assistance to the IAEA in the design and implementation of new physical protection recommendations, guidelines and technical implementing guides in conjunction with the IAEA and other Member States.

The ***Office of Nuclear Controls*** supports foreign governments and regional organizations in achieving national nonproliferation implementation objectives by improving their national systems of control and their capacities to detect and deter proliferation from within their borders and across regions. Abroad, NIS works with more than 70 international partners to strengthen national capacities in areas such as WMD-related commodity identification training, export control licensing, border security, and nuclear forensics. Domestically, NIS provides licensing, export enforcement and interdiction support to multiple government agencies as well as to the U.S. nuclear industry. All of these activities are pursued in accordance with international laws, regulations and standards promoted by international supplier regimes, such as the Nuclear Suppliers Group, and by treaty-based organizations, such as the IAEA.

The ***Office of Nuclear Verification*** negotiates, monitors and verifies compliance with international nonproliferation and arms control treaties and agreements. The United States must maintain the ability to verify nuclear reduction agreements and detect violations of treaties and other commitments, as well as other illicit activities in violation of international law. NIS develops technologies and procedures tailored for application at specific foreign facilities, as well as technologies designed to detect potential clandestine weapons programs or illicit diversions. NIS contributions to U.S. policy and technology development significantly enhance the U.S. Government's ability to accomplish its nonproliferation, arms control and transparency commitments and objectives.

The ***Nonproliferation Policy*** function, resident within the NIS front office as well as its other three offices, provides technical and scientific expertise to assist with developing and implementing DOE/NNSA nonproliferation and arms control policy to reduce WMD risk. Containing global proliferation and implementing Administration initiatives requires the development of innovative policies and approaches. NNSA expertise provides unique input into key U.S. Government decisions, programs and policies. NIS advises the U.S. Interagency process when treaties and agreements are being negotiated and developed. NIS facilitates engagement in proliferation-sensitive regions and pursues active participation in multilateral supplier regimes.

NIS Funding in FY 2010



FY 2010 NIS funding across the four main program areas topped $187 million.

4-1

Office of Nuclear Safeguards and Security

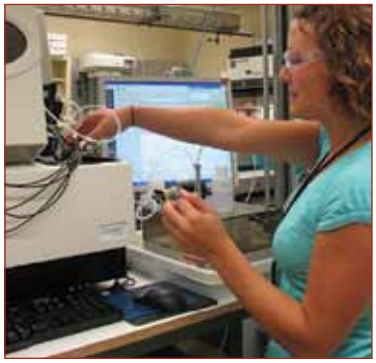
The work of the NIS Office of Nuclear Safeguards and Security is conducted under the umbrella of NGSI and the International Nuclear Security Program. In FY 2010, the office developed the personnel, technology and transformational concepts needed within the international safeguards and security systems to meet new proliferation challenges. Selected accomplishments are described below.

Safeguards Human Capital Development

The NGSI Human Capital Development (HCD) sub-program investments in university students and young professionals focus on recruiting, educating, training, retaining and promoting the next generation safeguards workforce. In the face of growing domestic and global demand for nuclear energy, the international safeguards community faces a critical human capital challenge. A recently completed NGSI study revealed that within 15 years, an estimated 82 percent of the current international safeguards specialists supporting NGSI-sponsored projects at U.S. National Laboratories will have left the workforce. Likewise, several IAEA reports, statements and growing anecdotal evidence suggest a significant percentage of IAEA and European safeguards experts will retire soon as well. In 2008, IAEA officials estimated that more than a third of senior IAEA staff is expected to retire by 2011 and more than half by 2013.

In FY 2010, the HCD sub-program sponsored 136 students from 62 universities in summer safeguards internships at U.S. National Laboratories. Additionally, six summer safeguards policy and technical courses ranging from one to three weeks in length were organized for university students and young professionals. These internships and summer courses have been at the heart of efforts to attract and train a new generation of safeguards professionals. Of past NGSI interns (in 2008 and 2009), approximately one-third returned to the National Laboratories to continue working on safeguards projects in 2010. Others have converted to Laboratory staff, while one in five is now pursuing a graduate degree with a nonproliferation-related focus.

The HCD sub-program also funded post-doctoral fellowship positions at eight National Laboratories; supported visiting Laboratory expert lecturers at more than 20 universities; worked with nine universities to develop new undergraduate and graduate-level coursework on international safeguards and nonproliferation; and initiated a Nuclear Nonproliferation and International Safeguards (NNIS) Graduate Fellowship program, which in the fall of 2010 began fully funding up to four years of graduate study for ten fellows.



An NGSI intern works on new techniques to monitor nuclear material flowing through processes.

Safeguards Technology Development

The NGSI Safeguards Technology Development sub-program develops advanced technologies and applications to improve the overall effectiveness and efficiency of safeguards implementation at both the facility and state levels.

The sub-program places particular emphasis on technologies that will reinforce the IAEA's gradual transition to a more "information-driven" safeguards approach. Examples of technology focus areas include advanced nuclear measurement technology, unattended and remote monitoring systems, data integration and authentication applications, information collection and analysis tools, and field portable detection tools to help inspectors verify the absence of undeclared nuclear materials and activities.

NGSI completed development of the portable LIBS device in FY 2010.

