U.S. DEPARTMENT OF ENERGY (DOE)
NATIONAL NUCLEAR SECURITY ADMINISTRATION (NNSA)
DEFENSE NUCLEAR NONPROLIFERATION (DNN)

DNN Sentinel

DEFENSE BY OTHER MEANS

VOL. I, NO. 2

IN THIS ISSUE:

Letter from the Deputy Administrator

Summer is often a quieter time when we have a chance to catch our breath and prepare for a busy autumn, but this year has seen little slowing of activity in the nuclear nonproliferation and security worlds. Preparations continued for the 2016 Nuclear Security Summit (NSS) with the announcement of the 2016 Summit dates and location—March 31–April 1 in Washington, D.C.—and a meeting of the Sherpa teams in Vilnius, Lithuania, in July. Building on the successful scenario-based policy discussion that was a highlight of the 2014 NSS hosted by The Netherlands, the use of these exercises is being expanded for 2016, including one at the ministerial level, which will be hosted by Secretary of Energy Moniz next January.

In addition, the IAEA held one of its largest technical conferences ever in July on the challenging and sensitive topic of cyber security. The "International Conference on Computer Security in a Nuclear World" boasted over 700 participants from over 90 countries and featured technical demonstrations—including blended cyber and physical attacks—and five days of lively conversation. The United States was well-represented and we were very proud of the substantial contributions made by headquarters and laboratory experts to the conference organization and execution.

No less important was the summer meeting of the Institute of Nuclear Materials Management (INMM). This meeting is a one-of-a-kind opportunity for professionals from around the globe to exchange and discuss best practices, learn about the latest technical developments, and interact with colleagues. The 2015 Annual Meeting was held in Indian Wells, CA with more than 600 participants from dozens of countries. DNN and its extended "family" were major contributors of technical papers and posters, and as recipients of INMM service awards.

DNN SENTINEL:
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http://nnsa.energy.gov/aboutus/ourprograms/nonproliferation-0

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Letter from the Deputy Administrator – *Continued*

Of course, this summer's biggest news was the July 14 announcement of final agreement on the Joint Comprehensive Plan of Action (JCPOA) on Iran's nuclear program. We are closely watching the Congressional discussions on the JCPOA, while also assessing and preparing for the impacts that its implementation will have on DNN. More to come on this front!

So without much of a pause, we are already well into the preparations for the September IAEA General Conference, which we will cover in the next edition.

Anne Harrington
Deputy Administrator
Defense Nuclear Nonproliferation

DNN QUICK LINKS

Follow the links below to learn more about DNN's most recent activities.

Press Releases

NNSA Supports IAEA Regional Training in Zambia on Management Practices for Uranium
http://nnsa.energy.gov/mediaroom/pressreleases/iaeazambiauoc

Armenia Secures Dangerous Radioactive Sources in Cooperation with NNSA
http://nnsa.energy.gov/mediaroom/pressreleases/armeniaradioactivesources032715

NNSA Conducts Experiment to Improve U.S. Ability to Detect Foreign Nuclear Explosions
http://nnsa.energy.gov/mediaroom/pressreleases/foreignnuclearexplosiondetectionexperiments

Blogs

Huizenga Leads Safety of Spent Fuel Management, Radioactive Waste Management Meeting in Vienna
http://nnsa.energy.gov/blog/huizenga-leads-safety-spent-fuel-management-radioactive-waste-management-meeting-vienna

NNSA Contributes to International Efforts to Further Strengthen Detection of Nuclear Explosions
http://nnsa.energy.gov/blog/nnsa-contributes-international-efforts-further-strengthen-detection-nuclear-explosions

U.S.–China Peaceful Nuclear Cooperation—Looking to the Future

By Wayne Mei

DOE–China cooperation in the nuclear field represents a key strategic relationship for both countries. China's robust civil nuclear energy sector is continuing to expand with more than 20 new nuclear reactors currently under construction, several of which use U.S. designs and technology. China also participates actively in the Nuclear Security Summits and continues to cooperate with DNN in a variety of nuclear security areas.

The principal framework for cooperation is the Peaceful Uses of Nuclear Technology (PUNT) Agreement. In May 2015, the United States and China held the 10th Joint Coordinating Committee (JCC) meeting under the U.S.–China PUNT framework. Held periodically since 2002, the meeting locations alternate between the United States and China with the most recent meeting held in Chengdu, the capital of China's Sichuan Province and a center of Chinese nuclear technology development activities.

The PUNT Agreement—signed in 1985 and entered into force in 1998—is the only formal government-to-government mechanism in place to facilitate U.S.–China bilateral technical cooperation in civil nuclear energy and nonproliferation. PUNT activities currently are organized into six working groups:

1. Nuclear Energy Technology
2. Nuclear Safeguards and Security
3. Environment and Nuclear Waste Management
4. Nuclear Emergency Management
5. Radioactive Source Security
6. Public and Stakeholder Outreach

"The significance of this 10th PUNT JCC meeting is not the meeting itself, but the growth of U.S.–China cooperation, which has been evident since the first JCC meeting in 2002," said DNN Deputy Administrator Anne Harrington, who was head of the U.S. delegation at the meeting. "It is important that we are continuing to explore new areas of mutually beneficial cooperation. The complexity of the topics being studied also is growing, which signals our mutual commitment to work together on the safe, secure, and peaceful use of nuclear technology."

DNN Deputy Administrator Anne Harrington (center) at the JCC meeting joined by (left to right) Edward McGinnis, DOE, Deputy Assistant Secretary for International Nuclear Energy Policy and Cooperation; Shao Jun, DOE, China; Peter Lyons, DOE, former Assistant Secretary for Nuclear Energy; Florence Knauf, DOE/NNSA, Office of Global Materials Security; and Ann Heinrich, DOE/NNSA, Office of International Emergency Management and Cooperation.

