Office of Nonproliferation and International Security (NIS)

National Nuclear Security Administration

Summer 2014

Highlights

NIS Engages the Heirs to Pakistan and India's Nuclear Challenge

BY LOVELY UMAYAM

In an effort to enhance transparency and develop confidence building measures between India and Pakistan, DOE/NNSA's Office of Nonproliferation and International Security (NIS) is sponsoring Track 1.5/2 workshops in which nuclear experts from both countries candidly discuss possible crisis management frameworks for the Subcontinent. While engaging seasoned and distinguished nuclear specialists from the region remains paramount, it is equally important to reach out to South Asia's rising generation of aspiring nuclear analysts, recognizing the need to equip them with the tools and experience to stabilize and ultimately lessen nuclear competition between their countries.

To reach these "nuclear heirs," NIS, working through Sandia National Laboratories and the South Asia Regional Center for Strategic Studies (RCSS), helped convene the Colombo Confidence Building Process, in which young Indian and Pakistani participants practiced carrying out a transparent process of dismantling aging and obsolete nuclear-capable missile systems. Indian and Pakistani teams visited the National Military Museum in Sofia, Bulgaria, to study models of obsolete missile systems and then conducted mock bilateral dismantlement exercises that

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NIS Helps Republic of Korea Realize Commitment to Establish Center of Excellence

BY ELAINE SPECHT

Kasia Mendelsohn (far left) represented DOE/NNSA at the tree planting ceremony to mark the opening of the KINAC training facility. Photo provided by KINAC/INSA.

During the 2010 Nuclear Security Summit, the Republic of Korea (ROK) committed to developing a Center of Excellence (COE) dedicated to nonproliferation and nuclear security training. In February 2014, the ROK officially opened the International Nuclear Nonproliferation and Security Academy (INSA), and Kasia Mendelsohn,

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From the Editor:
I am pleased to announce that *Highlights* received a First Place in the external newsletter category in the National Association of Government Communicators Blue Pencil & Gold Screen Awards Competition. NIS also received an Award of Excellence in the annual report category. While the individuals across NIS that take part in creating the publications are motivated by the desire to focus attention on the important work of NIS, it is gratifying to know that we measure up favorably by our peers in government communication in the areas of writing, design, cost effectiveness, and determination of success.

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NIS Bookshelf

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examined the feasibility of dismantlement technologies and techniques, as well as steps to negotiate the proper procedures for carrying out such a process. Through this exercise, the participants were able to develop an appreciation of the benefits and risks inherent in undertaking mutual confidence building initiatives. NIS developed a short documentary about the exercise that has been viewed by over 460,000 South Asian viewers ages 20–35 and has garnered 24,000 "Likes" on its Facebook page. The video is available online through https://www.facebook.com/missileCBMs (posted November 11, 2013).

The documentary of a missile dismantlement exercise held last summer captured the perspectives of the young Indians and Pakistanis involved.

Additionally, NIS has helped launch a series of other programs to cultivate this community of young security analysts from India and Pakistan, enabling them to interact with one another as they grapple with their countries' most pressing nuclear dilemmas. As reported last fall, NIS, in partnership with the Stimson Center, created *South Asian Voices* (http://southasianvoices.org/) a website featuring opinion pieces from young Pakistani and Indian scholars on nonproliferation, regional affairs, deterrence theory, and other policy issues. Through this virtual forum, both parties can ask questions about, reflect on, and constructively debate ways to reduce existing regional tension and avoid the possibility of nuclear confrontation. The *South Asian Voices* virtual space plays a key role in bringing together analysts who, due to the visa regimes of both countries, would not otherwise be able to work together on their analyses. The openness achieved through *South Asian Voices* has helped break down barriers and address preconceived notions about each country's motivations and actions.

The fostering of an eager and talented group of Indian and Pakistani strategic analysts is an investment in South Asia's future nuclear stability. NIS's aspiration is that by establishing these communications lines and cultivating a sense of camaraderie among the group, we will help realize their vision for a secure and stable Subcontinent in the future.