The centerpiece of the Safeguards Technology Development sub-program is a multiyear project to evaluate 14 non-destructive assay technologies with the potential to directly quantify plutonium in spent fuel. NGSI has completed development of a library of "virtual" spent fuel assemblies against which each of the techniques are being modeled. Technical reports will be completed by December 2010. In FY 2011, a technical review panel will be convened to conduct an independent assessment of the reports and provide recommendations as to which techniques should be selected for development into actual instrumentation for testing in domestic and foreign facilities.

In FY 2010, the NGSI Technology Development sub-program also completed the development of a portable instrument that utilizes laser-induced breakdown spectroscopy (LIBS) to conduct in-field analysis of materials of unknown composition. LIBS, a mature technology only recently pursued for its safeguards applications, shows tremendous promise in that it can analyze all elements in the periodic table, is highly configurable, and yields measurement results in near-real time. As a safeguards instrument, LIBS could enable the IAEA to conduct in-field screening and analysis of environmental samples as well as in-field characterization of unknown nuclear-related components and equipment.

Safeguards By Design

In addition to developing new technology and expertise, NGSI focuses on developing innovative and transformational safeguards policy, concepts and approaches to prepare for future safeguards challenges. In FY 2010, NGSI gave particular focus to advancing the Safeguards by Design (SBD) concept, which promotes the incorporation of safeguards requirements as early as possible in the planning process for a fuel cycle facility.

Under the SBD concept as defined by the IAEA, key stakeholders (states, industry and the IAEA) would begin discussions early in the conceptual design phase of a new nuclear facility, so that international safeguards measures would be fully integrated into the design process from initial planning through construction, operation and decommissioning. SBD is intended to help operators avoid costly and time-consuming redesign efforts; save the IAEA time, money and effort; and ultimately enhance the effectiveness and efficiency of safeguards implementation. To support development and eventual adoption of the SBD concept, NGSI has prepared studies on lessons learned, drafted model facility-specific SBD guidance documents, and begun engagement with industry and the IAEA on preparing authoritative guidance documents.

In FY 2010, NGSI focused on the preparation of model SBD guidance documents for uranium enrichment facilities, Gen III light-water reactors, and the DOE Next Generation Nuclear Plant gas reactor in consultation with industry and the IAEA. NGSI also opened a dialogue with companies that are currently planning, designing or building new uranium enrichment facilities in the United States, as well as those interested in advanced reprocessing and reactor technologies. Lastly, SBD was the theme for the annual NGSI meeting—the 3rd International Meeting on Next Generation Safeguards. At this meeting, safeguards policymakers and technical experts from national nuclear regulators, operators and the nuclear industry from 15 countries as well as representatives from international organizations such as the IAEA, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC), and the European Atomic Energy Community (EURATOM) met to discuss and develop recommendations to assist the IAEA in developing guidance for designers, operators and regulators in applying the SBD concept.

Safeguards Engagement

NGSI, through its International Nuclear Safeguards and Engagement Program (INSEP), collaborates with 23 international partners to strengthen State Systems of Nuclear Material Accounting and Control (SSACs) in partner countries. NGSI's international cooperation efforts enable more effective nuclear material accounting and control at the facility level and more complete and correct IAEA declarations at the state level. NGSI's partners range from those countries that have limited experience with nuclear materials to countries with the complete fuel cycle. International cooperation also advances other NGSI objectives such as technology development, human capital development, and concepts and approaches.

In FY 2010, NGSI established new safeguards cooperation partnerships with the United Arab Emirates, Malaysia and Tunisia. NGSI continued its efforts to assist states interested in bringing the Additional Protocol (AP) into force. The AP Declaration Helper, a new software tool developed

to simplify the decision-making process for the AP, was released to the public and currently is being tested with two international partners. Technical support for implementation of the AP was provided to Iraq, Malaysia, Vietnam, Thailand and Indonesia. NGSI helped address measurement and surveillance issues for Ukraine and ABACC, in both cases transferring technology developed in the United States to address needs identified by both partners. NGSI continues to work with established nuclear powers to strengthen the international safeguards system. In FY 2010, NGSI co-hosted regional IAEA training courses with Russia and China.

Nuclear Security

The International Nuclear Security Program works with international partners and the IAEA to strengthen nuclear security guidance documents, including INFCIRC/225; assess the adequacy of physical protection measures; and train foreign counterparts on physical protection best practices. Since 1978, DOE has conducted 105 courses on the physical protection of nuclear material and facilities for the IAEA and has trained over 3,200 officials from 115 countries.

In October 2010, IAEA Member States completed work on the fifth revision of the guidance document INFCIRC/225, "The Physical Protection of Nuclear Materials and Nuclear Facilities." Together with experts from other U.S. agencies and the U.S. National Laboratories, the NIS Office of Nuclear Safeguards and Security led the international effort to strengthen and clarify INFCIRC/225. The completion of this revision is one of the first completed deliverables of the 2010 Nuclear Security Summit and represents a significant accomplishment for NIS.

Since 1975, INFCIRC/225 has been the cornerstone of the international physical protection regime, and its recommendations are the criteria by which the adequacy of the physical protection of nuclear material and facilities is judged by the United States during bilateral assessment visits to countries holding U.S.-obligated nuclear material. It is also the standard used by the IAEA during its IPPAS missions. By revising the recommendations in INFCIRC/225 to address the current threat environment, the security of vulnerable nuclear materials will be improved and the nuclear terrorist threat will be reduced—two of the Administration's nonproliferation priorities.

Nuclear security cooperation with other countries and the IAEA is another important area of the program's work. As required by the Nuclear Nonproliferation Act (NNPA) of 1978, the International Nuclear Security Program provides training on key physical protection concepts for states that currently are, or in the future may be, responsible for the physical protection of nuclear materials and nuclear facilities.

