Office of Nonproliferation and International Security (NIS)

National Nuclear Security Administration

Spring 2014

Highlights

Elementary! A Nuclear Forensics Workshop Teaches Vital Skills to International Practitioners

BY CORNELIA BRIM AND LINDSAY MINNEMA

Fans of Sherlock Holmes or criminal investigation thrillers know that careful collection, preservation, categorization, characterization, and evaluation of evidence are key steps that support solving a crime and catching the criminal. It is no different in real-life situations in which nuclear or radioactive materials are intercepted out of regulatory control. Nuclear forensic scientists have a variety of techniques at their disposal to investigate security incidents involving radioactive materials, and a unique opportunity to practice those techniques brought 26 scientists and security experts from 10 countries to Richland, Wash., last fall.

In support of countries developing nuclear forensics capabilities, the International Atomic Energy Agency (IAEA) Division of Nuclear Security and the Department of Energy National Nuclear Security Administration's (DOE/NNSA) Office of Nonproliferation and International Security (NIS) teamed up to sponsor hands-on nuclear forensics workshops at the Pacific Northwest National Laboratory (PNNL).

Nuclear Forensics Workshop, Page 4...

NIS Observes Final Shipment of LEU from Russian Weapons HEU

BY GREG DWYER

Material from 20,000 Nuclear Warheads Converted into Fuel for U.S. Commercial Nuclear Reactors Under U.S.-Russia HEU Purchase Agreement

As NIS experts watched, the final 40 cylinders of low enriched uranium (LEU) derived from Russian highly enriched uranium (HEU) crossed the rail of the *Atlantic Navigator* at the Port of Saint Petersburg, Russia on December 14, 2013. These cylinders were the last of nearly 10,000 LEU cylinders delivered over the past

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Also In This Issue:

From the Editor: This issue of the *Highlights* features three workshops that are particularly representative of NIS's capacity-building engagement with international partners. In these courses, NIS applied its specialized technical understanding and policy expertise to improve the international community's ability to safeguard and control nuclear material, technology, facilities, and equipment, as well as to determine the origin of material found outside of regulatory control. By increasing the knowledge base of officials in other countries, NIS expands their ability to uphold international nuclear obligations associated with the peaceful uses of nuclear material and technology.

The Office of Nonproliferation and International Security applies program, technology and policy expertise to:

- **SAFEGUARD** AND **SECURE** NUCLEAR MATERIAL AND FACILITIES TO PREVENT DIVERSION, THEFT AND SABOTAGE.
- **CONTROL** THE SPREAD OF WMD DUAL-USE MATERIAL, EQUIPMENT, TECHNOLOGY AND EXPERTISE.
- NEGOTIATE, MONITOR AND **VERIFY** COMPLIANCE WITH INTERNATIONAL NONPROLIFERATION AND ARMS CONTROL TREATIES AND AGREEMENTS.
- DEVELOP AND IMPLEMENT DOE/NNSA NONPROLIFERATION AND ARMS CONTROL **POLICY** TO REDUCE THE RISK OF WEAPONS OF MASS DESTRUCTION.

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NIS Bookshelf

Final Shipment of LEU - *CONTINUED*

18 years under the landmark 1993 U.S.-Russia HEU Purchase Agreement, also called the "Megatons to Megawatts" Program.

Under the 20-year HEU Purchase Agreement, the Unites States purchased LEU derived from HEU extracted from Russian nuclear weapons. NIS's HEU Transparency Program monitored the Russian HEU-to-LEU conversion process to ensure that all LEU delivered to the United States under the Agreement was derived from Russian weapons HEU, and that the Agreement's nonproliferation objectives were fulfilled.

From Saint Petersburg, LEU from Russian HEU was shipped to the United States and fabricated into fuel rods, and ultimately delivered to commercial customers for use in U.S. nuclear power reactors. Under the Agreement, HEU from roughly 20,000 dismantled Russian nuclear warheads was downblended into LEU and has been used to generate nearly 10 percent of all U.S. electricity over the past 15 years.

"The Megatons to Megawatts Program made a substantial contribution both to the elimination of nuclear weapons material and to nuclear energy generation in the United States. Nearly every commercial nuclear reactor in the United States received nuclear fuel under the program," said Energy Secretary Ernest Moniz.

Greg Dwyer observes the delivery of the final LEU cylinders under the HEU Purchase Agreement aboard the MS Atlantic Navigator in Saint Petersburg, Russia, on November 14, 2013.

