Securing the Future

FY2011 Annual Report

Office of
Nonproliferation and **International Security** (NIS)

National Nuclear Security Administration

1954

1987

2010

"All Americans seek a better quality of life, prosperity, and strengthened national security. Also deep in our national DNA is the desire to provide our children and grandchildren with greater opportunities than we received from our parents. In today's rapidly changing world, none of our aspirations can be taken for granted."

U.S. Department of Energy Secretary, Steven Chu,
U.S. Department of Energy 2011 Strategic Plan

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Executive Message

2011 marked another 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). Priorities and achievements have been driven by the 2010 Nuclear Posture Review, which outlines broad policy parameters for the U.S. approach to preventing nuclear proliferation and terrorism. These priorities include strengthening the nuclear nonproliferation regime, securing the most vulnerable nuclear materials worldwide within four years, and pursuing arms control initiatives. Throughout 2011, NIS applied its unique technical and policy expertise to support the implementation of initiatives consistent with these policy goals. As the year comes to a close, I would like to take a moment to reflect upon some of our most significant accomplishments:

» Led U.S. Government and international efforts to revise international guidelines on the physical protection of nuclear materials and nuclear facilities (IAEA INFCIRC/225/Rev. 5), which will strengthen significantly international standards to reduce the risk of nuclear terrorism. These standards provide clear physical protection guidance to states with existing nuclear materials and facilities and states that may be developing peaceful nuclear energy for the first time.

» Led the effort in the Nuclear Suppliers Group (NSG) to enhance controls over the transfer of enrichment and reprocessing technologies with potential nuclear weapons applications.

» Supported the interagency ratification process for the New START Treaty and its subsequent implementation, including evaluation of Russian radiation detection equipment for use during inspections in the United States.

» Facilitated entry into force of the U.S.-Russia Agreement for Cooperation in the Field of Peaceful Uses of Atomic Energy (123 Agreement), which will provide the framework for continued coopeartion between our two countries.

» Completed monitoring of stored plutonium oxide and shutdown of Russian plutonium production reactors under the U.S.-Russia Plutonium Production Reactor Agreement (PPRA), thereby ensuring Russia's last plutonium production reactors were not restarted.

» Monitored the conversion of 30 metric tons (MT) of Russian highly enriched uranium (HEU) from dismantled Russian nuclear weapons into low enriched uranium (LEU), for a cumulative total of 433 MT (17,320 weapons) downblended and verifiably eliminated. This material can no longer be used for nuclear weapons programs.

» Commissioned the Expertise Proliferation Threat Assessment, which examined NNSA scientific engagement efforts conducted through the Global Initiative for Proliferation Prevention (GIPP) program, to ensure that the program is optimally organized to respond to the current and projected threat environment.

» Implemented the fourth year of the Next Generation Safeguards Initiative (NGSI), thereby bolstering international efforts to monitor and prevent the proliferation of nuclear weapons through the International Atomic Energy Agency (IAEA). This effort included the completion of a two-year, simulation-based evaluation of fourteen individual non-destructive assay techniques to improve inspectors' ability to detect and deter illicit plutonium diversion.

» Established the American Assured Fuel Supply to ensure the supply of nuclear material to the domestic and international civilian nuclear industry, thereby enhancing U.S. energy security.

» Issued the *Over the Horizon* study, which characterizes global trends and emerging challenges in the area of nonproliferation and international security. This effort will ensure the NIS mission and programs are appropriately positioned to meet future national security challenges and opportunities.

In keeping with the NNSA Strategic Plan and the NIS Multi-year Program Plan, NIS will continue engagement over the next year in a wide array of technical and policy activities designed to advance national security priorities and goals. Specifically, NIS will focus significant attention and resources to the following high priority initiatives:

» Provide technical and policy resources to international partners to fulfill 2010 Nuclear Security Summit commitments and support the 2012 Nuclear Security Summit.

» Support New START implementation, and U.S. Interagency consideration of potential next steps in nuclear arms reduction initiatives.

» Conduct bilateral physical protection assessments at overseas facilities containing U.S. obligated nuclear material, and implement INFCIR/225/Rev.5 consistent with the President's pledge to secure the most vulnerable nuclear materials within four years.

» Continue monitoring conversion of Russia weapons-origin HEU to LEU under the HEU Transparency Implementation Program. Twenty-four monitoring visits to Russian nuclear facilities are planned.

» Implement the new Global Security through Science Partnerships Program, thereby realigning the Global Initiatives for Proliferation Prevention program to address evolving proliferation threats through scientist engagement.

» Continue to lead the U.S. effort to conduct a fundamental review of the NSG control list to ensure that these export controls adequately reflect the latest technology developments in the nuclear fuel cycle and dual-use technology.

» Provide Commodity Identification Training (CIT) to new partners in the Middle East, Southeast Asia, and Africa, to prevent the illicit transfer of weapons of mass destruction (WMD)-relevant materials.

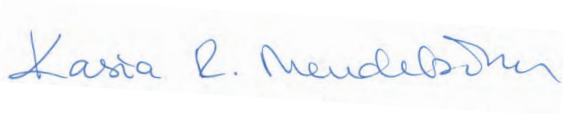
» Advance science and technology nonproliferation cooperation through engagement with the Middle East Scientific Institute for Security (Jordan) and the Global Nuclear Energy Infrastructure Institute (Abu Dhabi) regional centers of excellence, to address proliferation threats in the Middle East region.

» Begin developing a capability for age dating uranium hexafluoride (UF_6) in transport cylinders, to prevent illicit production and diversion of nuclear material in countries of concern.

» Represent DOE/NNSA in potential negotiation of a Fissile Material Cut-Off Treaty.

» Play a lead role in enhancing U.S.-China cooperation on Peaceful Uses of Nuclear Technology.

We will continue to apply our best expertise and innovative thinking to programs designed to prevent proliferation and nuclear terrorism. 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 regimes.



Kasia Mendelsohn
Acting Assistant Deputy Administrator
NNSA Office of Nonproliferation and International Security

NIS–Leading the Way

The mission of NIS is to prevent the proliferation of WMD by strengthening the nonproliferation, nuclear security, and arms control regime.

The U.S. Department of Energy, National Nuclear Security Administration (DOE/NNSA) Office of Nonproliferation and International Security (NIS) provides leadership in the formulation and implementation of nonproliferation, arms control, and nuclear security strategies to advance Administration national security objectives, deploying a unique variety of technically-based national security programs.

To fulfill its role, NIS engages and provides 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.

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

The ***Office of Nuclear Safeguards and Security*** focuses on programs to prevent the diversion, theft, and sabotage of nuclear materials. NIS addresses evolving proliferation threats, expanded responsibilities within the IAEA, the diffusion of sensitive technology through illicit networks, a retiring safeguards workforce, an increased threat of nuclear terrorism, and growth of nuclear power worldwide. The office works to revitalize, strengthen, and sustain the U.S. Government safeguards and security capabilities through the Next Generation Safeguards Initiative (NGSI) and International Nuclear Security (INS) programs. These programs support the development of sound safeguards and security policies, concepts, and approaches; develop human capital through training and education; develop and implement new safeguards systems, technologies, and infrastructure; support international safeguards and nuclear security infrastructure development; implement U.S. safeguards obligations; and strengthen the security of nuclear materials and facilities worldwide.