Lovely Umayam was an NNSA Graduate Fellow supporting the NIS front office June 2013 to June 2014 and continues to work with NIS through MELE Associates, Inc. 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.

New-Generation Neutron Detectors and Electronics for High-Count-Rate Applications

BY MARTYN SWINHOE, KIRIL IANAKIEV, METODI ILIEV, AND ALISON GOODSELL

Neutron detectors are used for nonproliferation and treaty verification applications to determine the presence or absence of special nuclear material (SNM). For more than three decades, Helium-3 (He-3) proportional counters have been the workhorse of neutron detectors. However, the limitations of these conventional neutron counter detector systems are being reached. Specifically, improvements are necessary to obtain accurate, cost-effective measurements for mixed oxide or advanced fast reactor fuels.

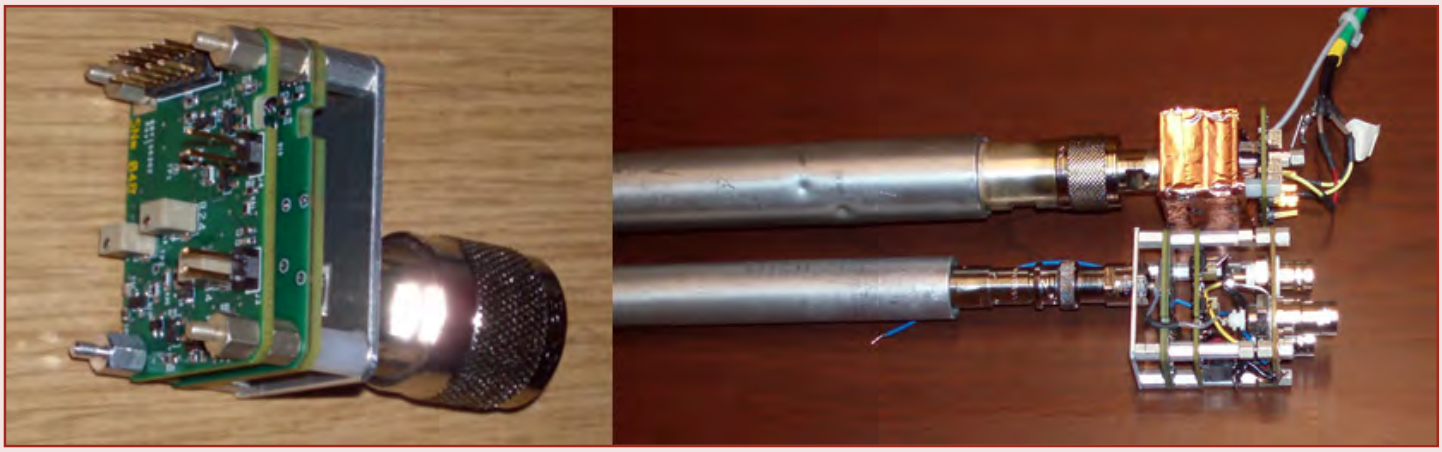
DOE/NNSA's Next Generation Safeguards Initiative has been working with Los Alamos National Laboratory (LANL) to develop the next generation of neutron detectors utilizing new front-end electronics to address this technology gap. DOE/NNSA Program Manager Hilary Lane is working with the LANL team, which consists of Kiril Ianakiev, Martyn Swinhoe, Alison Goodsell, and Metodi Iliev.

One thrust of the development has been to consider the ensemble of the detector and preamplifier as a unit (rather than optimizing the components separately). Enhancing the detector tubes with redesigned electrodes has decreased response times, reduced space charge effects (ion build-up) caused by high neutron and gamma intensities, and increased the gamma tolerance. As a result, detector responses are faster and provide more accurate information about certain types of nuclear material. Another benefit is that the commercially available, smaller-diameter tubes now being used can be combined into detection modules that require less He-3 for the same neutron detection efficiency as their conventional counterparts. This is important because the international community is facing a shortage of He-3.