Utilizing technical expertise from U.S. National Laboratories, the Program develops physical protection training and awareness curricula and materials to ensure that foreign officials have sufficient knowledge of how to implement the most current physical protection concepts and practices. Such training is conducted on a bilateral and regional basis and often with the IAEA, which relies on U.S. assistance to ensure that IAEA Member State officials responsible for protecting nuclear material and facilities have sufficient knowledge and expertise. During FY 2010, the Program provided training for 316 officials from 49 countries.

The Program also works on joint projects with foreign governments to strengthen physical protection practices worldwide. Although many of these bilateral and multilateral relationships have long been in place, some were recently strengthened through new efforts to ensure deliverables of the 2010 Nuclear Security Summit Work Plan are completed.

Finally, as required by the Atomic Energy Act of 1954 and the 1978 NNPA, the International Nuclear Security Program leads U.S. Government physical protection assessments of foreign sites with U.S.-obligated nuclear material on site (or to be provided) for peaceful purposes. Through these assessments, the physical protection of U.S.-origin nuclear material abroad is strengthened. Experts from the U.S. Department of State, the U.S. Nuclear Regulatory Commission and the U.S. Department of Defense joined NIS on four visits during the past fiscal year.

Budgeted Activities

The NIS Office of Nuclear Safeguards and Security strengthens international safeguards and security through the following budgeted activities:

- **Safeguards Policy, Concepts and Approaches, and Human Capital Development**—Supports U.S. policy development and bilateral/multilateral work to strengthen the international safeguards system, and revitalizes and expands human capital by attracting and training a new generation of talent.
- **Safeguards Technology Development**—Develops and applies tools, technologies and methods that optimize the effectiveness and efficiency of safeguards implementation at the facility and state levels.
- **Safeguards Engagement**—Collaborates with international partners to strengthen safeguards at all stages of nuclear development.
- **Nuclear Security**—Conducts physical protection assessments to verify that foreign sites are adequately protected, and trains foreign counterparts on physical protection best practices.

8-1

8-2

Office of Nuclear Controls

The NIS Office of Nuclear Controls builds global capacity for preventing theft, diversion and spread of WMD materials, equipment, technology and expertise. Office programs focus on both international and domestic engagement through workshops, seminars and technical trainings and emphasize long-term sustainability. Several FY 2010 accomplishments are described below.

Confidence-Building Measures

The NIS Confidence-Building Measures (CBM) program works on a regional and bilateral basis to help develop technical expertise capable of addressing regional security concerns and proliferation threats while enhancing transparency at the working level.

Since 2005, CBM's nuclear forensics initiative has supported U.S. and international efforts to deter illicit trafficking of nuclear and radiological materials through increased bilateral and regional data-sharing, research collaboration, and strengthening global capacity for effective forensics analysis. CBM has shown early success in its forensics projects in Central Asia, where work has included collecting nuclear forensics data in Tajikistan and Kyrgyzstan on samples of uranium ore, uranium ore concentrate, and uranium ore tailing.

In 2010, CBM expanded its engagement in Central Asia to include technical cooperation with Uzbekistan's Institute of Nuclear Physics of the Uzbekistan Academy of Sciences (INP-UAS). With INP-UAS, CBM will select a representative ore sample that will be analyzed jointly for isotopic, chemical and/or physical signatures as a means to share analytical techniques and methods and help INP-UAS develop standardized approaches to nuclear forensic measurements.

CBM also initiated discussions in 2010 with France, Russia, Australia, South Africa and Japan to promote technical collaboration in nuclear forensics. Joint activities will include analytical method sharing, development of national forensics libraries, and "round-robin" exercises with nuclear materials from across the fuel cycle. Other activities may include cooperative research and development to develop tools for determining nuclear material provenance including linking or excluding forensic data from interdicted samples with data from validated signatures.

As another important element of DOE/NNSA's comprehensive approach to combating the threat of nuclear proliferation, CBM's engagement with the Middle East Scientific Institute for Security (MESIS) in Amman, Jordan, continues to serve as a touchstone for enhancing regional science and technology cooperation to address common security concerns.

In 2010, CBM organized, in partnership with MESIS, the first joint DOE/Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) technical workshop to enhance national capabilities of state signatories in the Middle

East and South Asia (MESA) in the implementation of the CTBT and to promote technical engagement among seismology centers throughout the region. CBM's seismic monitoring cooperation in the Middle East supports development of a knowledgeable community of regional experts capable of working with the CTBTO and the International Monitoring System (IMS) to address verification concerns that historically have impeded CTBT ratification.

Through DOE/NNSA support, MESIS is fast becoming a regional center of excellence by providing a forum for training and dialogue on regional security and proliferation concerns, including export controls, border security and nuclear safety, security and safeguards and by marshaling regional, U.S. and international resources to cultivate indigenous nonproliferation expertise.

Global Initiatives for Proliferation Prevention

GIPP engages former weapons experts in civilian activity and facilitates partnerships between these former WMD experts, U.S. National Laboratories, and in many cases, U.S. industry. These partnerships develop innovative technology solutions in such priority areas as nonproliferation, specialty materials, counterterrorism and medical devices. GIPP systematically engages the business community and leverages its technical and commercial contributions in advancing U.S. nonproliferation goals.