In October 2013, the HEU Transparency Program completed its final monitoring activities in Russian facilities that processed HEU subject to the Agreement. Previously, the HEU Transparency Program performed 24 special monitoring visits (SMVs) every year, six to each of the four Russian nuclear facilities that processed HEU under the Agreement.

During SMVs, U.S. technical experts observed Russian uranium processing first-hand and obtained both Russian HEU processing documentation and measurement data from U.S.-designed monitoring equipment. U.S. monitors conducted SMVs at the Siberian Chemical Enterprise in Seversk, the Mayak Production Association in Ozersk, the Ural Electrochemical Integrated Plant (UEIP) in Novouralsk, and the Electrochemical Plant in Zelenogorsk.

During its 20 years of monitoring HEU processing facilities in Russia, the HEU Transparency Program:

- Conducted 385 visits to Russian HEU processing facilities and, from 1996 to 2012, maintained a U.S. monitoring office at UEIP, providing an almost constant, year-round U.S. monitoring presence at Russia's largest HEU down-blending facility.
- Developed a Blend Down Monitoring System to confirm Russian nuclear material declarations by providing continuous, unattended measurements of the HEU downblending process at each Russian HEU blending facility.
- Developed and deployed at each Russian facility portable non-destructive assay (NDA) equipment to measure the enrichment of HEU in sealed containers. From 1997 to 2013, HEU Transparency Program monitors performed over 41,000 NDA confirmatory measurements of HEU in various forms and containers in Russian facilities.
- Eliminated the HEU equivalent of approximately three nuclear warheads each day.

Although LEU deliveries to the United States under the Agreement are complete, NIS's HEU Transparency Program will continue to facilitate Russian monitoring in the United States in order to demonstrate the exclusively peaceful use of LEU. Russia maintains the right to perform SMVs at the Paducah Gaseous Diffusion Plant in Kentucky, where containers of weapons-origin LEU are received and stored. In addition, Russian monitors can visit three U.S. facilities that fabricate Russian-origin LEU into fuel for use in commercial nuclear reactors. These facilities are Global Nuclear Fuels-Americas in North Carolina, Areva-Richland in Washington, and Westinghouse in South Carolina. The HEU Transparency Program also provides the Russian Federal Atomic Energy Agency with monthly declarations related to Russian weapons-origin LEU activity in the United States.

The HEU Agreement permitted U.S. transparency monitors from NIS's HEU Transparency Program unprecedented access to the four Russian nuclear facilities that processed HEU under the Agreement.

The United States Enrichment Corporation (USEC) and Techsnabexport (Tenex) served as the respective U.S. and Russian Government executive agents for the Agreement's commercial implementation. The USEC-Tenex commercial contract successfully concluded in March 2014.

Participants from DOE/NNSA, the U.S. Departments of State, Commerce, and Treasury, and the White House/National Security Staff celebrated the December, 2013 arrival of the final LEU shipment in the United States.

Greg Dwyer is the team lead for the HEU Transparency Program within the NIS Office of Nuclear Verification. He is a graduate of the Monterey Institute of International Studies and has held various positions within NNSA since 2001.

Nuclear Forensics Workshop - *CONTINUED*

The workshops are intended to train international practitioners on basic analytical techniques useful in nuclear forensic examinations. Each iteration of the workshop engages participants from a different set of countries. The most recent, held October 28-November 8, 2013, involved participants from Algeria, Bulgaria, the Czech Republic, Indonesia, Malaysia, Mexico, Pakistan, Singapore, Thailand, and Vietnam.

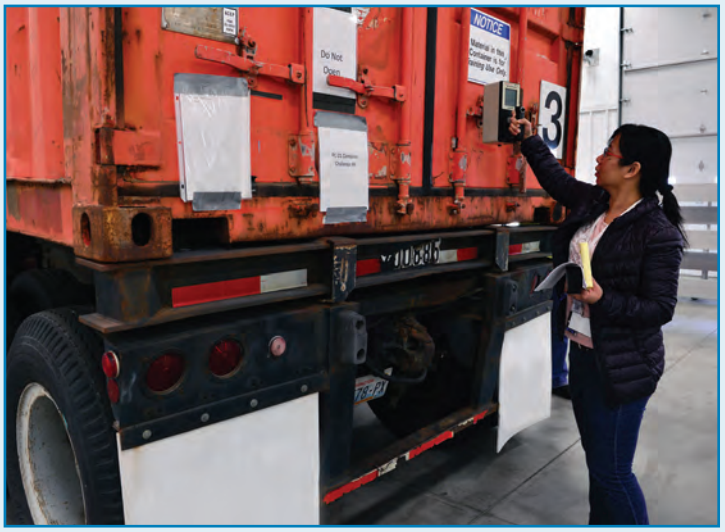
Experts from three National Laboratories—Los Alamos, Lawrence Livermore, and PNNL—collaborated with an internationally recognized cadre of experts from the IAEA, the Australian Nuclear Science and Technology Organisation, the United Kingdom Atomic Weapons Establishment, the European Commission Joint Research Center Institute for Transuranium Elements, and U.S. agencies to lead participants in classroom instruction and hands-on laboratory exercises. The exercises revolved around a scenario that simulated a nuclear smuggling incident, which participants were tasked with investigating using the nuclear forensic methodologies they learned.