Typical He-3 detectors produce a combination of pulse shapes from neutrons and gammas that are difficult to treat uniformly and in some cases cause false pulses to be produced (so-called, double pulsing). Armed with this knowledge, the development team optimized the design of the compact electronics package to include a filter that removes double pulsing. The updated electronics design has been commercialized for general use and will serve as a building block for new neutron instrumentation as well as a plug-in upgrade for existing detector systems.

The new generation of tubes and front-end electronics allows for operation at higher count rates and in higher gamma fields, pointing toward a possible solution for measuring spent nuclear fuel with high neutron efficiency, something previously not possible in systems that used Uranium-235 fission counters. Invention disclosures for the new detectors and electronics are under way.

The results of this work will be presented at the International Atomic Energy Agency Symposium on International Safeguards in Vienna in October 2014.



The new KM200 electronics package (left) installed on conventional (1-in. diameter tube) and new (3/4-in. diameter tube). He-3 proportional counters (right) improve the accuracy of neutron measurements.

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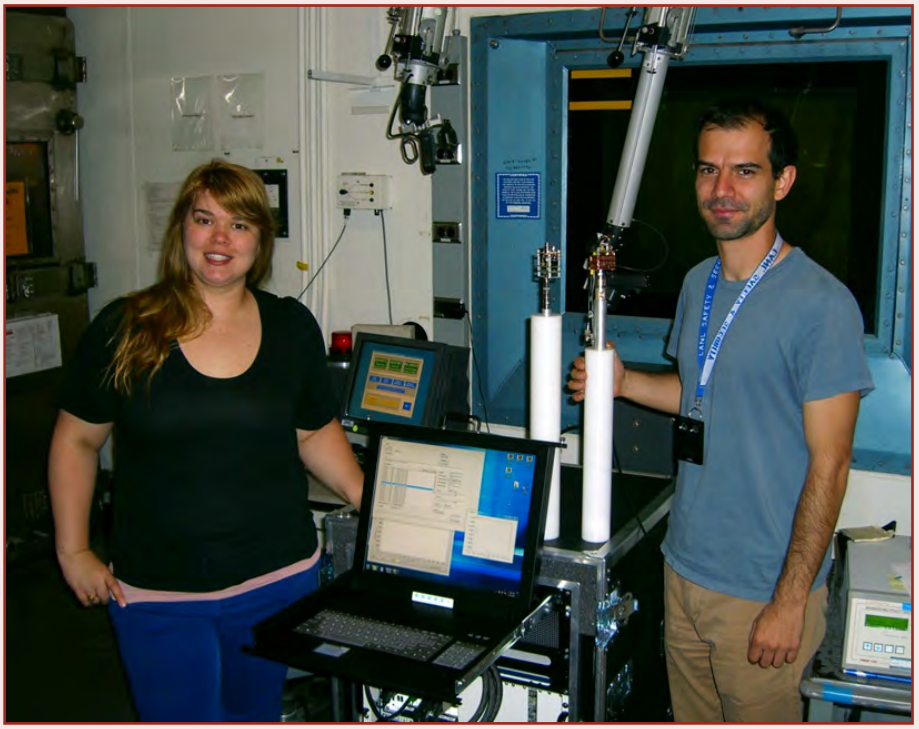
NIS Helps Korea Realize Commitment – *CONTINUED*

Assistant Deputy Administrator for the DOE/NNSA Office of Nonproliferation and International Security (NIS), was on hand for the occasion. Mendelsohn participated in the opening ceremony and served as an expert panelist during the inaugural international symposium.