In 2010, GIPP engaged 3,365 technical personnel at over 100 former WMD institutes and facilities. Ongoing projects that already have demonstrated results include the development of improved exhaust and emissions systems,

GIPP partners with countries around the globe to bring together U.S. National Laboratory scientists, industry and foreign WMD experts to redirect weapons scientists to peaceful, commercially viable activities.

U.S. Sen. Tom Udall joined officials from NNSA and Los Alamos National Laboratory for a ceremony at EDA Labs in Albuquerque, N.M., to officially start production of a new dental implant that uses stronger alloys that allow it to bond more quickly to human bone.

effective bio-decontamination methods, and hand-held devices to detect explosives under clothing. A recent example of a commercialization success resulting from GIPP is the October 2010 production launch of the first dental implant made with nanotitanium to be approved by the U.S. Food and Drug Administration. This technology was created under a three-year partnership among Los Alamos National Laboratory (LANL), several Russian institutes, and a U.S. company, Manhattan Scientifics. Nanotitanium is stronger than conventional metal alloys and integrates more quickly with human bone. Patients who receive this new generation of medical implant can expect faster post-surgery healing, as well as devices that are longer lasting and more reliable.

By collaborating with former weapons scientists on peaceful, commercially viable projects such as this, GIPP reduces the likelihood that these individuals will want to work with proliferators and in turn, reduces the likelihood that a proliferating state or terrorist organization will be able to recruit them.

U.S. Export Enforcement Training

The NIS International Nonproliferation and Export Control Program (INECP) strengthens global efforts to prevent transfers of WMD-sensitive materials, equipment and technology to weapons programs of concern. INECP enables capacity building overseas through a wide range of training programs in enterprise compliance, licensing analysis, export enforcement and border security analysis.

In the United States, INECP provides training to U.S. export enforcement agencies, such as the Department of Homeland Security's (DHS) Immigration and Customs Enforcement (ICE) Agency, to improve the U.S. Government's capacity to detect, inspect, investigate and prosecute illicit transfers of U.S.-origin strategic goods to Iran, North Korea and other destinations of concern. In FY 2010, INECP expanded its program to include tailored outbound targeting and inspectional training for DHS Customs and Border Protection (CBP) officers. In addition to providing information about how a strategic commodity could be used in a WMD program, these courses provide officers and agents with information about trade trends and commercial applications of so-called "dual-use" strategic items, so that CBP can focus on suspect shipments rather than on legitimate transfers. NIS specialists provide training to staff at the National Targeting Center-Cargo on identifying WMD-related goods based on export declarations while also training CBP officers at U.S. ports on visual recognition of these same items.

Budgeted Activities

The NIS Office of Nuclear Controls supports global nonproliferation through the following budgeted activities:

- **Confidence-Building Measures**—Advances technical collaborations in proliferation sensitive regions, builds transparency and capacity among indigenous technical communities, and strengthens international compliance.
- **Global Initiatives for Proliferation Prevention**—Helps to impede the proliferation of WMD expertise to rogue states and terrorist organizations.
- **Export Control Compliance**—Provides technical reviews of U.S. "dual-use" and nuclear technology export license applications for potential proliferation concerns.
- **International Nonproliferation Export Control Program**—Conducts training programs and provides related technical resources for partner countries seeking to strengthen national capacities to prevent the illicit transfers of WMD materials, equipment and technology.
- **WMD Interdiction**—Provides technical and policy support to the U.S. Government through several interdiction action groups.

Four outbound commodity identification trainings were provided at major seaports in FY 2010. The trainings included CBP officers from surrounding ports and CBP officers from the National Targeting Center-Cargo, as well as local ICE agents, so that investigations could begin immediately upon detection of suspect shipments.

During FY 2010, the Justice Department prosecuted several foreign citizens for illicit WMD-related procurement operations in the United States. These successes were made possible, in part, by NIS training of lead investigators and illustrate the value of NIS-customized support to the export enforcement process. NIS anticipates enabling additional successes of this kind with the recent initiation of outbound targeting and inspectional training.

NIS support of investigations into WMD-related procurement activities also resulted this year in several successful prosecutions of foreign nationals who were seeking to illegally divert U.S.-origin goods to foreign weapons programs.

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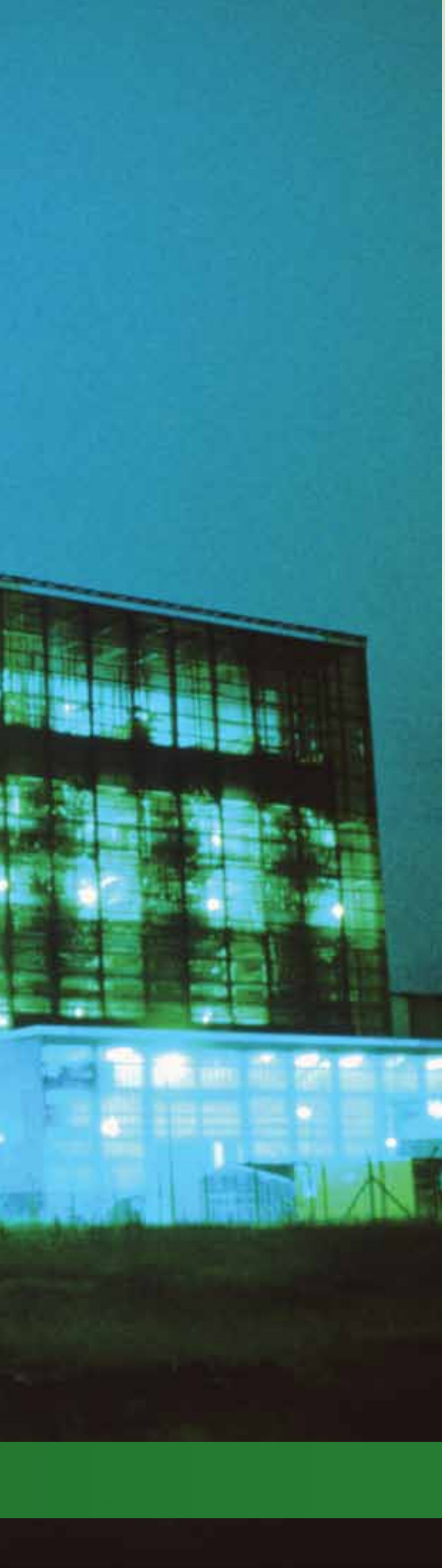