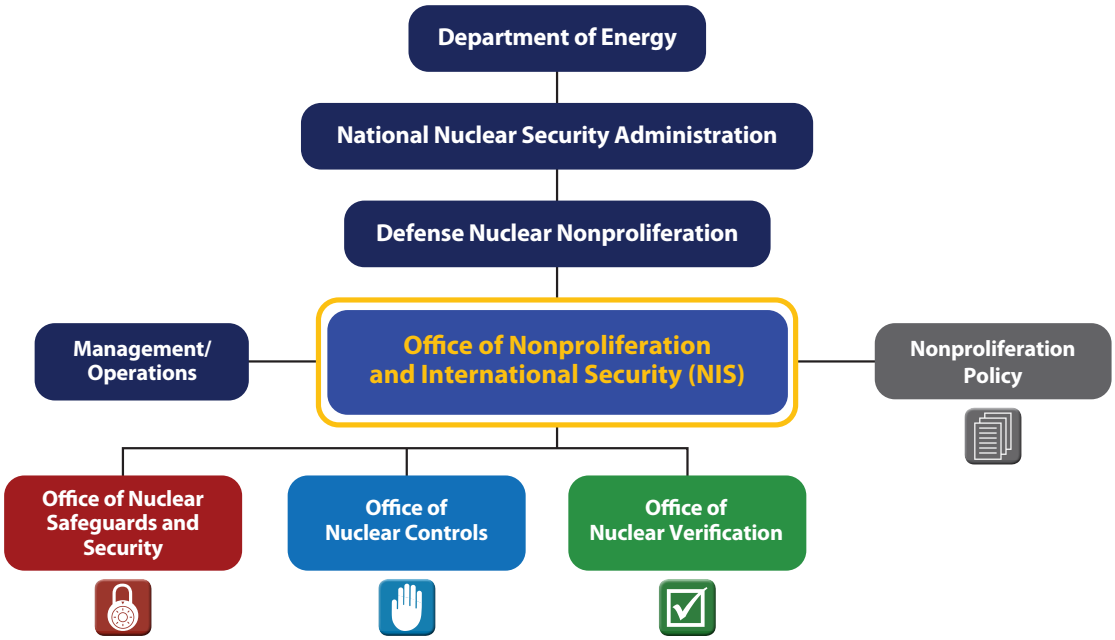
The ***Office of Nuclear Controls*** pursues collaborative relationships with foreign governments to assist them in meeting their nonproliferation obligations, strengthen their capacity to prevent proliferation from within their borders, and engage former weapons of mass destruction (WMD) experts in peaceful activities. Strong national systems of control are critical elements of a multilayered strategy aimed at preventing state and non-state actors from obtaining WMD. The office works to build a global capacity to prevent the diversion or spread of nuclear materials knowledge and expertise through programs that strengthen U.S. Government capacity to detect and prevent WMD-related commodity and technology transfers to foreign programs of concern; bolster foreign partner capacity to detect and prevent illicit trafficking of WMD-related material, equipment, and technology; mitigate risk of expertise proliferation through science and technology collaboration and partnerships; and build trust, transparency, and capacity among indigenous science and technology communities, thereby promoting compliance with nonproliferation and arms control regimes and advancing U.S. Government security initiatives.

Office of Nuclear Safeguards and Security

- Next Generation Safeguards Initiative (NGSI)
  - Safeguards Policy Program
  - Safeguards Engagement Program
  - Safeguards Technology Development Program
- International Nuclear Security (INS) Program

Office of Nuclear Controls

- International Nonproliferation Export Control Program (INECP)
- Global Initiatives for Proliferation Prevention (GIPP)
- Confidence Building Measures (CBM)
- Export Control Review and Compliance (ECRC)
- Weapons of Mass Destruction Interdiction



The *Office of Nuclear Verification* negotiates, monitors, and verifies compliance with international nonproliferation and arms control treaties and agreements. Nuclear Verification activities include developing arms control treaty negotiation and ratification strategies to achieve U.S. national security objectives for nonproliferation and arms control treaties and agreements; developing technologies, in coordination with the Office of Nonproliferation Research and Development, to monitor compliance with nonproliferation and arms control treaties and agreements and detect potential clandestine weapons programs or illicit diversion; and providing policy, technical, and implementation expertise to support these treaties and agreements.

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 presidential initiatives requires the development of innovative policies and approaches. NNSA expertise is marshaled into key U.S. Government decisions, programs, and policies. NIS focuses scientific and technology capabilities to advance high-level U.S. nonproliferation and arms control policy through engagement with interagency and international partners, policy support to shape U.S. nonproliferation and arms control negotiations, and enhancement of multilateral supplier regimes.

Office of Nuclear Verification

- Highly-Enriched Uranium (HEU) Transparency Program
- Nuclear Noncompliance Verification (NNV) Program
- Warhead Dismantlement and Fissile Material Transparency (WFMT)

Nonproliferation Policy

- Global Regimes Program
- Multilateral Supplier Policy Program
- Regional Analysis and Engagement Program

NIS FY2011 Accomplishments

Safeguards by Design

In FY2011, NGSI sponsored and hosted the Third International Meeting on Next Generation Safeguards at the Washington Hilton Hotel in Washington, D.C. The two-day technical meeting was convened on December 14–15, 2010, to discuss next steps for the practical implementation of the Safeguards by Design (SBD) concept. Approximately one hundred participants from thirteen countries represented government, industry, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC), the European Atomic Energy Agency (EURATOM), and the IAEA.

The primary objectives of this NGSI-sponsored meeting were to exchange views and provide recommendations on implementation of the SBD concept for four nuclear fuel cycle facility types: gas centrifuge enrichment plants, Generation III and IV reactors, aqueous reprocessing plants, and mixed oxide (MOX) fuel fabrication facilities.

Thomas D'Agostino, NNSA Administrator and Undersecretary of Energy for Nuclear Security, provided opening remarks to establish the context for the meeting. Daniel Poneman, U.S. Deputy Secretary of Energy, called for industry, governments, regulators, and inspectorates to form a strong partnership to "develop the concept of Safeguards by Design—a potentially transformational concept that meets both public and private sector goals…..With Safeguards by Design, we envision an intersection between good governance, good policy, and good business."

The dialogue culminated in the *Final Meeting Report of the Third International Meeting on Next Generation Safeguards: Safeguards by Design*. Sections of the document are intended to assist the IAEA's efforts to publish practical SBD guidance documents in the near future.

This effort was an extension of the NGSI program to study and identify SBD best practices and lessons learned, to engage industry on facilities planned in the United States, and to coordinate with the IAEA on the development of practical guidance for the application of SBD around the world.

Under Safeguards by Design, facility designers and operators consider broad international safeguards requirements and features from initial planning through design, construction, operation, and decommissioning. The objectives of SBD are to (1) design new civil nuclear facilities that meet national and international nuclear safeguards requirements, (2) make implementation of safeguards at such facilities more effective and efficient, (3) avoid costly and time-consuming redesigns and retrofits, minimize disruptions, and protect sensitive information, and (4) design facilities so that misuse of the facility and/or diversion of nuclear material is more technically difficult and easier to detect.

The achievement of these goals could save States, industry, and the IAEA time and resources—a mutually beneficial endeavor.

DEC 14-15

The Third International Meeting on Next Generation Safeguards was held in Washington, D.C. and focused on the implementation of the Safeguards by Design concept.

AUG 1939 — Albert Einstein sends a letter to President Roosevelt informing him of the German atomic research program and the potential for a bomb.

AUG 13 1942 — The Manhattan Project is initiated.

DEC 2 1942 — The first self-sustaining nuclear reaction occurs at the University of Chicago.

DEC 22

The U.S. Senate ratified the New START Treaty. Kurt Siemon, NIS Director of the Office of Verification and part of the U.S. Interagency team supporting Senate advice and consent, stands third to the right of Vice President Biden during a brief break in the ratification effort.

New START Treaty

Working with NNSA Defense Programs, Congressional Affairs, and other DOE/NNSA elements, NIS facilitated U.S. Senate consideration of the New START Treaty, submitted by the President to the Senate for its advice and consent on May 13, 2010. NIS prepared testimony for the Secretary of Energy and NNSA Administrator in support of the Treaty, and developed and coordinated responses to numerous questions for the record regarding the impact of New START on DOE/NNSA's future plans to maintain the nation's nuclear weapons stockpile. Kurt Siemon, Director of the NIS Office of Nuclear Verification, also spent the final weeks during the Senate deliberation of the Treaty on location at the U.S. Capitol as part of the U.S. Interagency team that supported the Senate Foreign Relations Committee.

Senate advice and consent to the New START Treaty was provided on December 22, 2010. The Russian Duma and Federation Council provided consent to ratification on January 25 and 26, 2011, respectively. The New START Treaty entered into force through the exchange of the Treaty's instruments of ratification on February 5, 2011. Since entry into force, NIS has continued to play an integral role in Treaty implementation, including through participation in the first meeting of the Bilateral Consultative Commission in April 2011 and evaluation of Russian radiation detection equipment for use during inspections of deployed strategic delivery systems in the United States. This involved coordination with other NNSA elements, National Laboratory assets, and the Department of Defense to develop and execute a coordinated testing and evaluation plan during the thirty-day equipment evaluation period provided under the Treaty. As a result of this work, the United States was able to approve use of the Russian equipment in the United States in April 2011.

The Russian Federation provided commensurate approval for use of U.S. radiation detection equipment, developed by Sandia National Laboratories, during inspection in the Russian Federation.

> **"Ratifying a treaty like START isn't about winning a victory for an administration or a political party. It's about the safety and security of the United States of America."**
>
> —President Barack Obama, Weekly Address (December 18, 2010)

JUL 16 **1945** The United States tests its first nuclear bomb.

JUL 20 **1946** The Atomic Energy Act of 1946 passes Congress.

APR 4 **1949** The North Atlantic Treaty Organization (NATO) is established.

NOV 1 **1952** The United States detonates its first thermonuclear device.