In response, Mr. Liu Baohua, Director General of the Nuclear Power Department of China's National Energy Administration (NEA) and the Chinese head of delegation, acknowledged that U.S.–China cooperation in the peaceful uses of nuclear energy has made great progress in a wide range of pragmatic areas. He further recommended that "both sides should strengthen communication and interaction at all levels, advance the pace of cooperation on the basis of mutual respect, promote substantial collaboration in every area and jointly research and respond to global challenges so as to facilitate the development of China–U.S. nuclear energy cooperation in a broader, deeper and higher-level manner."

In addition to DOE and NNSA, other U.S. agencies that have participated in the PUNT include the Nuclear Regulatory Commission and the Departments of State and Commerce. The China NEA leads U.S.–China PUNT discussions for the People's Republic of China and is supported by the Ministry of Foreign Affairs, the China Atomic Energy Authority, the China Institute of Atomic Energy, and the Ministry of Environmental Protection.

Read the NNSA press release about the meeting at http://nnsa.energy.gov/mediaroom/pressreleases/10-us-china-punt

Wayne Mei, a member of DNN's Office of Nonproliferation and Arms Control, helped coordinate the recent JCC meeting.

Yangshan Radiation Detection System Transitioned to China

To enhance China's capabilities to counter nuclear and radiological smuggling through the global maritime shipping system, DNN's Nuclear Smuggling Detection and Deterrence (NSDD) Program installed a radiation detection system at the Port of Yangshan, a deepwater port that is part of the Port of Shanghai, currently the world's busiest container port. In January 2015, DNN transferred long-term responsibility for the system to the General Administration of Customs of China (GACC). Representing DNN at the event, DNN Principal Assistant Deputy Administrator David Huizenga said, "We applaud GACC's commitment to combatting nuclear smuggling in the global maritime shipping system."

Installation of the radiation detection equipment, which was manufactured by the Chinese vendor, Nuctech, was completed in November 2011. In accordance with its standard approach, DNN provided GACC with three years of sustainability support. During this transition period, DNN and GACC worked toward enhancing GACC's capabilities to operate and maintain the radiation detection system autonomously. The transition ceremony in January marked the end of this period and recognized the Chinese commitment to full ownership, operation, and sustainment of the system.

DNN and GACC plan to continue their cooperation with DNN providing technical support and advice as GACC procures and installs additional radiation detection equipment at Yangshan Port and a radiation detection system at a port in Tianjin. DNN Deputy Administrator Anne Harrington considers DNN's work at the Port of Yangshan as a model partnership. "In this case, DNN worked to equip one port with a detection system as a pilot, which developed indigenous expertise and buy-in," she says, "China has followed through by equipping other ports, with DNN providing only technical advice. The seriousness of the Chinese commitment to own this important responsibility has been key to its success."

DNN and GACC share a long history of collaborating to combat nuclear terrorism that includes jointly building a Radiation Detection Training Center in China modeled after Pacific Northwest National Laboratory's HAMMER Facility. DNN's investment was $4.5M, and GACC's investment was approximately $20M. The center has been used to deliver training in the best practices in the operation and management of radiation detection systems to hundreds of GACC officers deployed across China.

The 17 radiation portal monitors installed at the Port of Yangshan will scan 100% of export containers.

Read the NNSA press release about the transfer of the radiation detection system at http://nnsa.energy.gov/mediaroom/pressreleases/nnsa%E2%80%99s-second-line-defense.

Contributions of National Laboratories

Several national laboratories have and will continue to lend their technical support for radiation detection systems at China seaports.

Los Alamos National Laboratory was instrumental in optimizing the detection equipment.

Oak Ridge National Laboratory led several tests of the Nuctech equipment to verify that it met NSDD's specifications.

Pacific Northwest National Laboratory contributed to overall management of the project and development of the training curriculum for the Radiation Detection Training Center.

Sandia National Laboratories provided extensive consultations on the network and communications systems.

LANL Hosts 5th DOE/Euratom Joint Steering Committee Meeting

Photos by Richard Robinson, Los Alamos National Laboratory

In July 2015, Los Alamos National Laboratory (LANL) hosted the 5th Joint Steering Committee (JSC) Meeting between DOE and the European Atomic Energy Community (Euratom) represented by the European Commission (EC). JSC meetings provide an opportunity to reinforce commitments, expand technical cooperation, and advance mutual nuclear security and nonproliferation objectives.

LANL scientist Andy Nelson briefs DNN's Anne Harrington and Elly Melamed along with European representatives in LANL's Fuels Research facilities on the laboratory's diverse suite of capabilities focused on the synthesis and characterization of actinide materials.

LANL chemist Rob Steiner (not pictured) explains how the ionization process works for thermal ionization mass spectrometry to tour participants.

Peter Santi, LANL's Safeguards Technology Training Coordinator, leads a tour of LANL's Nonproliferation and National Security Center Nondestructive Assay Training Area, where classes are held for IAEA inspectors and many others throughout the year.

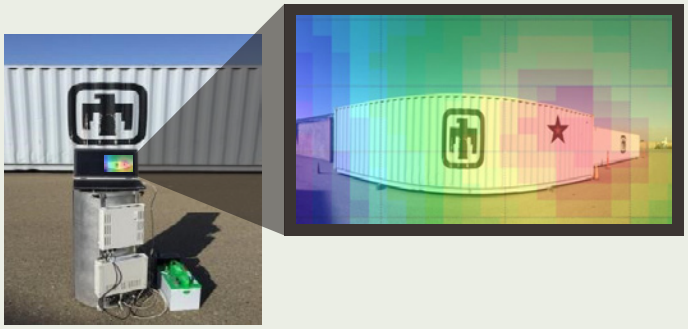
INNOVATION: Sandia's Mobile Camera Takes Aim at Detecting Nuclear Proliferation

Sandia National Laboratories (SNL) has developed an important new capability needed for detecting nuclear proliferation: the Mobile Imager of Neutrons for Emergency Responders (MINER) system, a tool that can rapidly distinguish between threatening and non-threatening radiation sources. DNN Research and Development (DNN R&D) funded the work as part of its support to NNSA's broader nuclear security mission, which includes requirements for developing a variety of radiation detection technologies.