Office of Nuclear Verification

The NIS Office of Nuclear Verification negotiates, monitors and verifies compliance with nonproliferation and arms control treaties and agreements. Highlighted below are several FY 2010 accomplishments.

New START Treaty

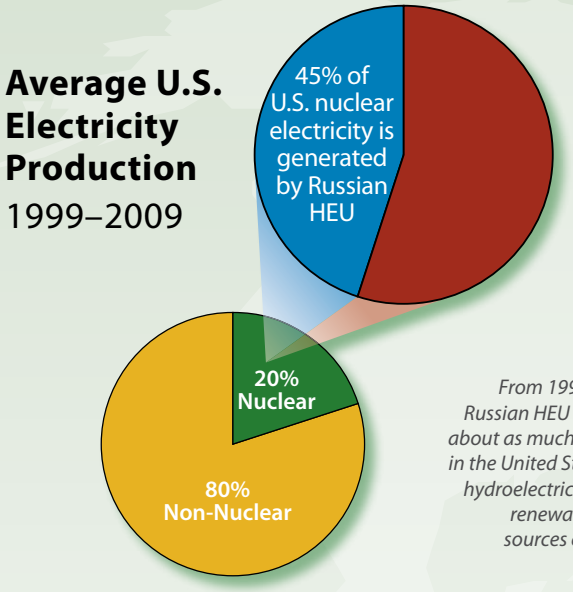
President Obama and Russian President Medvedev signed the historic *Measures for the Further Reduction and Limitation of Strategic Offensive Arms*—also known as the New START Treaty—in Prague on April 8, 2010. The Treaty between the United States and the Russian Federation was developed and negotiated with significant involvement from the NIS Office of Nuclear Verification.

New START is a bilateral nuclear arms reduction treaty that will replace the 1991 START Treaty, which expired in December 2009, and will supersede the 2002 Strategic Offensive Reductions Treaty, or Moscow Treaty. New START will reduce strategic delivery vehicles by more than 50 percent compared to START and will reduce deployed strategic nuclear warheads by 30 percent compared to the Moscow Treaty. Specifically, New START limits deployed and non-deployed launchers of intercontinental ballistic missiles (ICBMs), submarine-launched ballistic missiles (SLBMs), and heavy bombers to 800; deployed ICBMs, deployed SLBMs, and deployed heavy bombers to 700; and deployed strategic nuclear warheads to 1,550.

NIS served as the DOE/NNSA lead for New START negotiations, participated in key aspects of U.S. policy development, and was responsible for specific elements of the negotiation activities in Geneva from the beginning. Throughout the ten-month negotiation, NIS headquarters staff from the Warhead and Fissile Material Transparency (WFMT) program supported the Geneva-based team and the broader U.S. Interagency by providing reach back into NNSA, working with the Office of Defense Programs and other NNSA elements to develop and coordinate positions, providing guidance to the delegation, advocating NNSA positions within the U.S. Interagency, and preparing for the treaty's eventual signature and ratification.

NIS, working with the Office of Defense Programs and other NNSA elements, supported the larger U.S. Interagency effort to shepherd the New START Treaty through Senate advice and consent to ultimate ratification on December 22, 2010.

NIS representatives at the U.S. Mission in Geneva with Assistant Secretary of State Rose Gottemoeller, the U.S. Negotiator. From left to right are: Carolyn Pura (Sandia National Laboratories), Kurt Siemon (NIS), Rose Gottemoeller, Mona Dreicer (Los Alamos National Laboratory), and Greg Dwyer (NIS).



From 1999 to 2009, Russian HEU generated about as much electricity in the United States as all hydroelectric and other renewable energy sources combined.

The United States monitors HEU oxidation.

HEU Transparency Program

NIS achieved a significant nuclear nonproliferation milestone in 2010—the equivalent of over 16,000 Russian nuclear weapons has been permanently eliminated by converting HEU into low-enriched uranium (LEU). This milestone was met by successfully monitoring the cumulative "blending down" in Russia of more than 403 MT of HEU from Russia's nuclear weapons program. As a result, the 1993 HEU Purchase Agreement is now over 80 percent complete.

Under the Agreement, 30 MT of weapons-usable HEU is blended down annually into LEU for peaceful energy use, eliminating on average about three nuclear weapons every day. Every MT of HEU eliminated under the Agreement is one that will not require sustained security upgrades and can never be stolen or diverted for illicit use. This nonproliferation program produces commercial benefits as well; nearly 10 percent of electricity generated in the United States is derived from nuclear fuel obtained from the dismantled Russian nuclear weapons.