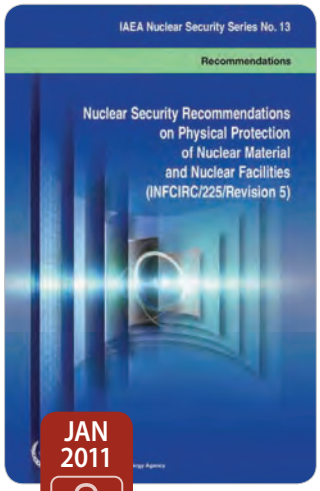
As Treaty implementation continues, NIS will continue to provide essential support for the New START Treaty implementation process. The Office will continue to work within NNSA and the U.S. Government to prepare for potential future arms control initiatives and ensure NNSA interests are well represented.

International Nuclear Security Program

NIS' INS program achieved one of the first major objectives delineated in the April 2010 Nuclear Security Summit Work Plan by leading the U.S. Government and IAEA Member State effort to finalize the fifth revision of the nuclear security recommendations document INFCIRC/225, "The Physical Protection of Nuclear Material and Nuclear Facilities," published in January 2011. INFCIRC/225 has provided internationally accepted criteria for protecting nuclear material and facilities and served as the cornerstone of the physical protection regime since it was first published in 1975. INFCIRC/225 recommendations also are integral to legally binding agreements governing U.S. civil nuclear exports to nearly 50 countries.

The fifth revision of this document contains strengthened guidelines for the protection of nuclear materials during use, storage, and transport, including new sections on the rapid recovery of missing nuclear material and protection against sabotage. These changes ensure better consistency with the amended Convention on the Physical Protection of Nuclear Materials and United Nations Security Council Resolutions 1540 and 1887, and provide clearer physical protection guidance to states that may be developing peaceful nuclear energy for the first time. INS is preparing to lead the international effort to implement and train other countries in the coming years on the new recommendations contained in INFCIRC/225/Rev.5.

In addition to leading the charge on implementation of the revised guidelines, INS is increasing training and cooperation with many partners in a variety of other areas to help them meet their 2010 Nuclear Security Summit commitments. This includes projects to assist Japan and the Republic of Korea in planning, development, and establishment of new nuclear security training centers. The Centers are a high priority for both countries and will be used to enhance and institutionalize support for nuclear security and nonproliferation, both domestically and for the Asian region, through classroom and hands-on training at new test facilities. INS launched several new projects in 2011 in support of these centers, including development of a nuclear security training curriculum, cooperation on nuclear security test beds, development of information technology and virtual reality tools for classroom training, and co-hosting international workshops on nuclear security.



JAN 2011

NIS' International Nuclear Security program supported the development of the new IAEA nuclear security guidance (INFCIRC/225/Revision 5).

Through these and other projects, INS is addressing the need outlined in the 2010 Nuclear Security Summit Communiqué—issued by 46 participating countries, the European Union, the IAEA, and the United Nations—for increased "capacity building for nuclear security and

> **"Disarmament and nonproliferation education have an essential role to play in maintaining and strengthening the momentum towards achieving a world free of nuclear weapons."**
>
> —IAEA Director General Yukiya Amano, February 25, 2011

DEC 8 **1953** President Dwight D. Eisenhower's "Atoms for Peace" speech outlines the establishment of the International Atomic Energy Agency (IAEA).

AUG 30 **1954** President Dwight D. Eisenhower signs the Atomic Energy Act of 1954 into law.

NOV 22 **1955** The USSR detonates its first thermonuclear weaponized device with a 1.6 Mt yield.

cooperation at bilateral, regional, and multilateral levels for the promotion of nuclear security culture through technology development, human resource development, education, and training."

International Export Control Outreach

Over the past two decades, networks of front companies and procurement agents seeking to acquire sensitive dual-use goods for nuclear and other WMD programs have created black markets that supply Iran's and North Korea's nuclear and missile programs. There is additional concern that "break-out" proliferators could use trans-shipment hubs to acquire the means for producing WMD. The International Nonproliferation Export Control Program (INECP) long has sought to help national governments disrupt the sources of illicit supply chains and is increasing its cooperation with trans-shipment countries in order to detect these illegal activities.

INECP made significant strides over the past year in partnering with countries such as the United Arab Emirates (UAE) and Malaysia to improve controls over WMD-related goods. After passing its Strategic Trade Act in 2010, the Malaysian government invited INECP—under the sponsorship of the Department of State's Export Control and Related Border Security Assistance (EXBS) program—to share best practices for assessing proliferation risks in the export license review process. Malaysian customs officials also are showing interest in INECP's WMD Commodity Identification Training (CIT). Several UAE Emirate-level customs organizations likewise have demonstrated interest in CIT. INECP delivered CITs in the Emirates of Ras Al Khaimah (February 17–20) and Abu Dhabi (February 20–22 and April 17–21). The Program currently is working with UAE federal agencies that are interested in offering CIT courses—conducted by Emirati instructors—to customs officials at all Emirate ports and throughout the region. To date, CIT has been delivered in over forty countries and provides instruction to frontline enforcement officers in the visual recognition of WMD-related commodities.

In addition to helping frontline officers enforce national trade control laws, CIT plays an important role in assisting nuclear regulators with implementing an Additional Protocol (AP) to existing national safeguards agreements with the IAEA. INECP has provided AP-CIT to Malaysia's Atomic Energy Licensing Board to support its adoption of the AP and, in collaboration with NGSI's International Engagement Program, expects to provide AP-CIT to the UAE's Federal Agency for Nuclear Regulation early next year.

The AP-CIT approach helps nuclear regulators identify which nuclear imports and exports require reporting to the IAEA under the AP. These activities complement emerging export control practices, in which reporting commodity transfers at the national level and identifying transfers that have not received appropriate permissions or "licenses" for export or re-transfer are critical in regulating WMD-related dual-use transactions.

FEB 2011

Emirati Customs officials test their knowledge of WMD-sensitive goods in an exercise to identify images of goods during NIS' CIT.

JUL 29 1957 The Statute of the IAEA enters into force.

APR 1958 The U.K. tests its first thermonuclear weapon.

JUL 3 1958 The U.S./U.K. Mutual Defense Agreement is signed.

OCT 31 1958 U.S., USSR, and UK experts begin Comprehensive Nuclear-Test-Ban Treaty (CTBT) discussions in Geneva.

NGSI Safeguards Policy

In FY2011, the NGSI Safeguards Policy Team developed a five-year program plan for the Global Tracking of Uranium Hexafluoride (UF_6) Cylinders project. NGSI's proposed program has six principal tasks: (1) baseline problem definition; (2) development of the concept of operation for a unique identifier and monitoring system; (3) determination of relevant technologies; (4) development of the cylinder registry database; (5) system integration to support demonstrating proof of concept; and (6) the actual demonstration of proof of concept. Extensive engagement with stakeholders including cylinder manufacturers, nuclear industry facility operators, the IAEA, and national regulatory agencies/states systems of accounting and control (SSACs) are a critical element throughout the project's duration.

The NGSI project team began work in April 2011 on Tasks 1 and 2 above. These initial tasks will be completed by the end of FY2012. NGSI then will determine whether to proceed with the remaining tasks, based on the findings to date, stakeholder support, and prospective costs.

The project's objective is to demonstrate proof of concept for a global approach to uniquely identify UF_6 cylinders and monitor their location through their life-cycle from fabrication to decommissioning. The nuclear industry uses these cylinders to ship natural uranium (UF_6) and low enriched uranium (LEU) between fuel cycle facilities, and to store depleted uranium pending final disposition. Each year, thousands of these cylinders move around the world. This number will grow with the projected worldwide expansion of nuclear power.

APR 2011

The NGSI Safeguards Policy Team worked on the Global Tracking of Uranium Hexafluoride Cylinders project. Below is cylinder handling operations.

Cylinders containing low-enriched UF_6 carry enough material to produce more than two nuclear weapons if the uranium is enriched to a level suitable for weapons. The spread of enrichment technology and concerns about detecting undeclared enrichment facilities make tracking of UF_6 cylinders a proliferation concern. Safeguards challenges associated with UF_6 cylinders include the absence of an industry-wide norm for unique identification and registration and the inability to correlate cylinders with specific UF_6 batches. This results in time-intensive cylinder identity verification activities, and difficulty reconciling imports and exports.

Several leaders in the nuclear fuel cycle industry have expressed strong interest in developing and universally implementing a unique identifying device for UF_6 cylinders to aid industry in managing, handling, and storing these cylinders in commercial operations. This system will benefit industry and, at the same time, will promote international safeguards.

The NGSI Policy Team also has advanced its Human Capital Development (HCD) mission through the project. The HCD sub-program aims to replenish the pool of retiring international safeguards specialists. To this end, several NGSI-sponsored post-doctoral fellows have gained valuable experience with safeguards concepts and technology while participating in the project. NGSI also is coordinating with the NNSA Office of Safeguards R&D.