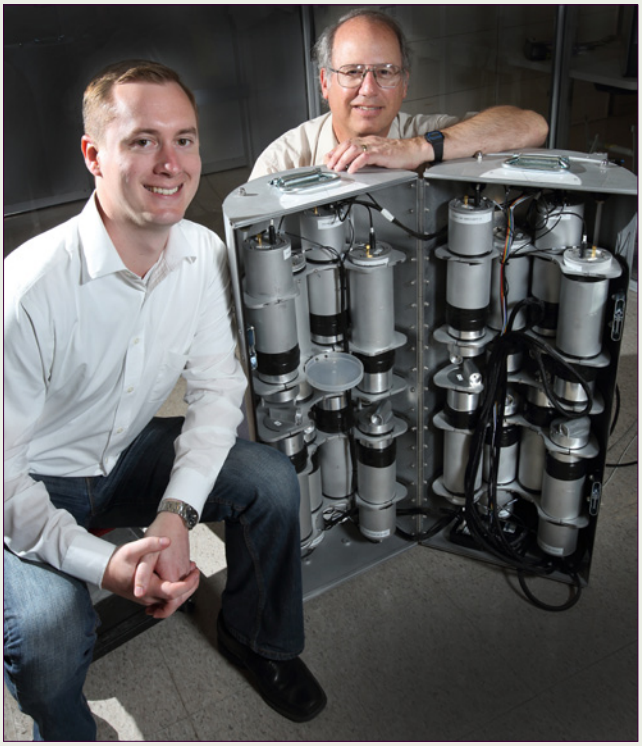
MINER is essentially a portable neutron scatter camera, which locates the source of fast neutrons coming from special nuclear material (SNM), even at significant distances and through shielding. MINER has improved on the original neutron scatter camera, reducing weight from 180 to 90 pounds, reducing height from 5 to 3 feet, and operating on batteries instead of requiring externally supplied power.

MINER consists of 16 proton-rich liquid scintillator cells arranged inside a large cylinder. The "scattering" comes into play when neutrons travel through the scintillator cells and bounce off protons like billiard balls. Those interactions enable the instrument to determine the direction of the radioactive source that emitted the neutrons.

As a neutron scatter camera, MINER has several advantages over other types of detectors, including the ability to discriminate the target signature from background radiation and measure the energy spectrum of the target's neutrons, which allows it to distinguish plutonium, for example, from other common commercial sources of neutrons.



Example of a MINER setup (left) and a rendering of the image it would generate (right) if a neutron source, such as SNM located in the area of the star, was detected in a shipping container.



SNL physicists Mark Gerling (left) and John Goldsmith with the MINER detection system opened to show the 16 liquid scintillator detector cells. Photo by Dino Vournas

In 2014, DNN R&D sponsored a successful demonstration of MINER where the capability was tested and verified for use as a homeland security application. Since then, SNL has been looking at other techniques to enable MINER to provide additional information, such as the mass of fissile material. The manager of the SNL department responsible for the development of MINER, Craig Tewell, explains, "When used as a neutron scatter camera, MINER is closed. But the system can be opened to gather additional information about the source by exploiting the timing distribution between correlated pairs of gamma rays and neutrons."

These exciting developments, advanced by SNL's expert physicists, will further enhance the measurement capabilities of MINER and increase its value to the proliferation detection mission.

Radiological Security Partnership: Secure Your Business, Your Community, and Your Country

By Kristina Hatcher

DNN has launched a targeted outreach campaign to prompt U.S. sites with Category 1 radioactive sources to volunteer to enhance their security beyond regulatory requirements. The outreach campaign, titled the "Radiological Security Partnership," includes email outreach, phone calls, webinars, and an online portal (http://nnsa.energy.gov/RSP).

In the United States there are roughly 450 buildings that house Category 1 radiological materials. As defined by the International Atomic Energy Agency (IAEA) Code of Conduct on the Safety and Security of Radioactive Sources, Category 1 sources are those that pose the greatest potential health risks if not handled properly, such as cobalt-60 and strontium-90. DNN's Radiological Security program has been working with Category 1 and 2 licensees since 2008 to enhance security beyond their regulatory requirements and to date has secured 300 of 450 buildings.

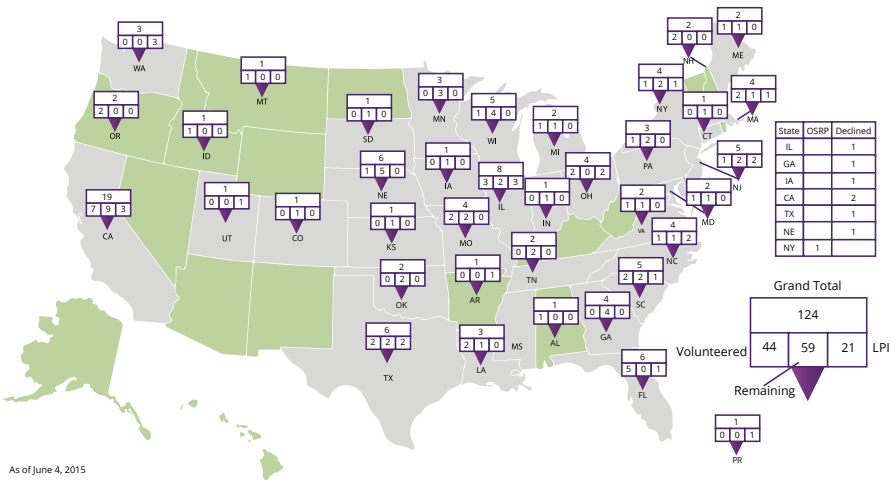
At the 2014 Hague Nuclear Security Summit (NSS), the United States and 23 other countries agreed to a set of actions—termed a "gift basket"—to secure all Category 1 radioactive sources within their territory by 2016. Toward that end, Congress has provided additional funding to DNN this year specifically set aside for U.S. Category 1 license holders to meet the goals set forth at the NSS and to demonstrate the U.S. commitment to global partners. While U.S. Nuclear Regulatory Commission requirements