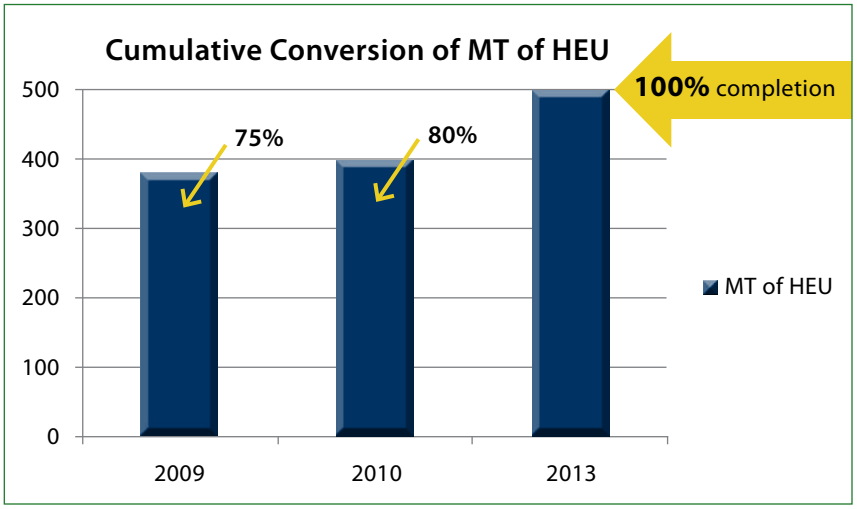
Under the 20-year HEU Purchase Agreement, Russia removes HEU components from disassembled nuclear weapons and converts the material into LEU for nuclear fuel sold in the United States. The HEU Transparency program fulfills the Agreement's nonproliferation requirements by monitoring the HEU-to-LEU "blending down" process in Russia. By comparing Russian process declarations, firsthand observations from U.S. experts, and data from U.S.-designed instruments, the program confirms that the LEU purchased and delivered under the Agreement is derived from Russian weapons program HEU.

To ensure that LEU derived from Russian HEU is used exclusively for peaceful purposes in the United States, Russia exercises reciprocal transparency rights under the Agreement.

The HEU Transparency program will fully implement U.S. monitoring rights through the Agreement's completion in 2013 to ensure that all 500 MT of Russian HEU are blended down subject to rigorous transparency measures and that the Agreement's nonproliferation objectives are fully achieved.

Development of a Sampling Technique to Assist in Measuring Energy Production

In FY 2010, Pacific Northwest National Laboratory (PNNL) developed the technology and associated equipment to collect samples in-situ from the core shroud walls of IRT-type (Soviet- designed) research reactors to analyze them using the Isotope Ratio Method (IRM). IRM is a proven way to estimate the energy production in a fission reactor to verify whether



the total energy produced over the operating lifetime of the reactor is consistent with operator declarations. The challenge, however, is to remotely collect core shroud wall samples from a functional IRT reactor while preserving the integrity and operability of the reactor. The core of an IRT reactor sits at a depth of approximately 27 feet in a pool of water. The sample collection system must be deployed from above the reactor pool using the same working platform that the reactor operators use for refueling.

Several sample collection methods were evaluated and Electrical Discharge Machining (EDM) was the least invasive to the reactor environment and most successfully preserved sample integrity. EDM works by generating a plasma between the cutting head of the EDM and the shroud wall wherein a pill-sized piece of the shroud wall is removed. The EDM system uses a hand-controlled camera that allows for accurate placement of the cutting head in the core by the operator while simultaneously recording the video feed on a portable hard drive.

The IRT reactor block.

Placement of the EDM against the shroud wall.

The full-scale EDM IRT sampling system was successfully tested in June 2010. The successful development of an EDM sample collection method to support the IRM technique now provides a complete tool that can be used for validation of declared IRT operations.

Attribute Measurement Verification Project

In FY 2010, the Office of Nuclear Verification's WFMT program concluded the Attribute Measurement Verification Project (AMVP), an important example of NIS-applied technology development initiatives. Under WFMT leadership, a team from LANL and Lawrence Livermore National Laboratory (LLNL) worked with counterparts from the All-Russia Scientific Research Institute of Experimental Physics (VNIIEF) to cooperatively design, fabricate and demonstrate the AMVP system. The system provides for the verification of plutonium presence, threshold mass and threshold isotopic ratio (^{240}Pu to ^{239}Pu <0.1) to confirm the presence of weapons-related plutonium components without revealing sensitive information. This type of measurement system has a number of potential applications, from domestic safeguards to international monitoring of stored and in-process weapons-related material. The AMVP drew from early work initiated as part of the U.S.-Russia-IAEA Trilateral Initiative for transparency measures utilizing information barrier concepts and was the final project completed under the now expired 1994 U.S.-Russia Warhead Safety and Security Exchange (WSSX) Agreement. Following the exchange of final project deliverables, NIS, LANL, LLNL and VNIIEF personnel conducted a special session during the July 2010 International Nuclear Materials Management annual conference to discuss lessons learned and document the project's accomplishments.

Russian and U.S. experts discuss fabrication of the attribute measurement verification system.