A UF_6 cylinder identification and monitoring system will provide an integrated solution to one of the important challenges facing the international safeguards system and industry stakeholders.

NGSI Safeguards Technology

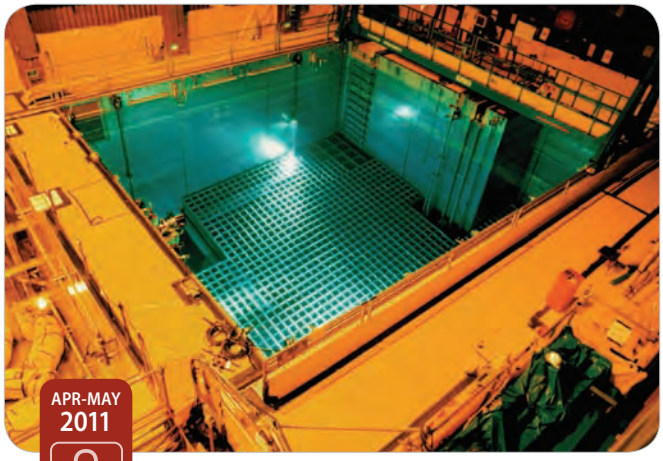
In FY2011, NIS researchers completed a two-year, simulation-based evaluation of fourteen individual non-destructive assay (NDA) techniques as part of the NGSI Safeguards Technology program's five-year effort to develop the next generation of spent fuel safeguards technology. To allow a systematic, side-by-side comparison, NIS researchers evaluated each technique's response to a

FEB 13 1960 France tests its first nuclear bomb.

JAN 1 1961 The IAEA establishes its first safeguards system.

SEP 26 1961 The Arms Control and Disarmament Agency (ACDA) is established pursuant to Congressional action.

OCT 16 1964 China tests its first nuclear bomb.



APR-MAY 2011

An external committee met to review the strengths and weaknesses of fourteen individual NDA techniques for spent nuclear fuel. Below is a spent fuel pool (*Source: Nuclear Regulatory Commission*).

common library of virtual spent fuel assemblies. In April and May 2011, an external committee—composed of academics, international partners, and National Laboratory experts—reviewed the strengths and weaknesses of each technique and explored complementary features that could be exploited through integration.

Based on the conclusions of this review committee, NIS has down-selected among the techniques and proposed four integrated systems with varying cost, size, robustness, and accuracy. In FY2012, NIS efforts will turn to prototype construction and field tests with domestic and international partners, while continuing to model instrument-specific requirements. This effort will culminate in the deployment of new non-destructive assay technologies to directly quantify plutonium in spent fuel by 2013, consistent with the 2011 NNSA Strategic Plan.

Currently, there exists no safeguards technology capable of independently or directly verifying the plutonium content in spent fuel. The specific objective of NIS' effort is to develop one or more instruments capable of quantifying plutonium mass in spent nuclear fuel using NDA, an approach that would allow timely and independent plutonium quantification of individual spent fuel assemblies. These instruments could be applied by safeguards inspectors, facility operators, and nuclear regulatory officials at nuclear power reactor sites, interim storage facilities, spent fuel reprocessing plants, or geologic repositories.

Given the complexity of spent fuel assemblies and their intense sources of background radiation, no traditional NDA technique is capable of quantifying plutonium in spent fuel singlehandedly. Instead, this project is guided by the premise that the integration of multiple, complementary techniques will enable inspectors to measure plutonium directly.

Over 90% of the world's safeguarded plutonium is contained within spent nuclear fuel. Accurate, independent assays of the plutonium contained in spent fuel will help the IAEA to resolve the problem of shipper-receiver differences, as well as provide an accurate inventory determination of the plutonium being loaded into dry storage casks and geologic repositories. Additionally, with the development of advanced reprocessing techniques, more accurate NDA measurements of the spent nuclear fuel may become necessary as a means to provide for the input accountability of plutonium being separated from the fuel.

JAN 1 **1968** The European Atomic Energy Community (EURATOM) enters into force.

MAR 5 **1970** The Nuclear Non-Proliferation Treaty (NPT) enters into force. The IAEA establishes its safeguards system for NPT parties.

MAY 26 **1972** The United States and USSR sign the Strategic Arms Limitation Treaty (SALT) I, which froze the number of strategic ballistic missile launchers at existing levels.

Nuclear Noncompliance Verification Program

ITo deter and combat illicit production and transfer of nuclear materials, the U.S. Government must have the ability to identify the likely origin of unknown uranium samples. In FY2011, NIS' Nuclear Noncompliance Verification (NNV) Program analyzed over 165 uranium samples, added the resulting 12,500+ data points to the Uranium Sourcing Database and delivered an improved query tool—version two of an internet-accessible Discriminant Analysis Verification Engine (iDAVE2)—for effectively and quantitatively estimating the likely origin of unknown uranium samples.

NNV developed the Uranium Sourcing Database as a National Nuclear Forensics Library containing data for materials involved in the early stages of the fuel cycle: uranium ore, uranium ore concentrate (also known as yellowcake), and uranium tetrafluoride (UF_4). This multi-laboratory effort involves Lawrence Livermore National Laboratory (LLNL), Los Alamos National Laboratory (LANL), and Oak Ridge National Laboratory (ORNL). The project includes sample acquisition, sample analysis, relational database development, database population, and data evaluation. It has been used for general queries for basic research and for specific national and international nuclear forensic cases. Additionally, the Uranium Sourcing Database project is ideally suited for international nuclear forensics technical engagement and has been the launching pad for many of NIS' international outreach efforts in nuclear forensics.

The Uranium Sourcing Database now contains data for over 2,000 samples representing over twenty-five countries and over sixty distinct origins. There are approximately 80 analytes per sample (e.g., major and trace elements, U isotopes, Pb isotopes, Sr isotopes, stable isotopes, concentrations of O, N, C, S, etc.) The database contains elemental and isotopic measurements, sample images (photographic and scanning electron microscope), visible and near-infrared spectra, and x-ray diffraction data.

To address the many data parameters for each sample and understand which parameters are critical for identifying the likely origin of an unknown sample, LLNL developed a statistical query tool that can be exercised through the internet. iDAVE utilizes Partial Least Squares–Discriminant Analysis (PLS-DA). This web-based statistical pattern classification application uses the Uranium Sourcing Database for uranium sample attribution.

MAY 2011

NNV analyzes samples of Uranium Ore Concentrate from all over the world.

Given iDAVE's success and increased user interest, LLNL completed a new version of iDAVE in May 2011. iDAVE2 is more efficient at utilizing all of the data parameters stored in the database and is more user-friendly. Specifically, iDAVE2 has the following upgrades:

- Enables faster repetitive queries;
- Provides the ability to down-select sources and/or variables for use in a query;
- Makes greater use of the available data;
- Utilizes a multiple model approach that provides better results for large, complex datasets;
- Makes available to the user the exclusion criteria used by the query engine;
- Characterizes the extent of class overlap;
- Shows weighting vectors of variables on the classification space;
- Shows how many samples represent each source; and
- Simplifies system administration and quality control.

The Uranium Sourcing Database project remains an active project as NNV continues to acquire samples from around the world, analyze the multitude of parameters associated with each sample, incorporate the data into the relational database structure, and evaluate data for the future sample attribution needs of the U.S. Government and international community.

1974 The Energy Reorganization Act of 1974 replaces the Atomic Energy Commission (AEC) with the Nuclear Regulatory Commission (NRC) and establishes the Energy Research and Development Agency.

MAY 18 1974 India's first "peaceful nuclear explosion."

AUG 4 1977 The Department of Energy Organization Act establishes the U.S. Department of Energy.

Export Control Review and Compliance

In order to control the spread of WMD-related material, equipment, technology, and expertise, the NIS Export Control Review and Compliance (ECRC) program conducted 7,600 statutorily-mandated reviews of U.S. export license applications, DOE projects with foreign nationals, and nuclear software code requests in FY2011. Further, to help ensure that international export control regimes remain relevant as new technologies and proliferation concerns emerge, ECRC provided significant technical support to the Australia Group (AG) chemical/biological control regime and the Missile Technology Control Regime (MTCR). This support included six technology presentations at the AG Plenary and Intersessional meetings (June 6–10, 2011 and November 15–17, 2010) and the MTCR Plenary (April 11–13, 2011). In addition, ECRC provided pertinent technical evaluations of U.S. and foreign proposals to amend the AG Common Control Lists and the MTCR Technical Annex. These control lists are critical resources used by other NIS programs such as INECP.