Safeguarding and securing nuclear material is a global concern, but in the event that safeguards and security measures fail, nuclear forensics becomes a useful tool in combating nuclear proliferation and terrorism. Nuclear forensics experts assist law enforcement investigations by processing evidence that contains or is contaminated with nuclear or other radioactive materials. Beyond that, experts also may use nuclear forensic methodologies to uncover the process histories and ultimate origins of nuclear or radioactive materials. Gaining insight into the material's place of origin and process history can contribute significantly to the determination of how and where control of material was lost so that potential security vulnerabilities associated with those facilities can be addressed. A robust nuclear forensic capability also supports deterrence by discouraging terrorist elements or rogue state actors from engaging in nuclear terrorism.

The curriculum for the IAEA/NIS workshop at PNNL supplements other IAEA training courses on nuclear forensics, focusing on the role of scientists and lab technicians in analyzing nuclear material and trace evidence contaminated with other radionuclides, as outlined in the IAEA's Nuclear Security Series #2 Document, "Nuclear Forensics Support." The latest workshop improved upon the 2012 workshop by featuring more hands-on exercises and an increased focus on techniques most feasible for states with nascent nuclear science capabilities—the workshop's intended audience.

The scenario-based exercises began with a demonstration at DOE's HAMMER (Hazardous Materials Management and Emergency Response) Federal Training Center of a mock nuclear material interdiction at a border crossing. Instructors drove a vehicle carrying special nuclear material through a radiation portal monitor, setting off alarms. Instructors then helped participants perform an on-scene assessment to make sure the "evidence" was rendered safe and fit for transportation to a radiological laboratory for further processing. Participants were then given the role of radiological laboratory technicians and were asked by investigators to inventory, categorize, and segregate evidence not containing, or contaminated with, nuclear or radioactive materials for processing at a traditional forensics laboratory. Then participants were asked to conduct basic physical measurements (mass, dimensions, density) and take images (using traditional photography and optical microscopy) of the remaining nuclear forensic evidence.

Nuclear scientists, law enforcement officials, and forensic specialists from around the world attended an international workshop on nuclear forensics at PNNL in Richland, Wash., from October 28 to November 8, 2013.



The scenario-based exercises began with a vehicle setting off an alarm at a radiation portal monitor at a mock border crossing.

Photos Courtesy of Dean Calma / IAEA

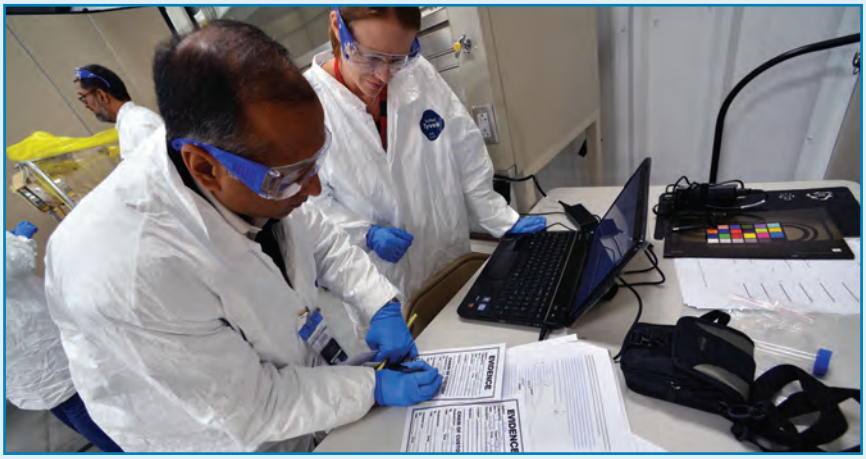


Photo Courtesy of Dean Calma / IAEA

Exercise participants inventoried, categorized, and segregated evidence within a mock radiological laboratory setting.