"Gift Basket" to Secure Category 1 Sources

The signatories to the 2014 Nuclear Security Summit gift basket on Category 1 radioactive sources agreed to secure their materials consistent with the IAEA Code of Conduct, which calls for each signatory to:

1. Support an independent regulatory body
2. Establish a comprehensive lifecycle management plan
3. Develop a comprehensive plan for sources out of regulatory control
4. Assess the domestic threat and develop a national response plan
5. Implement site level security measures
6. Provide rapid response to unauthorized attempts to access radioactive material

In addition, the gift basket text recommends that states institute additional security best practices such as: multifaceted access controls; active involvement of off-site response including law enforcement during a nuclear security event; a holistic framework that governs secure transportation, possession, and disposition; monitoring systems with defense in depth; and enhancements to increase the amount of time required to remove a source from its authorized location.



Progress toward enhancing security at 153 additional facilities across the United States that house Category 1 radioactive sources.

DNN Promotes Radiological Security Partnership Campaign – *Continued*

for license holders are consistent with the IAEA Code of Conduct, the NSS commitment highlights the opportunity for licensees to develop additional best practices by volunteering for security enhancements provided by DNN's Radiological Security program.

The 150 remaining sites for enhanced security are located throughout the United States and consist of large cobalt-60 gamma irradiation facilities, aerospace research companies, cancer treatment facilities, and hospitals. Since December 2014, 44 sites have volunteered for the program. DNN is working aggressively in the lead up to the next Nuclear Security Summit to target the remaining Category 1 licensees.

Under the Radiological Security Partnership, security experts provide assessments, share observations and make recommendations for enhancing material security. When appropriate, DNN funds the installation of agreed upon security enhancements. Typical security enhancements include: automated access control; motion sensors; radiation sensors; electronic seals; alarm control and display systems; remote monitoring of licensee facilities at off-site response locations; enhanced security force communications and protection equipment; delay elements; and transportation security enhancements, when appropriate. DNN also provides cost-free alarm response training for law enforcement and site personnel at the Y-12 National Security Complex in Tennessee.

In addition to offering voluntary security enhancements, DNN helps licensees dispose of unwanted material through the Off-Site Source Recovery Project (OSRP). OSRP has a mission to remove excess, unwanted, abandoned, or orphan radioactive sealed sources that pose a potential risk to health, safety, and national security.

Kristina Hatcher manages the Office of Radiological Security's Domestic Radiological Security Program.

IAEA Co-hosts 25th International Nuclear Material Protection Course at Sandia National Laboratories

Photos by Randy Montoya, Sandia National Laboratories

Anne Harrington, DNN Deputy Administrator, addresses the media on April 20, 2015, during welcoming ceremonies for the 25th International Training Course on the Physical Protection of Nuclear Material and Nuclear Facilities. Looking on are Sandia National Laboratories Director Paul Hommert (left), who has since retired, and Denis Flory, Deputy Director General for Nuclear Security at the International Atomic Energy Agency.

Denis Flory and Anne Harrington examine sensors used in detecting the failure of nuclear reactors during a tour with Dept. 6230 Senior Manager Susan Pickering at Sandia's Training and Technology Demonstration Area as part of the welcoming ceremony for the 25th International Training Course.

Exercise Series Strengthens Rad Transportation Security Across U.S.

By Mark West and Todd Cannan

RADIOACTIVE MATERIAL HIJACKED

April 10, 2014 – Two trucks carrying highly-radioactive material were hijacked by a group of armed assailants from a truck stop located several miles outside a major metropolitan area. The trucks were last seen getting on the highway; the current whereabouts of the assailants is unknown.

While the preceding event may appear as if it was "ripped from the headlines," in reality it was a fictitious scenario used during a radiological transportation security table top exercise (TTX) sponsored by DNN's Office of Radiological Security (ORS). Events involving the theft of radioactive material in transit actually occurred in Mexico in 2014 and 2015, and radiography cameras are stolen regularly in the United States. DNN's Radiological Security (RS) program has partnered with the Federal Bureau of Investigation (FBI) to jointly sponsor a series of radiological transportation security TTXs in the United States. The target audience of these exercises is federal, state, and local first responders; public health personnel; and radiological shippers and carriers. The series is designed to provide these organizations with:

- Increased situational awareness regarding security incidents involving the transport of radiological materials
- Relationship building between first responders and the companies that transport these materials
- A venue to exercise security and response plans and procedures with the agencies/organizations that would be involved in a real-world incident

The TTX series is designed to enhance security awareness and response through the one-day exercises where participants work through a notional scenario focusing on a malicious event involving high-consequence radiological material in transit. ORS, in direct coordination with FBI's Weapons of Mass Destruction Directorate, Nuclear and Radiological Countermeasures Unit (NRCU), plans, develops, and facilitates the TTXs. NRCU also coordinates FBI's participation, at both the headquarters and local field office levels, for each TTX.

The concept behind the TTX series is to build on the ongoing work of ORS and the FBI to familiarize first responders and industry personnel with potential security vulnerabilities associated with radiological material transport. One of the main goals of the series is to promote cross-sector communication and cooperation among federal, state, local, and private industry stakeholders when dealing with a security-related incident or event involving radioactive material in transit. The TTX scenarios and discussion, which include preventative actions and en-route measures, primarily focus on crisis management and also address initial actions for consequence management, such as immediate post-event recovery efforts. Each scenario is tailored specifically to the exercise location and features local threat information and response assets to ensure the TTX is credible and relevant to the participants.

At the conclusion of each TTX, ORS conducts a post-exercise debrief to capture lessons learned and follow-up issues for an after-action report.

To date, exercises have been conducted in Wytheville, Virginia; Oriskany, New York; and Buffalo, New York. Future exercises for FY 2015 are scheduled for Little Rock, Arkansas; Detroit, Michigan; Albuquerque, New Mexico; and Columbia, South Carolina.