NIS has provided key support to the Korea Institute of Nuclear Nonproliferation and Control (KINAC), the entity responsible for running INSA, throughout the design of the physical protection test bed at the facility and development of the training curriculum now being offered. The first training on the new grounds, a hands-on course in international physical protection of nuclear materials and facilities, was held in March 2014. Thirty trainees from twelve countries, including Egypt, Mongolia, Myanmar, Philippines, Saudi Arabia, Thailand, Vietnam, Japan, United Arab Emirates, Jordan, Indonesia, and Malaysia completed the course. James Conner of NIS joined President of KINAC Young-Myoung-Choi in providing closing remarks at the course.

NIS also is assisting INSA in developing safeguards and export control curricula. The first introductory international safeguards course at INSA was held June 9–13, with key technical support provided by NIS and U.S. National Laboratory experts. Lance Stubblefield of NIS also is leading a team to work out details for an export control training course on nonproliferation norms, strategic goods identification, end-use/user analysis, and licensing to be taught by INSA trainers later this year. INSA will be the first COE in the region to host such export control trainings for Koreans and foreign participants.

New-Generation Thermal Neutron Detectors and Electronics – *CONTINUED*



Alison Goodsell and Metodi Iliev testing the new detector and electronics with a pulsed neutron generator.

Martyn Swinhoe has a B.Sc., M.Sc., and Ph.D. in nuclear physics from the University of Birmingham in the UK. He is an internationally recognized expert in nuclear safeguards, with 30 years of experience. Dr. Swinhoe is involved with international collaborations with Japan, the European Union, the Republic of Korea, and the International Atomic Energy Agency, where he was responsible for the design and deployment of many nondestructive analysis systems.

Kiril Ianakiev has an M.S. in electrical measurement technology from the Technical University of Sofia in Bulgaria. He has 30 years of experience in signal processing for radiation detectors, the accommodation of detectors and electronics for active interrogation, research and development of ^{6}Li neutron detectors, and online enrichment monitoring for gas centrifuge enrichment plants. Mr. Ianakiev holds four U.S. patents in the field of nuclear instrumentation.

Metodi Iliev received a B.S. in electrical engineering and computer science from UC Berkeley and an M.S. in electrical and computer engineering from California State University, Northridge. He is currently a post-M.S. graduate student research assistant at LANL. His expertise is in designing front-end electronics for different types of radiation detectors, as well as analog and digital signal processing.

Alison Goodsell received her M.S. in nuclear engineering from Texas A&M University and a B.S. in physics from California Polytechnic State University in San Luis Obispo. She is a graduate research assistant at LANL and will be returning to Texas A&M University to pursue her Ph.D. in the fall of 2014. From June 2012–2013, Alison participated in the Nonproliferation Graduate Fellowship Program in Washington, D.C.