JUN 6-10

The ECRC program presented technical details and recent advancements of "rocker-type" disposable bioreactor systems, such as this one, at the 2011 AG Plenary.

Comprehensive Nuclear-Test-Ban Treaty

As part of its support for the potential ratification and implementation of the Comprehensive Nuclear-Test-Ban Treaty (CTBT), NIS leads the interagency effort for U.S. engagement on the development of the CTBT On-Site Inspection (OSI) regime. This includes engagement with the Preparatory Commission for the CTBT Organization on a number of OSI technical issues, such as preparations for a large-scale OSI Integrated Field Exercise (IFE) in 2014. A series of smaller OSI exercises is being carried out in preparation for the next IFE. One such exercise—Directed Exercise 2010, with an emphasis on ground-based visual observations and field communications—was conducted in Jordan in November 2010. Here, four NIS technical experts joined a group of forty-five international experts from fourteen CTBT signatory states.

JUN-JULY 2011

Nine NIS-sponsored technical experts, comprised of four instructors and the five U.S. surrogate inspector candidates, participated in the Advanced Training Course for Comprehensive Nuclear-Test-Ban Treaty On-Site Inspection in Hungary.

Strong NIS participation continued in many OSI activities throughout FY2011. One notable example is the successful June 19–July 9, 2011 session of the Advanced Training Course for CTBT OSI surrogate inspectors. Nine NIS technical experts, comprised of four instructors and the five U.S. surrogate inspector candidates, participated in a program of classroom instruction and field exercises at several locations in Austria and Hungary. Three NIS surrogate inspector candidates were asked to conduct part of the training for the other international trainees.

1978 Nuclear Supplier Group Guidelines were published as IAEA Document INFCIRC/254.

MAR 10 **1978** President Jimmy Carter signs the Nuclear Nonproliferation Act (NNPA) into law.

JUN 18 **1979** The United States and USSR sign the Strategic Arms Limitation Talks (SALT) II, which sought to curtail the manufacture of strategic nuclear weapons and was a continuation of progress made during SALT I talks.

> **“Entry into force of the CTBT is an essential step toward the peace and security of a world without nuclear weapons”**
>
> —Rose Gottemoeller, Assistant Secretary, Bureau of Arms Control, Verification and Compliance, U.S. Department of State; June 14, 2011; Vienna, Austria; Comments to the CTBTO Preparatory Commission

The United States supports installation and sustainment of the CTBT's International Monitoring System (IMS) and International Data Centre (IDC) in Vienna, Austria, which already provide real-time information prior to the Treaty's entry into force. IMS data collected following North Korea's 2006 and 2009 announced nuclear tests and distributed to the signatory states validated independent assessments and provided a basis for the United Nations to take firm action against North Korea. The CTBT verification system also performed well during the March 2011 Japanese earthquake, tsunami, and nuclear power plant accident, providing important information for humanitarian relief and tracking the spread of radioactivity. NIS supports the operation of the CTBT radionuclide laboratory at Pacific Northwest National Laboratory in Richland, Washington—one of a planned network of sixteen worldwide laboratories certified for the analysis of radionuclide samples from IMS stations. Other U.S. National Laboratories making key contributions to the CTBT regime with NIS support include LLNL, LANL, and Sandia National Laboratories (SNL).

Moving into FY2012, NIS will continue to lead DOE's efforts within the U.S. Interagency to complete an efficient and effective CTBT monitoring and verification regime using the technical expertise and experience resident in the National Laboratories resulting from the core NNSA nuclear security mission.

The Colombo Initiative

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 a nuclear crisis. A major source of undesired escalation is the presence of nuclear-capable, short-range (< 300 km) ballistic missiles (SRBM) that could be deployed near conflict zones. Strategic experts agree that the presence of these nuclear-capable SRBMs are a source of unwanted instability in that they could drive rapid escalation of a conflict either by their use, an accident involving one, or by providing a tempting target. Moreover, these missiles have outlived their original mission purposes and are reaching the end of their service life, thus necessitating their eventual removal from service and dismantlement.

To promote stability in South Asia, NIS has been pursuing an innovative effort to initiate discussions between key Indian and Pakistani strategic experts with the goal of mutual and transparent elimination of certain SRBMs from India's and Pakistan's deployed arsenals. With the support of NIS, a small group of independent experts (the Colombo Group) from India and Pakistan met in Colombo, Sri Lanka, to discuss the modalities of mutual, transparent, nuclear-capable SRBM reductions. The Colombo Group reached consensus with respect to the desirability of such reductions for the purpose of stabilizing nuclear deterrence in South Asia.

JUL 25-27

Indian and Pakistani exercise participants practice managed access transparency techniques by masking missile components not covered by the agreement negotiated during the exercise.

FEB 8 1987 Convention on Physical Protection of Nuclear Materials (CPPNM) enters into force.

DEC 7 1987 President Reagan and Soviet General Secretary Gorbachev sign the Intermediate-range Nuclear Forces Treaty (INF Treaty), the first arms control agreement to eliminate (not just set limits on) nuclear missile systems.

JUL 10 1991 South Africa accedes to the NPT as a non-nuclear-weapon State after terminating its nuclear weapons program.

The Colombo Group considered scenarios and developed a process for removing Prithvi 1 and HATF 1 and HATF 2 missiles from deployed status. This voluntary and transparent process could be done unilaterally or bilaterally and repeated on a reciprocal basis as political conditions permit. In order to advance mutual acceptance and provide important insights into the requirements for an actual transparency exchange, the parties agreed to conduct a mock Joint Transparency Exercise (JTE) using a retired missile from a neutral party. This JTE took place on July 25–27, in Bulgaria with participation from Indian and Pakistani strategic analysts, NIS organizers, U.S. National Laboratory staff, U.S. Government observers, and representatives of an international verification and transparency non-governmental organization (NGO).

The National Military Museum in Sofia, Bulgaria, provided an ideal venue for conducting practical transparency exercises on full-scale solid and liquid-fueled missiles. The Group gained insight from Bulgaria's experience in the transparent elimination of missiles. For the first time ever, participants from India and Pakistan undertook unique, rigorous, two-sided missile dismantlement exercises. The first JTE demonstrated transparency by exchanging photographs of the missiles before commencement of a dismantlement process. The second JTE demonstrated the concept of reciprocal on-site visits to designated missile locations. The participants negotiated the use of techniques, technological tools, and procedures for managed access to gain an appreciation of the perils and opportunities inherent in sharing missile dismantlement information, while also protecting one's own sensitive data. The Colombo Group concluded that such techniques and procedures could be appropriate for demonstrating transparency in the retirement of HATF I and Prithvi I missiles.

Against the backdrop of the renewed India-Pakistan Composite Dialogue, NIS and the Colombo Group envision a number of follow-on activities for implementation in FY2012. It is the opinion of the Colombo Group participants that the transparent elimination of obsolete missiles would not diminish Pakistani or Indian security and will, in due course, enhance mutual confidence and promote strategic stability.

"No one nation can create the conditions that would lead to the day when nuclear weapons are obsolete. We need other countries to step forward with us.... [and] be as transparent and as open as we are to provide confidence for deep reductions."

—Ellen Tauscher, Under Secretary for Arms Control and International Security; June 29th-July 1st; Conference on Confidence Building Measures toward Nuclear Disarmament and Non-Proliferation; Paris, France

JUL 31 1991 The United States and USSR sign the Strategic Arms Reduction Treaty (START) I.

OCT 2 1992 President George H.W. Bush signs into law the Hatfield Amendment establishing a nuclear testing moratorium.

JAN 3 1993 The United States and Russian Federation sign START II.

DEC 1993 The UN General Assembly adopts Resolution 48/75, which recommends the negotiation of the Fissile Material Cut-off Treaty (FMCT).

Reliable Fuel Services

NIS is facilitating the development of the Reliable Fuel Services (RFS) concept as an attractive alternative to the development of sensitive nuclear fuel cycle technologies. RFS encourages states to refrain from developing enrichment and reprocessing technologies in favor of multilateral alternatives that guarantee a reliable assurance of fuel for power reactors. RFS thus enables and promotes the peaceful use of nuclear energy without increasing the risk of nuclear proliferation. Several assured fuel supply proposals have been put forward for international consideration, including reserves of LEU to serve as backup fuel supply for foreign or domestic reactors in the event of a supply disruption.

NIS announced the availability of a DOE LEU fuel bank, the American Assured Fuel Supply (AFS), which will serve as a supply assurance for domestic and foreign operators. The AFS is a fuel bank of approximately 230 tons of LEU for use in civil nuclear reactors. A Notice of Availability, signed by Energy Secretary Chu, was published in the Federal Register on August 18, 2011. This reserve stems from a policy that Secretary of Energy Samuel Bodman announced in 2005. Secretary Bodman set aside 17.4 metric tons (MT) of surplus HEU to be downblended to LEU and held in reserve to deal with disruptions in the nuclear fuel supply. Secretary Chu will sign off on future use of the AFS. By providing a credible source of backup supply, the AFS decreases the need for states interested in developing nuclear power programs to develop sensitive and costly enrichment technology.