Exercise players consider response options during the TTX held at the New York State Preparedness Training Center in Oriskany.

Mark West is the federal manager for transportation tabletops within the Office of Radiological Security. Todd Cannan is a Senior Exercise Specialist and Principal with Summit Exercises and Training. He has conducted exercises and workshops for DNN's Office of Global Material Security and NNSA since 2009.

NNSA Program Develops the Next Generation of Nuclear Security Experts

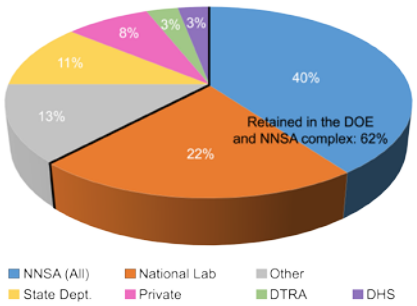
By Cornelia Brim and Maren Disney

You hear about it all the time—organizations acknowledging their staff members as their greatest asset. What you do not hear about as often are the investments to cultivate that asset. One of the ways NNSA is fostering the next generation of nuclear security experts is through its NNSA Graduate Fellowship Program (NGFP).

NGFP offers its Fellows an exceptional career development opportunity through hands-on experience supporting NNSA mission areas across policy and technology disciplines. This program has grown from its inception in 1995 as a small program in DNN with 3 graduate students, to an NNSA-wide program with more than 40 Fellows in the class of 2015.

The one-year fellowships give tomorrow's leaders in global nuclear security and nonproliferation unparalleled exposure to NNSA and the National Laboratories through assignments to program offices across NNSA. Although originally a nonproliferation program, expanding the program in recent years has allowed Fellows to contribute to a wide range of projects supporting DNN such as developing a framework for engaging national nuclear forensics libraries to support outreach with international partners, coordinating an interagency working group on export controls, assisting with the U.S. delegation to the International Atomic Energy Agency General Conference, assisting with the DNN Cyber Task Force to strengthen cybersecurity protection for nonproliferation activities, and co-leading interagency collaborations between DNN and the Department of Homeland Security on alternative technologies.

Placement of NGFP Alumni



With 62% of NGFP alumni employed in the DOE/NNSA complex, the program is developing the next generation of nuclear security experts.

NGFP is managed under NNSA's Office of Management and Budget and administered by the Pacific Northwest National Laboratory (PNNL). Together, NGFP's federal and PNNL program managers develop and implement an outreach strategy based on program objectives, the results of an annual NNSA hiring needs assessment, partnerships with NNSA offices requesting Fellows, and engagement with universities and professional societies. As NNSA missions evolve and technical challenges grow increasingly complex, the NGFP recruiting responds. For example, for the outgoing NGFP class, the program recruited 34% more technical applicants than in previous years. NGFP also broadened its mission impact for the incoming class with two of the Fellows assigned to the U.S. Department of State.

The fellowships begin in June with orientations at PNNL in Richland, Washington, and NNSA Headquarters in Washington, D.C. Other events include DOE leadership and national laboratory roundtables, briefings with various congressional committees, and alumni networking events to bring the current

Earlier this year, DNN Principal Assistant Deputy Administrator David Huizenga moderated the NGFP Alumni Forum with NGFP Alumni (left to right) Lauren Lafaro (2008), Courtney Stewart (2007), Claudio Gariazzo (2002), and Peter Sprunger (2011).

NGFP Continues to Foster Future Nuclear Security Experts – *Continued*

Fellows together with former Fellows and other leaders from the nuclear security complex.

Recruitment for the 2016 class is under way. The application system opened in May and will close October 19, 2015. Interviewing and hiring will begin in the fall. Outreach and recruitment activities span the country, with recruiters visiting dozens of top-tier universities both in person and virtually. More information on the program, recruitment and applications process is available by visiting http://ngfp.pnnl.gov.

The invaluable experiences and networking opportunities afforded by the NGFP are helping to build the workforce of the present and future: 62% of alumni are employed in the DOE/NNSA complex, and more than 80% of alumni overall are employed in various positions supported by the U.S. Government.

"As this program moves forward, I'm thrilled to see it continue to grow and recruit the top talent in nuclear security policy, science, and engineering. The breadth and impact of the NNSA Graduate Fellowship Program is clearly evident, and its future potential seems unlimited," said Madelyn Creedon, NNSA Principal Deputy Administrator, who recently spoke at the NGFP Alumni Forum.

See NNSA's recent blogs on the outgoing and incoming Fellows at:

- http://nnsa.energy.gov/blog/pnnl-hosts-nnsa%E2%80%99s-graduate-fellowship-program-closing-ceremony
- http://nnsa.energy.gov/blog/nnsa-graduate-fellowship-program-class-2016

Cornelia Brim and Maren Disney are senior communications specialists at PNNL.

NGFP Alumna Personifies Success of Program for Fellows and Their Future Employers

Joyce Connery, an alumna of the NNSA Graduate Fellowship Program, can testify to the impact of this program on a young professional's career and to the infusion of enthusiasm and energy Fellows bring to their current and future employers. "The on-the-job training I got in Kazakhstan pushed me into the field of nonproliferation. I would be doing something completely different if it weren't for NGFP." Fortunately she embraced the opportunity and the nation has benefitted from her service to the nonproliferation mission ever since.

Connery currently serves as Director of Nuclear Energy Policy within the Office of International Economics on the National Security Council in the White House, a position she has held since 2012. In this role she develops policy among agencies and aligns and coordinates programs covering nuclear safety, security, and nuclear trade. She recently was nominated by the White House to become the chair of the Defense Nuclear Facilities Safety Board.

As part of her one-year NGFP fellowship, Connery (Class of 1999), served in Kazakhstan with Argonne National Laboratory-East, leading nonproliferation efforts including export control and industrial outreach. This assignment brought her back to a part of the world where she had worked before, as a Peace Corps volunteer.