Expanding the Next Generation Safeguards Professional Network

BY RISA HADDAL AND JAMES DOYLE

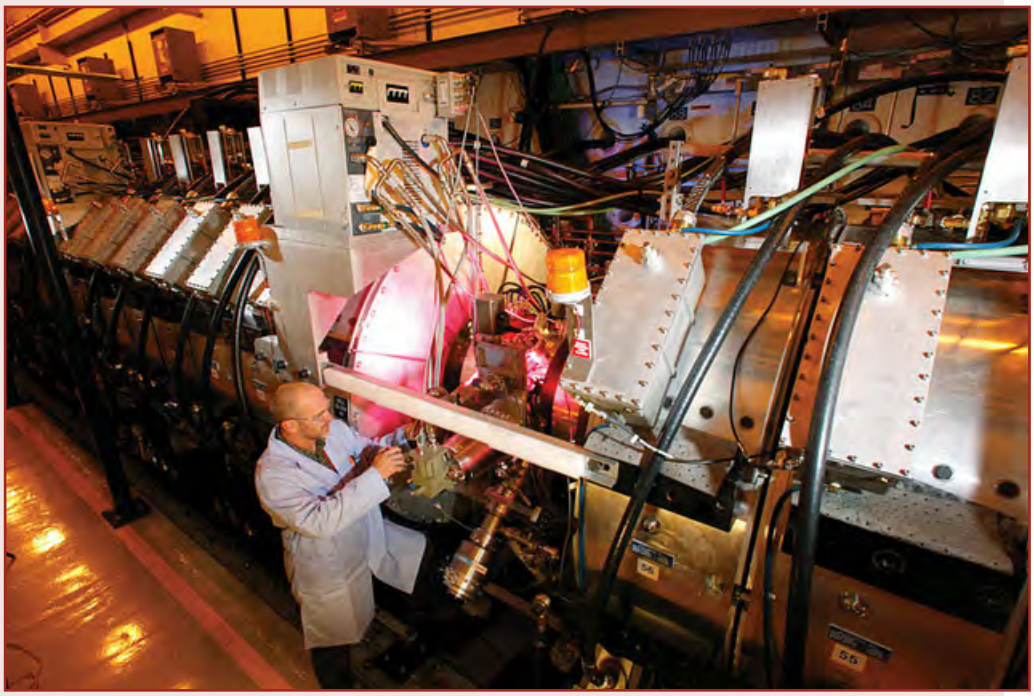
DOE/NNSA's Next Generation Safeguards Initiative (NGSI) within the Office of Nonproliferation and International Security (NIS) develops the technologies and human capital necessary to strengthen the international nuclear safeguards system as it evolves to meet proliferation challenges. The Next Generation Safeguards Professional Network (NGSPN) is one of the means to achieve NGSI's human capital development objectives, using training of and job creation for young safeguards professionals in the National Laboratory workforce. Among the highlights of NGSPN workshops are visits to nuclear facilities and organizations, which increase participants' awareness of safeguards capabilities and expertise, and provide hands-on experience with safeguards challenges.

At the most recent workshop in March 2014, 17 research associates, post-doctorates, and early career staff from across the U.S. nuclear complex traveled to Sandia and Los Alamos National Laboratories (SNL and LANL). At SNL, participants heard presentations and took part in activities related to containment and surveillance, cryptography, geospatial information tools, intrusion/detection technologies, and information assurance. Safeguards technologies introduced included the Remotely Monitored Sealing Array, the Enhanced Data Authentication System, on-site inspection and continuous monitoring technologies, the Augmented Computer Exercise for Inspection Training, radiological monitoring technologies, access control, and tracking systems. SNL also presented briefings on nonproliferation programs including nuclear infrastructure development in the Middle East and chemical and biological threat reduction.

The participants toured the Integrated Security Facility, used to provide training to international partners on physical protection and nuclear safety, security, and safeguards, and the Technology, Training and Demonstration Area, where nonproliferation, counterterrorism, international security, and arms control related technologies are on exhibition.

Participants also visited Aquila Technologies Group, a commercial manufacturer of instruments for the detection, identification, and measurement of nuclear materials.

At LANL, the NGSPN workshop agenda focused on international safeguards implementation and technology, highlighting LANL expertise in nuclear materials measurement and verification systems. Safeguards topics included the "safeguards-by-design" campaign and the application of safeguards technology including an advanced uranium enrichment monitor, micro-calorimetry techniques, neutron detection, and nuclear material measurements for arms control verification.



Dual-Axis Radiographic Hydrodynamic Test (DARHT) Facility at LANL visited by the NGSPN participants.

Participants also visited two LANL facilities that support both the U.S. nuclear stockpile stewardship program and nonproliferation/counterterrorism efforts. First, the NGSPN attendees toured LANL's TA-55 plutonium facility and process areas. The visit covered the facility's work converting former weapons components to plutonium oxide to support the U.S.-Russian Plutonium Disposition Agreement, as well as measurement and process controls relevant to safeguards at large-throughput nuclear facilities.