NIS also is addressing technical, regulatory, political, and economic questions raised by non-nuclear weapon states at the IAEA on the concept of a nuclear fuel bank. In addition, NIS is leveraging the U.S. investment of $50 million for the IAEA LEU fuel bank, which consists of 60–80 MT of LEU. The IAEA Board of Governors approved this backup LEU reserve in December 2010. The IAEA since has begun accepting funds to implement the fuel bank initiative, and a process of solicitation for a host state. NIS is providing key support in addressing issues involved in the operation and implementation of the fuel bank, including 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.

> **"I believe with all my heart and soul that nuclear weapons must be eliminated."**
>
> —IAEA Director General Yukiya Amano During an address to the 23rd UN Conference on Disarmament Issues in Japan (July 27, 2011)

Confidence-Building Measures

The Confidence-Building Measures (CBM) Program builds trust, transparency, and technical capacity among science and technology communities to strengthen compliance with nonproliferation and arms control regimes and advance U.S. Government security initiatives. CBM builds scientific and technical capacity in partner countries, supports technical collaboration and informal Track 1.5 and Track 2 efforts to advance scientific dialogue for collaborative research and implementation of international treaties and obligations, and develops networks of scientific and technical experts capable of addressing regional security concerns and proliferation threats, while enhancing transparency at the working level. Track 1.5 refers to informal engagement involving high ranking politicians and decision makers. Track 2, on the other hand, refers to unofficial dialogue aimed at building relationships that can inform formal intergovernmental activities, typically involving influential academic and NGO leaders and other civil society actors.

In FY2010, CBM laid the foundation for a comprehensive nuclear forensics engagement program that emphasizes international capacity-building and expanded information-sharing to improve attribution and response to counter illicit nuclear trafficking. This effort directly supports the 2010 Washington Nuclear Security Summit Work Plan and advances the nuclear security goals of the Global Initiative to Combat Nuclear Terrorism (GICNT).

CBM significantly expanded bilateral and multilateral cooperation in international nuclear forensics in FY2011, increasing engagement from seven to seventeen partners. New engagement partners include: the European Union, Ukraine, Singapore, Vietnam, Thailand, Malaysia, Indonesia, the IAEA, the GICNT, and the Association of Southeast Asian Nations (ASEAN) Regional Forum. These projects span all three CBM engagement tiers from working with peer nations on research and development in nuclear

SEP 24 **1994** President Bill Clinton signs the Comprehensive Nuclear-Test-Ban Treaty (CTBT).

MAY 12 **1995** NPT is extended indefinitely.

DEC 9 **1995** The Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods is agreed to by 33 States.

APR 29 **1997** Chemical Weapons Convention enters into force.

forensics, to developing best practices for emerging nuclear forensics programs, and supporting broad awareness of nuclear forensics. Multilaterally, CBM initiated a first-time partnership with the IAEA's Office of Nuclear Security for the joint development of a standardized Nuclear Forensics Methodologies training curriculum, which will be delivered by experts from Pacific Northwest National Laboratory (PNNL) for interested IAEA member countries in February 2012. Furthermore, CBM partnered with the European Commission, the ASEAN Regional Forum, and Thailand to jointly organize technical and policy workshops and training seminars—in September and December 2011—to enhance nuclear forensics capabilities in Southeast Asia.

SEP 2011

An LLNL scientist at ANSTO performs forensic analysis. In FY2011, CBM was able to expand bilateral and multilateral cooperation in international nuclear forensics.

In addition to its nuclear forensics engagements, CBM supported bilateral and multilateral technical collaborations that enhanced the U.S. and international ability to monitor and detect underground nuclear tests. CBM worked bilaterally with countries in the Middle East such as Turkey, Oman, Kuwait, and Jordan to improve their familiarity with the CTBT and the work of the Preparatory Commission. These engagements help to enhance the national capabilities of partner states in support of CTBT implementation through inter alia, the deployment of advanced seismic stations, and joint data analysis techniques. CBM also works multilaterally to build regional seismic monitoring capacity by supporting DOE Laboratory contributions to, and participation in, workshops such as the Gulf Seismic Forum (GSF). The CBM-initiated GSF has been well attended and widely supported in the region, and there is now a proposal to place the sponsorship of the Forum directly under the Gulf Cooperation Council. In recognition of CBM's contributions to verifying and monitoring the CTBT, the State Department has funded high priority USG engagements in FY2012 out of a one-time U.S. voluntary contribution to support the CTBT Organization Preparatory Commission.

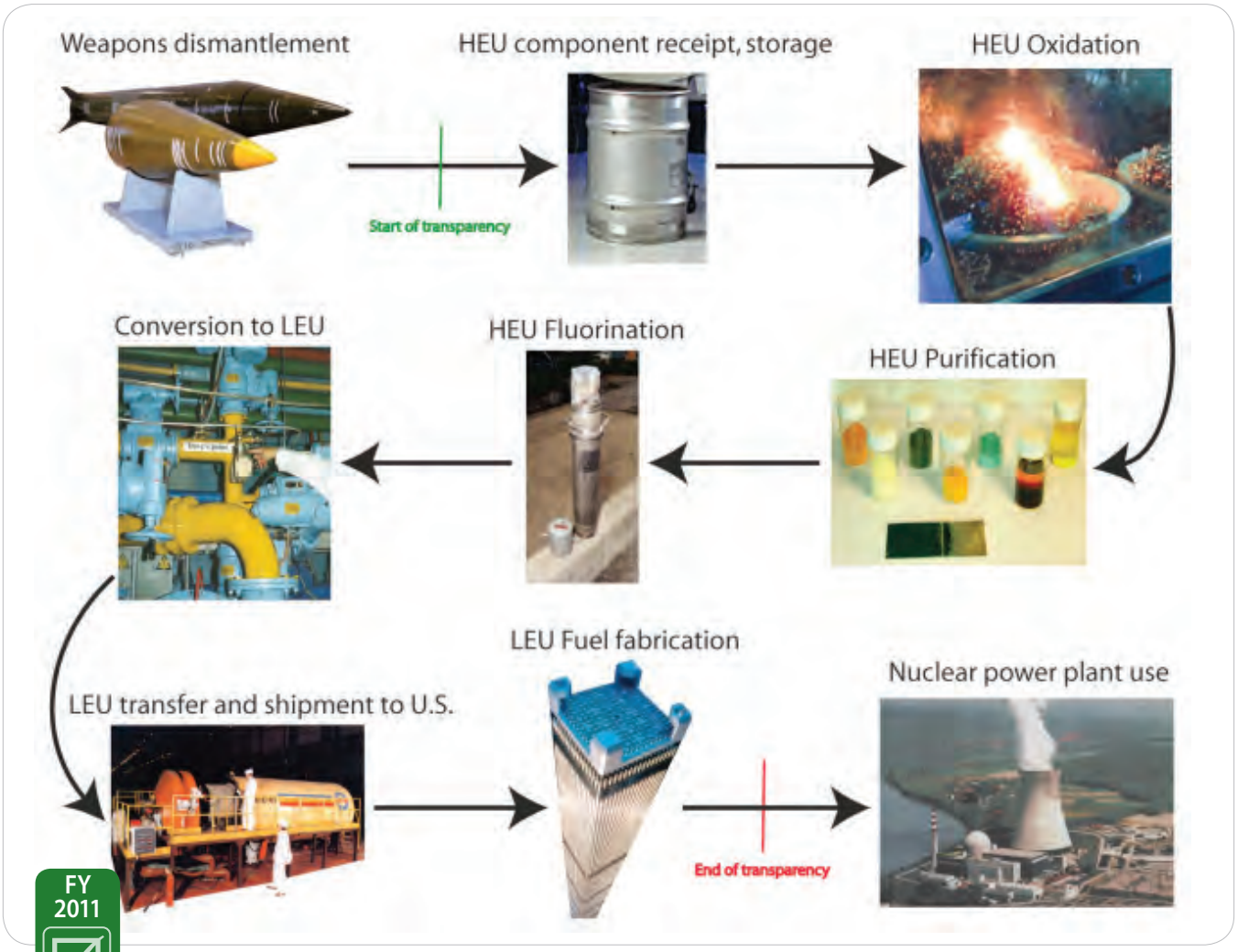
Finally, CBM strengthened its support of regional nonproliferation centers, such as the Middle East Scientific Institute for Security (MESIS) in Amman, Jordan, to promote regional capacity-building and foster sustainability of assistance efforts. Through MESIS, the CBM promotes regional security cooperation and implements the Administration's call for more comprehensive engagement with Middle East and North African countries in the area of science and technology. The Institute also facilitates workshops and training efforts for other DOE/NNSA and U.S. Government nonproliferation programs, and provides a focal point for international efforts to more effectively advance common nonproliferation and security interests in the Middle East. In FY2011, MESIS was used by several NNSA offices, U.S. Central Command, other interagency offices, and various international organizations for workshops and training events related to CTBT implementation, the Biological Weapons Convention, export controls, border security, and capacity-building activities for Iraqi scientists.