Working in teams, the participants developed analytical plans to direct their analyses. In order to implement their plans, participants received extensive hands-on instruction in a nondestructive assay technique called high-resolution gamma spectroscopy and the destructive assay technique known as high-resolution alpha spectrometry. Both techniques can be used to categorize nuclear or radioactive materials. The teams were responsible for implementing their plans, conducting gamma spectroscopy, alpha spectrometry, and other measurements on the "evidence" collected at the mock border crossing they observed at the beginning of the workshop. Instructors also introduced participants to more advanced analytical techniques, such as optical emission spectroscopy, mass spectrometry, and scanning and transmission electron microscopy, and advised them where to access these capabilities.

The workshop concluded with participants presenting the results from their two-week investigations and evaluating how their measurements of the "evidence" compared with information found in a database of material characteristics—an analysis that enabled them to identify the interdicted material and hypothesize about its possible origins. Participants noted that the workshop improved their understanding of nuclear forensics and that they gained knowledge and experience that would be useful in their jobs.

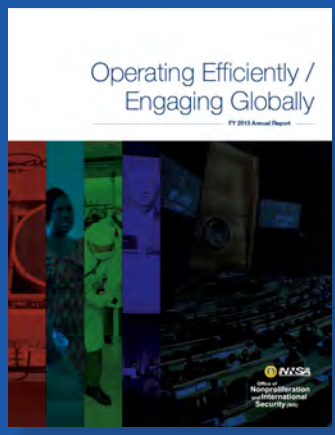
The success of this workshop highlights efforts by the IAEA and NNSA to promote international understanding and collaboration. The strength of the workshop lies in its ability to bring practitioners in nuclear security from around the world together for two weeks of classroom and laboratory instruction on technical forensic examinations supporting investigations of nuclear security incidents. The IAEA and NNSA look forward to holding the third iteration of this workshop in 2015.

Cornelia Brim is a senior communications specialist at PNNL with more than 20 years' experience providing communications support in areas of national security, nuclear energy, environmental management, and fundamental science.

As an NNSA Graduate Fellow with NIS in 2012-2013, Lindsay Minnema was instrumental in keeping the nuclear forensics workshop on track. She is now with the U.S. Department of Energy.

See the NIS Year in Review

The Office of Nonproliferation and International Security (NIS) has released its ***FY 2013 Annual Report***. An electronic version is available at issuu.com/nis_publications along with annual reports from previous years and all back issues of Highlights.



The FY 2013 Annual Report and recent issues of Highlights also are posted on the NNSA website at www.nnsa.energy.gov/nonproliferation/nis.

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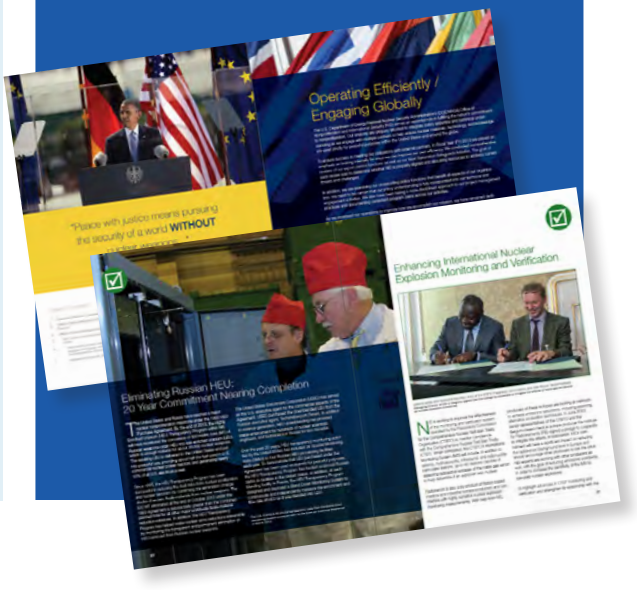

NIS Encourages Center of Excellence Sustainability at London Meeting

BY LOVELY UMAYAM AND MARGOT MININNI

In September 2013, the Department of Energy National Nuclear Security Administration's (DOE/NNSA) Office of Nonproliferation and International Security (NIS) co-hosted a meeting in London with the Lloyd's Register Group to identify and discuss factors important to the sustainability and enduring success of nuclear security and nonproliferation training Centers of Excellence (COE). Officials from the United States, United Kingdom, and the European Commission and their national laboratories, along with representatives from COEs in Morocco, Jordan, and Japan, attended the workshop. Facilitated by Pacific Northwest National Laboratory, the London workshop focused on the three most challenging aspects of reaching COE sustainability: (1) cultivating stakeholder relationships; (2) diversifying funding streams; and (3) developing performance metrics to evaluate sustainable practices.