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Expanding the Next Generation Network – *CONTINUED*

Second, NGSPN toured LANL's Dual-Axis Radiographic Hydrodynamic Test (DARHT) Facility: two large x-ray machines that produce freeze-frame radiographs (high-powered x-ray images) of materials that implode at speeds greater than 10,000 miles an hour. The images of hydrodynamic tests at DARHT help to improve and verify computer models of nuclear weapons, which, in the absence of actual nuclear testing, are critical in assessing the effects of aging and remanufactured parts in nuclear weapons.

Participants were enthusiastic in their evaluations, indicating across the board that the 2014 NGSPN event strengthened their understanding of international nuclear safeguards and the various technical capabilities at SNL and LANL.

A full report on the 2014 NGSPN Meeting is available at www.osti.gov/servlets/purl/1129826/.

Participants in the 2014 NGSPN workshop held at SNL and LANL.

James E. Doyle, Ph.D., has been a nonproliferation and nuclear security specialist at LANL since 1997. Dr. Doyle has focused on defining educational requirements for nuclear security specialists and developing university training courses in this area. He coordinates LANL activities NGSI's Human Capital Development project. His edited textbook "Nuclear Safeguards, Security and Nonproliferation: Achieving Security with Technology and Policy," in use at over three dozen university departments worldwide, focuses on integrating technical and policy issues in the field of nuclear safeguards and security.

Risa Haddal of SNL focuses on nuclear safeguards cooperation with the Republic of Korea, France, and Germany and she supports technical collaboration with Argentina, Brazil, the European Atomic Energy Agency (EURATOM), and the International Atomic Energy Agency. Ms. Haddal also is engaged in the development of biological risk management curriculum in the Middle East and North Africa region and has extensive experience designing and implementing international workshops.

NNSA Graduate Fellowship Program Brings Young Professionals to Nonproliferation

BY LAURA SCHMIDT DENLINGER AND ELAINE SPECHT

NNSA has bid farewell to its 2013–2014 class of NNSA Graduate Fellowship Program (NGFP) Fellows. NGFP offers the "best and brightest" next generation of national security and nonproliferation professionals the opportunity to explore a career in global nuclear security at NNSA. Through the NGFP, fellows work on programs designed to support national security, nonproliferation, counterproliferation, arms control and nuclear security. The twelve-month, full-time, salaried fellowship program provides participants with specialized training and practical experience on projects and initiatives that contribute to a safer world.

The 2013–2014 class marked the first year the NNSA Graduate Fellowship Program combined two previous NNSA programs—the Nonproliferation Graduate Fellowship Program and the Future Leaders Program—into one dynamic opportunity for current and recent graduate-level students. The program will continue in 2014–15 with assignments available across the NNSA enterprise. The range of available positions provides opportunities for a variety of skill sets, including technical disciplines, policy, health and safety, safeguards and security, and program management support.

NGFP fellows assigned to NIS make meaningful contributions to the field of nonproliferation while gaining valuable experience. The following is a representative sampling of top accomplishments by this year's NGFP fellows in support of NIS:

NNSA Graduate Fellowship Program, Page 7...

NNSA Graduate Fellowship Program – *CONTINUED*

Kellie Bolling (Export Licensing/Interdiction)

- Helped manage the rollout of the Australia Group (AG) Handbook, jointly funded by NNSA and the Department of State, and supported NNSA's preparations for the AG Plenary where the Handbook was presented to all AG members.
- Coordinated within NIS to complete the Export Control Review and Compliance Handbook for the NIS Office of Nuclear Controls.

Matt Chambers (International Nuclear Export Control Program [INECP])

- Established INECP Headquarters and lab-wide protocol and developed guides for equipment donations to foreign partners, thereby enabling INECP to follow through on prior commitments.
- Managed the creation of the Domestic Export Enforcement Support Engagement Plan for FY2015. This document outlines INECP's engagement with the U.S. domestic export enforcement community through FY2020.
- Supported successful export control training events in Peru, Panama, Chile, and Morocco.