Connery stayed in Kazakhstan after her fellowship, working for Argonne National Laboratory-West, overseeing the decommissioning of the BN-350 fast breeder reactor. Since then, she served in various capacities within NNSA and in the National Security Council under the Obama and Bush administrations. Over the course of her career her exemplary service has been recognized; she received the NNSA's Silver Medal, the Secretary of Energy's Distinguished Service Award, and a Presidential Citation from the American Nuclear Society.

Reflecting on her NGFP experience, Connery offered the following advice to the current NGFP class: "Get the most of your experience by working with your 'cohort' (fellow NGFPers) to find out what they are doing to get a broader perspective. Do not limit yourselves to the narrow job description, but branch out to get involved in other issues in which you are interested. Network—not with any particular goal in mind, but to meet new people with different perspectives."

And Connery also encourages NNSA and interagency program managers to support and work with NGFP Fellows: "This is the future of the Department. Your Fellows may not stay in your organization but they will be forever connected to your organization after they leave and will be able to recommend folks to you and vice versa. They will be able to work better through the interagency because of their understanding of what you do. They are young and enthusiastic and can bring a whole different vibe to your organization."

DNN Expert Profile: Heather Dion

The nuclear nonproliferation mission requires access to scientific and technical expertise that often is not available at Headquarters. When DNN decided to develop a focused program on international nuclear forensics it sought out a laboratory specialist with the right balance of technical background and policy awareness to help define the mission, vision, and scope of the fledgling program. In 2010, Dr. Heather Dion was identified as the right fit for the job, and was detailed from Los Alamos National Laboratory (LANL) to join the DNN team. To support the rapidly growing international program and take maximum advantage of Dr. Dion's expertise, DNN decided to shift her to working through an Intergovernmental Personnel Act (IPA) agreement, which allows her to function with the decision-making authority of a federal employee.

Nuclear forensics came to the forefront of the national stage through the Nuclear Security Summit of 2010. Dr. Dion explains, "Before the Summit, the vast majority of nuclear forensics work was being conducted by the weapons states, however, after the Summit, we had the backing of all the participating heads of state to move forward on developing capabilities in nuclear forensics for a much larger audience." What was then a manageable scope of work, mushroomed overnight and DNN's small program was inundated with requests for nuclear forensics assistance and technical cooperation.

Dion has spent much of her time on the road and routinely spends more time out of the office than in. This dedication has paid off and what started as a small effort to establish a nuclear forensics outreach program, formerly the International Nuclear Forensics Cooperation program under DNN's Office of Nonproliferation and Arms Control Office (NPAC), has increased into an internationally recognized effort to support countries in their refinement and development of an integrated nuclear forensics capability. The program is now part of DNN's Office of Global Material Security Nuclear Smuggling Detection and Deterrence (NSDD) Program. Dion prides herself in helping international partners understand the importance of nuclear forensics in supporting law enforcement, uncovering the origin of interdicted nuclear or radioactive materials, and encouraging better safeguards and security practices around existing nuclear facilities.

One specific example is Dion's contribution to the U.S.–Japan Nuclear Security Working Group, a White House-led activity established in 2011 to support the Nuclear Security Summit process. Dion serves as the U.S. chair for two working groups: one to advance the technical aspects of nuclear forensics and the other to develop a coordinated national response for using nuclear forensic assets. This type of high-level government-to-government interaction invigorates Dion. She is a self-proclaimed challenge seeker and finds the interface between the technical and policy world as constantly pushing her to be innovative and strategic in her actions.

The Nuclear Security Summit may have brought nuclear forensics onto the international stage, but without the support of implementation focused organizations, little progress at a national level would be made. Dion recognized this need and supports a number of efforts focused on reaching the working-level community. Her frequent role as subject matter expert to the Global Initiative to Combat Nuclear Terrorism (GICNT) and the IAEA helps move nuclear forensics forward on both the global and national agendas. She recently served on the organizing committee for the IAEA's first International Advances in Nuclear Forensics Conference held in July 2014 at the IAEA's Headquarters in Vienna and often serves as a facilitator at GICNT events.

The **Intergovernmental Personnel Act Mobility Program** provides for the temporary assignment of personnel between the federal government and state and local governments, colleges and universities, Indian tribal governments, federally funded research and development centers, and other eligible organizations.

To learn more, go to https://www.opm.gov/policy-data-oversight/hiring-authorities/intergovernment-personnel-act/#url=Overview.

Mo-99: Industry Role in Meeting the Nonproliferation Challenge of Medical Isotope Production

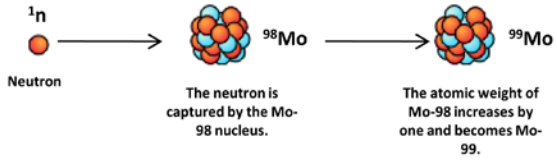
By Savannah Fitzwater

What do you do when a medical isotope that is used in over 50,000 medical procedures in the United States each day is 100% supplied by foreign vendors, most of which use highly enriched uranium (HEU) in the production process? As part of NNSA's efforts to minimize the use of HEU in civilian applications, the Material Management and Minimization Office (M^3) is working with commercial partners to accelerate the establishment of a reliable supply of molybdenum-99 (Mo-99) in the United States, produced without HEU. The decay product of Mo-99, technetium-99m (Tc-99m), is used to diagnose heart disease and cancer, to study organ structure and function, and to perform other important medical applications. For example, patients undergoing a common procedure—the cardiac "stress test"—likely have benefited from Tc-99m.

Today Mo-99 is produced mainly in aging research reactors that in recent years have experienced an increased frequency of unplanned outages. Some of these outages have caused global Mo-99 supply shortages, in some cases forcing hospitals to delay critical patient treatment. With the planned shutdown of Canada's NRU reactor—historically the United States' largest supplier—in late 2016, NNSA has been working since 2009 to accelerate commercial production of Mo-99 in the United States by supporting a variety of innovative technologies that do not use HEU.