The report issued at the close of the 2014 Nuclear Security Summit notes that 12 countries have established Centers since 2010 and several other countries have made commitments to develop COEs as a tangible means to contribute to strengthening national security and the overall international nuclear security infrastructure. With the potential for these Centers to become local training hubs and repositories of nuclear security knowledge, many of these countries are keen on developing practices to ensure that COEs make an impact well beyond 2014. Although the objectives and operating models of COEs differ, they share common performance indicators and parameters that can help establish organizational maturity. In that vein, the London meeting provided a unique forum for countries and organizations involved in establishing or operating COEs to share information on common elements and good practices that encourage sustainability. Among other concepts, participants also explored the idea of COEs as "communities of practice," noting that success is not contingent on amassing a large staff or expertise, but on becoming an effective part of a larger coordinating network that bridges resources together.

The September scoping session was an opportunity to review what has been done to date and share lessons learned. Al-Sharif Nasser Bin Nasser, Director of Jordan's Middle East Scientific Institute for Security (MESIS), shared his experiences in helping shape the COE's organizational identity as "connector, facilitator, and interlocutor" and how this affects the COE's relationship with its sponsors and stakeholders. Itimad Soufi, Director of Safety and Security Office of The National Center for Nuclear Energy, Science, and Technologies (CNESTEN) in Morocco, discussed sustainability in the context of developing a relationship with their specific audience, such as other Francophone countries, acknowledging that CNESTEN's strength lies in focusing on a select client base. For its part, Japan's Integrated Support Center for Nuclear Nonproliferation and Nuclear Security (ISCN) has focused on enhancing its capabilities to provide nuclear security, safeguards, and nonproliferation assistance and training regionally, both in Japan and other Asian countries, according to ISCN Deputy Director Yosuke Naoi. The Lloyd's Register Group, a UK company founded in 1760 with experience in the energy and transportation sectors, also shared insights on common performance indicators and other useful metrics that can help develop organizational maturity and gauge improvements in sustainable practices.

Moving forward, NIS will continue to engage with a number of individual COEs around the world, including Jordan's MESIS, Japan's ISCN, the developing Center in Morocco, and the Republic of Korea's International Nuclear Nonproliferation and Security Academy. NIS will continue to coordinate its efforts with the International Atomic Energy Agency (IAEA) to enhance nuclear security through the IAEA's International Network for Nuclear Security Training and Support Centres (NSTSC), a collaborative network of security training and support centers. NIS and other NNSA Office of Defense Nuclear Nonproliferation (DNN) programs also contribute to the Global Partnership's Sub-working Group on COEs, which has supported COEs in optimizing information exchange and global collaboration since 2012. Various DNN programs including NIS are also in close coordination with the European Union's network focused on mitigating chemical, biological, radiological, and nuclear threats across eight regions.

NIS also aims to build on the productive discussions in London to further

Delegates from the United States, United Kingdom, and the European Commission met in September to discuss strategies for sustaining the growing number of regional nuclear security and nonproliferation Centers of Excellence.

encourage and assist COEs more broadly to adopt sustainable operational practices for long-term viability. NIS is in the process of conducting follow-up interviews with workshop participants and analyzing related research, which will inform a more comprehensive analysis on COE sustainability. Having organizations continue to build on practices laid out in London is essential for COEs to develop the level of experience and resiliency necessary to weather organizational difficulties and tackle emerging nuclear security challenges.

Lovely Umayam is an NNSA Graduate Fellow for NIS. She supports the NIS Front Office as well as its Regional Analysis and Engagement Program. Previously, she was a graduate research assistant at the Monterey Institute of International Studies as well as a visiting scholar at Tsinghua University in Beijing, China.

Working across programs in NIS, Margot Mininni carries out interagency outreach for NA-242 programs and coordinates new projects and special initiatives including those pertaining to COEs. With professional and graduate experience in Russia and the countries of the former Soviet Union, Margot has managed scientist engagement programs for NNSA since 1998 and also has led scientist engagement efforts in Libya and Iraq. Her current focus extends to broader regional support and peaceful use engagement, including safeguards training activities for nuclear energy newcomer states particularly in South East Asia.