Jennifer Dahnke (International Nuclear Safeguards Engagement Program [INSEP])

- Coordinated INSEP support to the International Atomic Energy Agency (IAEA) on developing Safeguards Implementing Practice Guides.
- Served as the Headquarters lead on a project to improve spent fuel measurement at the Armenian Nuclear Power Plant.

Madeleine Foley (NIS Front Office)

- Supported the Office of Defense Nuclear Nonproliferation in preparing for the March 2014 Nuclear Security Summit in the Netherlands.
- Coordinated U.S. Government papers for the Nuclear Suppliers Group meetings in Vienna, Austria.
- Served on the U.S. delegation to the NSG Plenary meetings in Argentina.
- Supported NIS 10 CFR 810 application reviews and new rulemaking.

Gisele Irola (Safeguards Policy)

- Prepared a comprehensive timeline and paper on the Voluntary Offer Agreement for IAEA safeguards in the United States and is co-authoring a paper with the Nuclear Regulatory Commission as a result of that research.
- Supported the NGSI Human Capital Development program and co-facilitated its program review.

Monica Kang (Confidence Building Measures)

- Led logistics and communications with international partners for NNSA's three-day ASEAN Regional Forum workshop in Thailand on strengthening regional nuclear security practices involving forensics in Southeast Asia.
- Supported and actively participated in the IAEA Nuclear Forensics Workshop at Pacific Northwest National Laboratory.

NNSA Graduate Fellowship Program, Page 8...

Jessica McNutt (Safeguards Technology)

- Managed multiple technology development projects, including the development of a neutron coincidence counter at Los Alamos National Laboratory—a Helium-3 alternative neutron detector—capable of performing comparably to He-3 based detectors.
- Helped organize an international workshop and field trial of He-3 alternative technologies to be held in Italy in October 2014.

Maria Smith (Confidence Building Measures/INECP)

- Helped plan, organize, implement and participated in an Asian international experts meeting on nuclear forensics in Vietnam which was jointly sponsored by the EURATOM Joint Research Center. Building on previous capacity-building ASEAN regional events, NNSA provided equipment and hands-on training in detection and measurement of radiation.
- Wrote with INECP subject matter experts a proposal for a graphic guide to engage and educate law enforcement officers and industry representatives on nonproliferation strategic trade controls.

Jordan Swarthout (Nuclear Security)

- Led an interagency effort to compile, review, and finalize a draft guidelines document to be used as the standard for the U.S. bilateral physical protection assessment program.
- Managed and maintained the U.S. bilateral physical protection database, analyzed data, prepared customized reports and presented findings to assist senior NNSA program officials in making U.S. nuclear security policy.

Maria Lovely Umayam (NIS Front Office)

- Prepared materials, secured funding paperwork, and attended a U.S.-U.K.-Myanmar Track II Dialogue, which discussed nonproliferation issues and the importance of committing to international norms with Myanmar security experts.
- Assisted DOE/NNSA safeguards experts to coordinate a workshop to assist Myanmar officials and other stakeholders in the process of implementing the Additional Protocol.

The 2014–2015 class began their Fellowships with NNSA in June. The new class includes seven fellows supporting the following NIS offices and programs: Front Office, Office of Nuclear Controls (Confidence Building Measures, Export Control Review and Compliance, International Nonproliferation Export Control Program), and Office of Nuclear Safeguards and Security (International Nuclear Safeguards Engagement Program, Safeguards Technology, International Nuclear Security Program). Their achievements will be reported in a future issue of Highlights.

Laura Schmidt Denlinger is a senior nonproliferation specialist at Pacific Northwest National Laboratory with 18 years' experience in nonproliferation, diplomacy, and communications. She is the PNNL team lead for NGFP Fellows supporting the Office of Defense Nuclear Nonproliferation.

Elaine Specht is the managing editor of the Highlights *newsletter and other NIS publications.*