Budgeted Activities

The NIS Office of Nuclear Verification provides policy, programmatic direction, and applied technology development and evaluation to ensure transparent and verifiable compliance with treaties and other obligations through the following budgeted activities:

- **HEU Transparency**—Annually monitors the conversion in Russia of 30 MT of HEU from dismantled Russian nuclear weapons to LEU.
- **Warhead and Fissile Material Transparency**—Develops policy, technology and approaches for transparent reductions and monitoring of nuclear warheads, fissile material and related facilities.
- **Nuclear Noncompliance Verification**—Provides advanced technology applications to verify declared nuclear activities, detect undeclared nuclear materials and activities, and support the verifiable dismantlement of nuclear programs.

Nuclear
Security
Summit
Washington, 2010
Nuclear
Security
Summit
Washington, 2010

Official White House photo by Chuck Kennedy

Nonproliferation Policy

NIS is at the forefront of the Administration's push to strengthen implementation of global nonproliferation norms and practices. The information below highlights NIS successes in bolstering multilateral nuclear diplomacy around the globe.

Cradle-to-Grave Nuclear Fuel Cycle Concept

The "Cradle-to-Grave" (CTG) nuclear fuel cycle concept is based on the principle of comprehensive, reliable and economically viable global front- and back-end fuel services, offered by one or more states or private companies. Such a CTG program would allow countries without extensive nuclear infrastructure to more confidently adopt nuclear power as a low carbon energy source and would have the long-term nonproliferation advantage of centralized high-security storage of the resulting irradiated fuel from such programs. The concept has become the core concept in the Administration's approach to international nuclear fuel cycle cooperation.

NNSA has contributed significantly to the advancement of this concept over the past year. NIS commissioned a joint study conducted by several U.S. National Laboratories in cooperation with the DOE Office of Nuclear Energy to address the economic and financial features of a CTG approach, specifically assessing the economic feasibility of a CTG program. The study found that the potential market for such a program is large enough to generate significant economies of scale and thus cost savings relative to indigenous development of long-term storage and disposal programs in countries participating in a CTG program.

NNSA will work with the Office of Nuclear Energy and the Interagency to continue to define activities in support of a CTG regime. NNSA also will continue to participate in the International Framework for Nuclear Energy Cooperation fuel assurance working group to promote the CTG concept and work on ways to address the front-end challenges. As the Blue Ribbon Commission on America's Nuclear Future completes its consideration of the back-end of the nuclear fuel cycle, NNSA will incorporate those results into the CTG concept and strategy.

Reliable Fuel Services

NIS has been active in addressing technical, regulatory, political and economic questions that have been raised by non-nuclear weapon states on the concept of a nuclear fuel bank. The concept encourages states to refrain from developing domestic enrichment and reprocessing capabilities in favor of multilateral alternatives that guarantee reliable assurance of fuel for power reactors. Several assured fuel supply proposals have been put forward for international consideration, and an IAEA international nuclear fuel bank was approved during the December 2010 IAEA Board of Governors meeting. NIS will make significant contributions to the IAEA nuclear fuel bank by facilitating the contribution of nearly $50M to the IAEA and by defining the procurement and pricing of the LEU in the bank, conditions for the release of the fuel to a recipient state, and terms for the replacement of dispersed fuel.

One of the frequently-cited criticisms of the various fuel supply proposals is that, while they provide for assurance of LEU, they do not guarantee the supply of fabricated nuclear fuel assemblies. To increase credibility, nuclear fuel assurance proposals must provide assurance of actual fuel assemblies tailored to the specifications of individual reactors. NIS is providing technical analysis to the IAEA on questions related to nuclear fabrication and also is engaging the nuclear industry in exploring solutions for potential reliable supply concerns and in addressing general questions related to developing backup assurances to market supply.

2010 NPT Review Conference

NIS served an important role on the U.S. delegation to the May 2010 Nuclear Non-Proliferation Treaty Review Conference (RevCon). Representing DOE equities, NIS experts provided policy and technical advice to the NPT Special Ambassador on issues including safeguards, export controls and nuclear disarmament.

NIS coordinated NNSA Administrator Thomas D'Agostino's briefing at the May 2010 RevCon.

To amplify the U.S message on disarmament issues at the RevCon, NIS coordinated a well-received briefing by NNSA Administrator Thomas D'Agostino on the "U.S. Commitment to Disarmament." More than 200 representatives from counterpart delegations, nongovernmental organizations and the media attended this event, which focused on U.S. fulfillment of its NPT disarmament commitments by reducing deployed nuclear weapons, ceasing production of weapons material, disposing of excess weapons materials, managing a smaller nuclear stockpile, and strengthening global nuclear security. The Administrator called on NPT parties to seize the opportunity to take steps towards realizing President Obama's Prague vision of a world without nuclear weapons. NIS also facilitated the presentation of a joint DOE-State-Nuclear Regulatory Commission briefing on U.S. support for the development of peaceful uses of nuclear energy under the NPT.

The month-long conference culminated in a Final Document, which included a consensus action plan to strengthen implementation of the NPT. NIS and the rest of the U.S. delegation worked with counterparts from 171 other countries to successfully negotiate this Document, which urged state parties to comply fully with their obligations under the treaty and included language that supports the President's Prague vision. The Document encourages parties to join the United States in negotiating a fissile material cut-off treaty, develop in full the CTBTO's verification regime, and conclude and bring into force additional safeguards protocols. Lastly, it recommends strengthening the IAEA's ability to meet its safeguards objectives and encourages stronger export controls for nuclear technology.