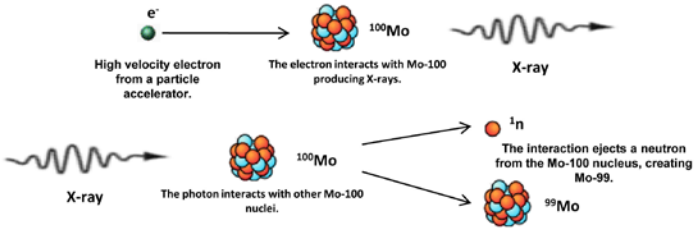
NNSA is using cooperative agreements that provide up to $25 million in matching funds, based on a 50/50 cost-share between NNSA and the U.S. commercial partners, to support the development of non-HEU-based Mo-99 production. NNSA currently has cooperative agreements for three projects with two partners: Northstar Medical Radioisotopes and SHINE Medical Technologies. A key pillar of the program is NNSA's technology-neutral approach, which recognizes that a successful solution to prevent a shortage of Mo-99 is more likely to be found through the parallel development of several production technologies.

Northstar Medical Radioisotopes is developing both neutron capture and accelerator-based technologies, which will utilize NorthStar's RadioGenix™ Tc-99m Generating System. NorthStar's neutron capture technology will be based at the University of Missouri Research Reactor (MURR) in Columbia, Missouri and will use molybdenum-98 (Mo-98) to capture neutrons produced in MURR. The additional neutrons create Mo-99 from Mo-98, as the atomic weight increases.



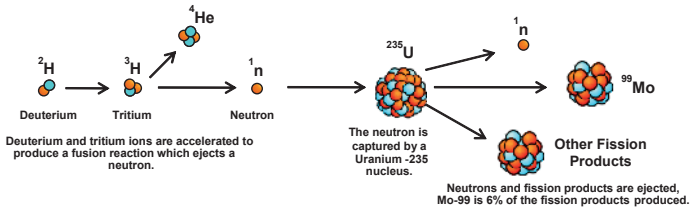
Neutron Capture Technology

NorthStar's accelerator-based technology will be based in Beloit, Wisconsin and will use an accelerator to bombard molybdenum-100 (Mo-100) with electrons, causing the Mo-100 to lose a neutron and become Mo-99.



Accelerator-Based Mo-100 Technology

SHINE Medical Technologies is developing an accelerator technology with low enriched uranium (LEU) fission. SHINE's accelerator technology hits a neutron against a uranium-235 nucleus to break out Mo-99, among other fission products. SHINE's accelerator technology is based in Janesville, Wisconsin.



Accelerator-Based LEU Fission Technology

Savannah Fitzwater was an NNSA Graduate Fellow in the Mo-99 program with DNN's Office of Material Management and Minimization.

COUNTRY PROFILE: JORDAN

Building Capacity to Support a Secure Nuclear Future

Jordan is a key partner for the United States and DOE in reducing nuclear security risks in the Middle East. With Iraq and Iran to the east; Israel and Egypt to the west; Syria, Lebanon, and Turkey to the north; and Saudi Arabia and the Gulf of Aqaba to the south, Jordan sits at the center of Middle East geopolitical dynamics. Historically, Jordan has been a crossroads for trade and transit, putting it on the frontline for combatting illicit trafficking in the region. As a country that must import the majority of its energy resources, Jordan is including nuclear energy as part of a long-term solution to energy demands. Jordan is already well on its way to begin operations at its new research reactor by the end of 2015.

DNN has cooperated with Jordan in building its capabilities in nuclear and radiological security for the past 10 years. This includes improving physical security measures at multiple facilities and deploying radiation detection systems at seaport and border crossing sites. DNN also has provided training courses and workshops for Jordanian participants both within the United States and in Jordan, covering topics such as physical protection of nuclear materials and nuclear facilities, drafting safeguards regulations, and handling samples and categorizing materials in the early stages of a nuclear forensics investigation.

Keep reading to learn more about specific collaborative activities where DNN has shared its expertise to help Jordan prevent nuclear proliferation and become a regional leader in nuclear security.

Commodity Identification Training and Tabletop Exercise

Jordanian border enforcement agencies understand the importance of recognizing legitimate commercial equipment and materials that also can be used in the manufacture of weapons of mass destruction (WMD)—so-called dual-use items—as well as specific chemical, biological, radiological, nuclear, and explosives (CBRNe)-related commodities that can be used in improvised WMD devices. Recently, two NNSA programs worked collaboratively with the Government of Jordan to combine a Commodities Identification Training (CIT) workshop and a WMD counterterrorism tabletop exercise (TTX) into a training course, which was held in April 2015 at the Middle East Scientific Institute for Security (MESIS). Jordan Customs Department and other Jordanian security organizations, including the Armed Forces, Public Security Directorate, and General Intelligence Service, participated.

DNN's Office of Nonproliferation and Arms Control, in coordination with the U.S. Department of State's Office of Export Control Cooperation, began this combined training with its CBRNe version of the CIT training curriculum.

Jordan's Nuclear History in Brief

1978 — Safeguards agreement in place with the International Atomic Energy Agency (IAEA)

1998 — Additional Protocol in place with IAEA

2007 — Jordan Atomic Energy Commission (JAEC) established and charged with moving Jordan from a net energy importer to a net exporter

Jordan Nuclear Regulatory Commission (JNRC) established

JNRC merged into the Energy and Minerals Regulatory Commission (EMRC)

2014 — An IAEA review conducted upon Jordan's invitation reported favorably on the country's preparations for nuclear power

2015 — Anticipated completion of research and training reactor at Jordan University for Science & Technology; the reactor also will be used to produce medical isotopes

Country Profile: Jordan – *Continued*

CBRNe CIT workshops enhance law enforcement officials' capacity to detect and interdict CBRNe commodities to prevent their use, particularly by non-state actors and terrorist organizations. Through technical presentations tailored for airport, seaport, and land border officers, subject matter experts from the Oak Ridge, Savannah River, and Pacific Northwest National Laboratories taught Jordanian officials to visually recognize material, equipment, and components required to develop and use CBRNe-based improvised devices.