MAY 11 1998 India conducts three nuclear tests at the nuclear test site in Pokhran, Rajasthan.

MAY 28 1998 Pakistan tests five nuclear devices.

SEP 2 1999 The U.S. Senate passes legislation creating the National Nuclear Security Administration (NNSA).

MAY 31 2001 The Russian Federation and the United States conduct the final inspection pursuant to the provisions of the INF Treaty.



FY 2011

In 2011, the United States and Russia moved closer to achieving successful completion of the HEU Purchase Agreement, which is scheduled to take place in 2013 (above: HEU downblending flow diagram).

HEU Transparency Program

The NIS HEU Transparency Program ensures that HEU from dismantled Russian nuclear weapons is dedicated to peaceful use as LEU fuel for U.S. commercial nuclear power reactors. The Program implements the transparency monitoring provisions of the 1993 U.S.-Russia HEU Purchase Agreement. Under the Agreement, Russia will convert 500 MT of weapons-origin HEU into LEU by the end of 2013. This is enough material for 20,000 nuclear weapons per the IAEA significant quantity definition.

In FY2011, 30 MT of Russian weapons-origin HEU was converted into LEU and the Program conducted 24 monitoring visits to four Russian HEU processing facilities and staffed an extended-presence monitoring office at the Ural Electrochemical Integrated Enterprise. The Program also carried out maintenance to ensure the continued operation of the Blend Down Monitoring System (BDMS) installed in each Russian HEU blending facility. The BDMS is a U.S.-designed instrument that performs continuous, unattended measurements and monitoring of the Russian HEU blending process.

LEU from Russian nuclear weapons is purchased by the United States Enrichment Corporation, the U.S. executive agent for the commercial aspects of the Agreement. The LEU is fabricated into nuclear fuel in the United States and generates nearly 10% of all U.S. electricity.

To ensure that all Russian LEU purchased under the Agreement is derived from Russian weapons HEU, the

2002 Iran admits to the development of secret uranium enrichment and heavy water facilities.

MAY 24 2002 The United States and Russia sign the Strategic Offensive Reductions Treaty (SORT), also known as the Moscow Treaty, at the Moscow Summit.

JAN 10 2003 DPRK announces its withdrawal from the NPT, effective January 11th.

Program conducts transparency monitoring in Russian facilities that process and blend the HEU into LEU. These Russian facilities are the Electrochemical Plant, the Mayak Production Association, the Siberian Chemical Enterprises, and the Ural Electrochemical Integrated Enterprise.

By conducting on-the-ground process monitoring, analyzing data from U.S.-designed monitoring equipment, and reviewing Russian HEU processing declaration, the Program maintained high confidence that all LEU delivered to USEC in FY2011 was derived from 30 MT of Russian weapons-origin HEU. The Program also provided U.S. LEU processing and shipping documentation to Russia in FY2011, meeting our reciprocal transparency obligations to demonstrate that all LEU purchased under the Agreement is used in the United States for exclusively peaceful purposes.

The successful implementation of the HEU Purchase Agreement continues to support U.S. nuclear disarmament, nonproliferation, and critical threat reduction goals. To date, the Program has monitored the conversion of 433 MT HEU from Russian nuclear weapons into LEU for peaceful use in the United States. This is equivalent to 17,335 nuclear weapons now permanently eliminated per the IAEA's definition of a significant quantity. The Program is on schedule for the successful completion of the in-Russia monitoring portion of the Agreement in 2013 with the cumulative elimination of 500 MT of Russian weapons-origin HEU.

Training for U.S. Export Enforcement Agencies

The United States is the leading producer of WMD-related dual-use commodities. Illicit transfers of these items are difficult to detect, since most export activities are for legitimate commercial uses. This situation results in frequent attempts by black market proliferation networks to acquire these goods from U.S. manufacturers for use in illicit foreign WMD programs. In order to help mitigate this threat, NIS' INECP provides training in WMD dual-use commodity recognition to a broad range of U.S. export enforcement agencies including the Department of Homeland Security's Immigration and Customs Enforcement (ICE) and Customs and Border Protection (CBP) and the Federal Bureau of Investigation (FBI).

In 2011, INECP conducted a training event at Oak Ridge National Laboratory (June 1–2) covering the identification of dual-use commodities used in uranium enrichment. Another training session at the Kansas City Plant (March 30–April 1) focused on dual-use commodities used in missile production. INECP also provided training at ports in San Diego (April 19–21) and Philadelphia (December 14–15), and established a long-term partnership with the Port of Long Beach, one of the largest and busiest commercial ports in the United States. This partnership has enabled INECP to provide CBP officers stationed in Long Beach with multiple courses (April 26–27 and August 16–17) on recognizing and targeting the dual-use commodities most coveted by proliferators.

FY 2011

An NIS technical expert trains CBP officers to recognize dual-use commodities sought by proliferators.

FEB 4 2004 — AQ Khan reveals that for two decades he provided DPRK, Libya, and Iran with technical and material assistance for making nuclear weapons.

APR 2004 — The UN Security Council adopts Resolution 1540, which requires all states to implement measures aimed at preventing non-state actors from acquiring nuclear, biological, and chemical weapons, related materials, and their means of delivery.

SEP 22 2004 — Libya's disarmament task is complete.

Global Initiatives for Proliferation Prevention

Established in 1994, the Global Initiatives for Proliferation Prevention (GIPP) program mitigates the risk of expertise proliferation by building science and technology collaboration and partnerships between former weapons experts, U.S. National Laboratories, and in many cases, U.S. industry. These partnerships result in the development of innovative technology solutions in priority areas such as nonproliferation, specialty materials, counterterrorism, and medical devices. In FY2011, GIPP projects engaged more than 2,000 experts at over 85 institutes and facilities.

FY 2011

The AMPMI system was developed as part of the GIPP.

In one recent success story, PNNL, the Kharkiv Institute of Physics and Technology in Ukraine, and U.S. industry partner the Advanced Medical Isotope Corporation developed an Alternative Method for Producing Medical Isotopes (AMPMI). The method combines a high neutron flux with an advanced target design, producing medical isotopes with less complexity and expense than conventional production techniques. The AMPMI system was designed, constructed, and successfully demonstrated through GIPP projects. The system is easy to operate (with an electrical on-off switch), is cheaper and has smaller dimensions than other isotope production methods, and is safer than reactor-based production. In addition, the AMPMI system enables production of medical isotopes to occur in much closer proximity to the place where they will be used for diagnostic or therapeutic purposes.

Another GIPP success is the development of a Deep Sea Probe (DSP) in a project involving the Kansas City Plant, Russia's All-Union Scientific Research Institute of Experimental Physics (VNIIEF), and Millennium Technologies—with support from ExxonMobil. The DSP significantly enhances the effectiveness of offshore oil exploration by increasing the accuracy of sample information and sea floor location. It is less expensive and lighter than other offshore exploration methods, and its on-board electronics can determine the exact location where the probe collected the sample. During the final phase of the project, the team demonstrated prototype deep sea probes off the coast of Miami, Florida, by taking sealed sediment core samples from the sea floor.

Interdiction Technical Analysis Group

To detect and deter illicit transfer of WMD-relevant goods and technologies, the Interdiction Technical Analysis Group (ITAG) provided continuous support for interdiction cases to the U.S. Interagency. ITAG's support in FY2011 included technical and policy analysis of more than 2,900 cases related to the potential transfer of items that could support nuclear, missile, chemical, or biological weapons programs. ITAG technical analysis products allowed interagency policy-makers to gain a greater understanding of potential commodities of concern and their legitimate and illicit applications. Additionally, NIS maintained an increased interface with interagency working groups that improved interagency access to DOE/NNSA technical expertise and allowed DOE/NNSA to provide often real-time responses to issues of concern.

FY 2011

Two U.S. Customs and Border Patrol agents analyze materials coming into the United States.

JUL 16 2007 The IAEA confirms the shutdown of the Yongbyon nuclear facilities in DPRK.

JAN 6 2009 U.S. Additional Protocol enters into force.