Indo-Pakistani Strategic Stability

Relations between Islamabad and New Delhi remain strained by ongoing conflict over Kashmir and cross-border terrorism, either of which could be the flashpoint that causes nuclear escalation. To promote stability in South Asia, NIS has been pursuing an innovative effort to initiate bilateral arms control discussions between key Indian and Pakistani strategic experts. The approach focuses on coordinated retirement of nuclear-capable, first generation short-range ballistic missiles, which both India and Pakistan deploy. Analysts in both countries—and in the United States—have voiced concern that these missiles undermine strategic stability and could cause unintended rapid escalation during a conflict. Moreover, these missiles have outlived their original mission purposes and are reaching the end of their service life. They eventually will be removed from service and dismantled.

NIS sponsored and participated in a workshop at Wilton Park, an executive agency of the British Foreign and Commonwealth Office, in April 2010 to discuss international experiences with dismantling strategic missile systems. Experts from the United States, the United Kingdom, Russia and France shared with leading Indian and Pakistani experts the strategic rationale and technical requirements for removing strategic missiles from their arsenals. The workshop also examined verification options for dismantlement and shared insights from the negotiation and implementation of various arms control agreements. The Indian and Pakistani participants discussed ways in which these experiences could inform initial arms control efforts in South Asia.

The Wilton Park conference laid the foundation for a select group of Indian and Pakistani strategic experts to produce a draft treaty to eliminate some nuclear-capable, short-range ballistic missiles from the strategic arsenals of India and Pakistan in a verifiable manner.

Future Outlook

Across the spectrum of safeguards, controls and verification, NIS offers a unique blend of policy expertise, technical capacity and program activities to support and shape U.S. policy objectives and enable domestic and international partners to respond to a rapidly evolving strategic environment to further U.S. nonproliferation objectives.

NIS has conducted a planning process to look at specific actions necessary to meet our goals. Concurrent to the completion of a 2011–2015 Strategic Implementation Plan, NIS launched an extended forward-looking 2016–2020 planning effort. The 2016–2020 endeavor will provide NIS with a long-term outlook to facilitate decision-making with respect to our internal priorities and planning. Through focused internal execution of the Strategic Implementation Plan, but with an eye towards the coming decade of proliferation challenges, we will position ourselves as a proactive provider of integrated policy and programmatic solutions. We must continue to challenge ourselves to anticipate uncertain scenarios. Through the anticipation and analysis of potential over-the-horizon proliferation challenges and by improving our strategic planning capabilities as an organization, NIS will be well positioned to meet the challenges of the next decade.

Looking forward to FY 2011 and beyond, NIS will focus significant attention and resources on the following high priority initiatives:

- Support the New START Treaty entry into force.
- Expand Safeguard and Security programs and conduct a safeguards review.
- Work with the Office of Nuclear Energy and the Interagency to define activities in support of a Cradle-to-Grave regime.
- Support the CTBT ratification process.
- Implement a new Expertise Proliferation Risk Reduction program.
- Modify existing export control programs to reflect changes as defined by the Export Control Reform Initiative.
- Conduct a review of trigger and dual-use control lists.

As NIS moves forward, the Strategic Implementation Plan will shape day-to-day actions to ensure these activities achieve excellence in applying DOE and NNSA nonproliferation policy, technical and implementation expertise to make the world safe and secure.

Acronyms

ABACC	Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials
AMVP	Attribute Measurement Verification Project
AP	Additional Protocol
CBM	Confidence-Building Measures
CBP	Customs and Border Protection
CTBT	Comprehensive Nuclear-Test-Ban Treaty
CTBTO	Comprehensive Nuclear-Test-Ban Treaty Organization
CTG	Cradle-to-Grave
DHS	Department of Homeland Security
DOE	Department of Energy
EDM	Electrical Discharge Machining
EURATOM	European Atomic Energy Community
FMCT	Fissile Material Cut-Off Treaty
FY	Fiscal Year
GIPP	Global Initiatives for Proliferation Prevention
HCD	Human Capital Development
HEU	Highly Enriched Uranium
IAEA	International Atomic Energy Agency
ICBM	Intercontinental Ballistic Missile
ICE	Immigration and Customs Enforcement
IMS	International Monitoring System
INECP	International Nonproliferation and Export Control Program
INFCIRC	Information Circular
INP-UAS	Institute of Nuclear Physics of the Uzbekistan Academy of Sciences
INSEP	International Nuclear Safeguards and Engagement Program
IPPAS	International Physical Protection Advisory Service
IRM	Isotope Ratio Method
LANL	Los Alamos National Laboratory
LEU	Low-Enriched Uranium
LLNL	Lawrence Livermore National Laboratory
LIBS	Laser-Induced Breakdown Spectroscopy
MESA	Middle East and South Asia
MESIS	Middle East Scientific Institute for Security
MT	Metric Ton
NGSI	Next Generation Safeguards Initiative
NIS	Office of Nonproliferation and International Security
NNIS	Nuclear Nonproliferation and International Safeguards
NNPA	Nuclear Nonproliferation Act
NNSA	National Nuclear Security Administration
NPT	Nuclear Non-Proliferation Treaty
PNNL	Pacific Northwest National Laboratory
RevCon	Review Conference (for the Nuclear Non-Proliferation Treaty)
SBD	Safeguards by Design
SLBM	Submarine-Launched Ballistic Missile
SSACs	State Systems of Nuclear Material Accounting and Control
START	Strategic Arms Reduction Treaty
VNIIEF	All-Russia Scientific Research Institute of Experimental Physics
WFMT	Warhead and Fissile Material Transparency
WMD	Weapons of Mass Destruction
WSSX	Warhead Safety and Security Exchange

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