DOE and IAEA Host Workshop at ORNL on Integrated Approaches to Safety, Security, and Safeguards ("3S") Management

BY MARI GILLOGLY AND JENNIFER DAHNKE

From December 2 to 6, 2013, the Department of Energy National Nuclear Security Administration's (DOE/NNSA) Office of Nonproliferation and International Security (NIS) and the International Atomic Energy Agency (IAEA) Department of Nuclear Energy, Integrated Nuclear Infrastructure Group organized the *Workshop on Effective Management of Safety, Security and Nonproliferation Issues at Operating Facilities*. Hosted at Oak Ridge National Laboratory (ORNL), the workshop included 34 participants from 22 IAEA Member States* that are all currently laying the groundwork for nuclear power for the first time or are expanding existing nuclear power capacity.

The workshop gathered experts from nuclear facility management and operations who described the organization and systems needed to achieve excellence in operations, with a focus on the interface of safety, security, and safeguards ("3S"). Each of these three elements is important, but while the requirements for each are defined separately, they can overlap in the operation of a facility. Therefore, the concept of "3S management" is to facilitate the implementation of safety, security, and safeguards by managing the interface between the separate set of requirements with an aim to avoid conflict in the demand on operators. Presenters came from ORNL, the U.S. Nuclear Regulatory Commission, and Exelon Nuclear Partners, as well as Finland and the United Arab Emirates. Participants shared their experiences integrating management of 3S throughout civil nuclear programs, from developing regulations and management systems to operating reactors and spent fuel repositories to constructing facilities.

Classroom presentations were enhanced by facilitated exercises, as well as tours and lectures at the High Flux Isotope Reactor (HFIR) and ORNL's Radiochemical Engineering Development Center and Emergency Operations Center. A visit to

** Participating states included Hungary, Romania, Slovakia, Ukraine, United Arab Emirates, Finland, Belarus, Vietnam, Bangladesh, Ghana, the Russian Federation, Malaysia, Indonesia, Saudi Arabia, Kenya, Nigeria, South Africa, Tunisia, Algeria, Egypt, Poland, and the United States.*

Participants visit the Radiochemical Engineering Development Center at the Oak Ridge National Laboratory where nuclear isotopes are manipulated and processed for medical applications and research.

Integrated 3S Management, Page 8...

Integrated 3S Management - CONTINUED

the TVA/Watts Bar Nuclear Power Plant gave the participants an opportunity to familiarize themselves with both a plant in operation and a plant under construction.

Many workshop participants agreed that integrated implementation of 3S at the national level can be an effective and efficient approach for nuclear infrastructure development, and recognized that a national regime for nuclear safety, security, and safeguards starts with a top-down approach directed by international obligations and national laws and regulations. NIS has followed the development of integrated 3S with interest and will continue to encourage further discussion on this topic among international partners.

Mari Gillogly completed a Nonproliferation Graduate Program Fellowship with NIS in June 2013. She now supports an array of NIS projects, from international safeguards engagement to domestic and international export controls, through ORNL's Nuclear Security and Isotope Technology Division.

Jennifer Dahnke is an NNSA Graduate Fellow in NIS, where she supports international safeguards engagement efforts. Prior to joining the fellowship program, she completed her graduate degree in Nonproliferation and Terrorism Studies from the Monterey Institute of International Studies.

U.S. Department of State and NIS Conduct Commodity Identification Training in Saudi Arabia

The U.S. Embassy in Riyadh hosted a four-day commodity identification training course for Saudi Arabian officials in February 2014. During this course, experts from the Department of Energy National Nuclear Security Administration's Office of Nonproliferation and International Security (NIS), the Kansas City Plant, and Pacific Northwest National Laboratory trained participants to identify commercial goods (also known as dual-use commodities) that could be misused for the development of weapons of mass destruction. The U.S. Department of State and the NIS International Nonproliferation Export Control Program (INECP) jointly funded the course.

Through the commodity identification training, INECP and the U.S. Department of State Export Control and Related Border Security (EXBS) program are working with Saudi officials to increase global security, protect the domestic interests of the Kingdom and foster the legitimate trade that is vital for economic growth.

With the completion of the first-ever NIS training engagement in Saudi Arabia, participants are planning for future cooperation that might include additional courses and working with Saudi customs officials to develop export controls for dual-use commodities. These efforts will strengthen the Kingdom's capability to manage strategic goods and technologies to support international export controls.

Participants in NIS's first training engagement in Saudi Arabia learned how to identify dual-use commodities.