APR 8 2010 President Barack Obama and Russian President Medvedev sign the New START agreement.

APR 12-13 2010 President Barack Obama hosts a Nuclear Security Summit with the heads of states from 47 nations.

Comprehensive Nuclear Fuel Services

FY 2011

NIS has contributed significantly to development and advancement of the Comprehensive Nuclear Fuel Service (CFS) concept. CFS 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. A CFS program would allow countries without extensive nuclear infrastructure to more confidently adopt nuclear power as a low carbon energy source. It would have the long-term nonproliferation advantage of centralized high-security storage of the resulting irradiated fuel from such programs. The Obama Administration recently adopted CFS as the core concept in its approach to international nuclear fuel cycle cooperation.

NIS works with the DOE Office of Nuclear Energy and the U.S. Interagency to define activities that support CFS as part of a new framework for civil nuclear cooperation, as President Obama called for in his 2009 Prague speech. In FY2011, NIS began a comprehensive study on CFS and its role in this new framework. The NIS study assesses the role for both suppliers and recipients in CFS and the broader new framework for civil nuclear cooperation. The report provides background to NIS as the Office makes important decisions on nuclear cooperation with other nations and provides technical and policy expertise on relevant delegations, like those to the Nuclear Suppliers Group and the Nuclear Non-Proliferation Treaty review process. NIS will continue through this report to assess country interest in participating in a CFS program, the potential roles each country could play, and the proliferation criteria to be applied for participation in a CFS program.

NIS also is participating in the International Framework for Nuclear Energy Cooperation Reliable Fuel Services Working Group both to address the front-end challenges and promote the CFS concept. With all current work on CFS and a new framework for civil nuclear cooperation, NIS is incorporating findings from the July 2011 report by the Blue Ribbon Commission on America's Nuclear Future by focusing on two key elements from the Commission's recommended strategy on back-end solutions: "Support for continued U.S. innovation in nuclear energy technology and for workforce development;" and "Active U.S. leadership in international efforts to address safety, waste management, nonproliferation, and security concerns."

DEC 3 2010 — IAEA Board agrees to create International Nuclear Fuel Bank.

DEC 22 2010 — New START is ratified by the U.S. Senate.

JAN 26 2011 — New START is ratified by Russia's upper house of Parliament.

FEB 2011 — The IAEA publishes the fifth revision of Information Circular 225, its recommendations on the "Physical Protection of Nuclear Materials and Nuclear Facilities" (previously published in 1975, 1977, 1989, 1993, and 1998).

Financial Summary

The NIS budget for FY2011 totaled approximately $149.41 million (M) spread over four primary areas: Nuclear Safeguards and Security, Nuclear Controls, Nuclear Verification, and Nonproliferation Policy.

The ***Office of Nuclear Safeguards and Security*** executed a $52.67 million budget by successfully managing the Next Generation Safeguards Initiative (NGSI), overseeing support for the U.S. Support Program (USSP) to IAEA Safeguards, collaborating with the IAEA and other partners to enhance the application of physical protection and safeguards norms and best practices, and implementing DOE AP and Voluntary Offer Agreement (VOA) Safeguards activities at U.S. sites and facilities.

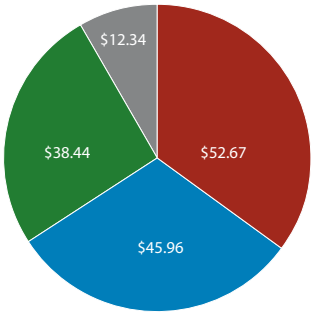
The ***Office of Nuclear Controls'*** $45.96 million budget allowed for strengthening foreign partner WMD export control systems at the governmental and industry level; providing technical support to enhance U.S. Government capacity to detect and prevent illicit WMD-related commodity technology transfers to foreign programs of concern; mitigating the risk of expertise proliferation through science and technology collaboration and partnerships; and supporting regime compliance through regional technical collaborations in priority areas, such as nonproliferation nuclear forensics and seismic monitoring.

The ***Office of Nuclear Verification***, with a budget of $38.44 million, successfully reduced proliferation concerns by promoting transparent arms reductions, including negotiating, implementing, and strengthening U.S. nonproliferation and arms control treaties and agreements; and designing and developing required verification tools, equipment, technologies and approaches, and associated transparency-monitoring tools for implementing nonproliferation and arms control treaties and agreements.

Nonproliferation Policy executed a budget of $12.34 million by conducting policy and technical analysis on urgent national security issues; supporting the development and negotiation of nuclear treaties and agreements; providing nonproliferation policy guidance on nuclear fuel cycle issues; and undertaking activities to improve and update multilateral nuclear supplier arrangements and identify supplier vulnerabilities and potential gaps in supplier arrangements.

FY2011 NIS Program Funding (Millions)

Office/Program	FY11 Funds
Office of Nuclear Safeguards and Security	
Safeguards Policy	$15.92
Safeguards Engagement	$17.44
Safeguards Technology Development	$15.60
International Nuclear Security	$3.71
Office of Nuclear Controls	
International Nonproliferation Export Control	$14.13
Global Initiatives for Proliferation Prevention	$17.62
Confidence Building Measures	$1.55
Export Control Review and Compliance	$9.82
Weapons of Mass Destruction Interdiction	$2.84
Office of Nuclear Verification	
Warhead Dismantlemant and Fissile Material Transparency	$17.83
Nuclear Noncompliance Verification	$7.87
HEU Transparency Implementation	$12.74
Nonproliferation Policy	
Global Regimes	$3.87
Regional Analysis and Engagement	$4.61
Multilateral Supplier Policy	$3.86



FY2011 NIS Office Funding (Millions)

Acronyms

ABACC—Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials

AFS—American Assured Fuel Supply

AG—Australia Group

AMPMI—Alternative Method for Producing Medical Isotopes

AP—Additional Protocol

ASEAN—Association of Southeast Asian Nations

BDMS—Blend Down Monitoring System

CBM—Confidence Building Measures

CBP—Customs and Border Protection

CFS—Comprehensive Nuclear Fuel Service

CIT—Commodity Identification Training

CTBT—Comprehensive Nuclear-Test-Ban Treaty

DOE—U.S. Department of Energy

DSP—Deep Sea Probe

ECRC—Export Control Review and Compliance

EXBS—Export Control and Related Border Security (Department of State)

EURATOM—European Atomic Energy Agency

FBI—Federal Bureau of Investigation

GICNT—Global Initiative to Combat Nucler Terrorism

GIPP—Global Initiatives for Proliferation Prevention

GSF—Gulf Seismic Forum

HCD—Human Capital Development

HEU—Highly Enriched Uranium

IAEA—International Atomic Energy Agency

ICE—Immigration and Customs Enforcement

iDAVE—internet-accessible Discriminant Analysis Verification Engine

IDC—International Data Centre

IFE—Integrated Field Exercise

INECP—International Nonproliferation Export Control Program

INS—International Nuclear Security

IMS—International Monitoring System

ITAG—Interdiction Technical Analysis Group

JTE—Joint Transparency Exercise

LANL—Los Alamos National Laboratory

LEU—Low-Enriched Uranium

LLNL—Lawrence Livermore National Laboratory

MESIS—Middle East Scientific Institute for Security

MOX—Mixed Oxide

MT—Metric Ton

MTCR—Missile Technology Control Regime

NDA—Non-Destructive Assay

NGO—Non-Governmental Organization

NGSI—Next Generation Safeguards Initiative

NIS—Office of Nonproliferation and International Security

NNSA—National Nuclear Security Administration

NNV—Nuclear Noncompliance and Verification

NSG—Nuclear Suppliers Group

ORNL—Oak Ridge National Laboratory

OSI—On-Site Inspection

PLS-DA—Partial Lease Squares-Discriminant Analysis

PNNL—Pacific Northwest National Laboratory

PPRA—Plutonium Production Reactor Agreement

PUNT—Peaceful Uses of Nuclear Technology

RFS—Reliable Fuel Services

SBD—Safeguards by Design

SNL—Sandia National Laboratories

SRBM—Short-Range Ballistic Missile

SSAC—State System of Accounting and Control

STA—Strategic Trade Act

UAE—United Arab Emirates

UF_4—Uranium Tetrafluoride

UF_6—Uranium Hexafluoride

USSP—U.S. Support Program

VNIIEF—All-Union Scientific Research Institute of Experimental Physics

WFMT—Warhead Dismantlement and Fissile Material Transparency

WMD—Weapons of Mass Destruction

United States Department of Energy
National Nuclear Security Administration
Defense Nuclear Nonproliferation
Office of Nonproliferation and International Security
1000 Independence Avenue, S.W.
Washington, D.C. 20585

www.nnsa.energy.gov/nonproliferation/nis