NNSA's Office of Counterterrorism Policy and Cooperation led the second part of the course—the "Jordan Discovery" TTX. The TTX began with a review of the international and regional WMD terrorism threat and relevant national laws and international frameworks used to counter that threat. The TTX's fictitious scenario involved three distinct "moves" of commodities covered in the CBRNe CIT workshop. Participants were challenged to identify "red flags" indicating illegal transport activity, recognize what was being transported, discuss agency lines of authority and interagency communication, and identify the country's standard operating procedures to be followed during the interruption of a CBRNe-related terrorist plot. Participants appreciated that the workshop and TTX focused on preventing the assembly and use of an improvised WMD device, rather than how to respond after a detonation or harmful release has occurred.

The workshop's discussions and exercises focused on a cooperative approach to implementing the IAEA Nuclear Security Series guidance related to MORC. Sessions explained all IAEA Member States' responsibilities to establish, implement, maintain, and sustain a nuclear security regime to protect persons, property, society, and the environment from the harmful consequences of a nuclear security event. Further emphasis centered on regulatory provisions that would provide competent authorities with administrative and enforcement powers, as well as sufficient and sustainable resources.

Throughout the workshop, NSDD representatives emphasized the concept of a sustainable regulatory structure as a key component to any state's nuclear security approach. Representatives from EMRC presented on Jordan's regulatory framework and status of detection systems. Further conversations focused on having appropriate memoranda of understanding between the competent Jordanian authorities that define clear roles, responsibilities, and communications. Finally, smaller groups worked on identifying potential gaps in regulatory structures, enhancing interagency communications and coordination, and using available tools to evaluate regulations and conduct a gap analysis.

Contributions to this article were provided by Troy Wright, Shayne VanDyke, Kelly Bray, Laurel Cotton, and staff writers.

Strengthening Jordan's Regulatory Structure for Nuclear Security

In March 2015, DNN's Nuclear Smuggling Detection and Deterrence (NSDD) Program and its Jordanian partners held a joint workshop to assess and strengthen Jordan's regulatory framework with respect to material out of regulatory control (MORC). Participants represented multiple Jordanian agencies, including the Energy and Minerals Regulatory Commission (EMRC), Ministry of Interior, General Intelligence Directorate, the Jordan Atomic Energy Agency, Civil Defense, Ministry of Foreign Affairs, and Public Security, as well as the International Atomic Energy Agency (IAEA).

Participants in the working group meeting with Jordan, IAEA, and DOE/NNSA to strengthen Jordan's regulatory framework for detection and response to materials out of regulatory control.

FAQs: Reports Reflect the Evolving Nature of Nuclear Nonproliferation

March 2015 saw the release of two reports focusing on DNN and its future challenges: *Prevent, Counter, and Respond—A Strategic Plan to Reduce Global Nuclear Threats (FY 2016–FY 2020)*, was released March 23, and the *Secretary of Energy Advisory Board, Report of the Task Force on Nuclear Nonproliferation* was released on March 31. They are available through the NNSA and DOE websites at:

- http://nnsa.energy.gov/aboutus/ourprograms/dnn/npcr
- http://energy.gov/seab/secretary-energy-advisory-board-seab-task-force-nuclear-nonproliferation

The answers below address several of the frequently asked questions about the two reports.

Prevent, Counter, and Respond

Why is the document referred to as the NPCR Report?

The report describes, in one document, the strategic approach and program activities that NNSA is taking to reduce global nuclear dangers. The "N" is used to show that this is an NNSA report. P-C-R is short-hand for "Prevent, Counter, and Respond," the three strategic pathways that NNSA is using to organize and direct its nuclear nonproliferation and counter terrorism program planning.

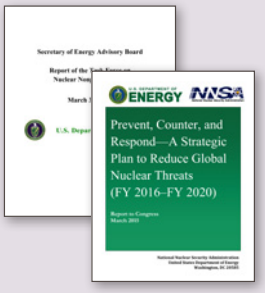
What does Prevent, Counter, and Respond mean?

The three missions describe the breadth of the NNSA approach to addressing nuclear threats across the nuclear threat spectrum:

1. **Prevent** non-state actors and additional countries from developing nuclear weapons or acquiring weapons-usable nuclear materials, equipment, technology, and expertise; and **prevent** non-state actors from acquiring radiological materials for a radiological threat device.

2. **Counter** the efforts of both proliferant states and non-state actors to steal, acquire, develop, disseminate, transport, or deliver the materials, expertise, or components necessary for a nuclear or radiological threat device or the devices themselves.

3. **Respond** to nuclear or radiological terrorist acts, or accidental/unintentional incidents, by searching for and rendering safe threat devices, components, and/or radiological and nuclear materials, and by conducting consequence management actions following an event to save lives, protect property and the environment, and enable the provision of emergency services.



Was this report required by Congress?

No, the report responds to Secretary of Energy Moniz's request (as recommended by the Secretary of Energy Advisory Board's Task Force on Nuclear Nonproliferation) for NNSA to articulate for the first time, in a single document, the NNSA program activities to reduce the threat of nuclear proliferation and nuclear terrorism. As such, the NPCR report serves as a companion piece to the DOE/NNSA annual *Stockpile Stewardship and Management Plan*, which describes in detail the programs within the NNSA's Weapons Activities appropriation account.

Secretary of Energy Advisory Board Report

What actions is DNN taking to address the recommendations in the final report?

For those recommendations focused on DNN activities, DNN has already responded to a number, such as:

- Creating the *Prevent, Counter, and Respond* report;
- Establishing the DNN Science Council to improve integration of the National Labs, plants, and sites into DNN policy and planning; and
- Standing up a Strategic Planning and Integration Office as part of the DNN office realignment implemented in January 2015, to manage the DNN-wide strategic planning and analysis that will allow DNN to better anticipate, and prepare for, evolving and emerging threats to nuclear nonproliferation and security.