Testimony of
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Chairman Ratcliffe, Ranking Member Richmond, and distinguished Members of the Subcommittee. Thank you for the opportunity to testify before you today. I am honored to join my esteemed colleagues from the U.S. Department of Homeland Security (DHS) at this hearing regarding the emerging threats we face and the development of technologies employed to defend the Homeland. Whether it is strengthening cybersecurity, combating cybercrime, protecting critical infrastructure, or preventing nuclear and radiological terrorism, DHS seeks to employ our Nation's talents and technological edge to defeat sophisticated and agile adversaries. I appreciate your attention to the threat of nuclear terrorism and your interest in the efforts and progress DHS' Domestic Nuclear Detection Office (DNDO) has made to prevent its occurrence.

As President Obama stated on March 25, 2014 at the joint press conference following the 2014 Nuclear Security Summit, "I convened the first Nuclear Security Summit in Washington four years ago because I believed that we need a serious and sustained global effort to deal with one of the greatest threats to international security -- and that's the specter of nuclear terrorism. … given the catastrophic consequences of even a single attack, we cannot be complacent." The potentially catastrophic effects of a nuclear detonation, whether executed surreptitiously by a state or a non-state actor, would have far-reaching impacts on our Nation and the world. A radiological attack, via a "dirty bomb," would result in far less destruction, but would still be extremely disruptive to our way of life.

The spectrum of nuclear security spans physical protection of nuclear and other radioactive materials, detection of such materials out of regulatory control, rendering devices safe, response and recovery to incidents, and forensics and attribution of materials. DNDO has specific, focused responsibilities for two elements in this spectrum: detection and nuclear forensics. And as reducing the risk of nuclear terrorism is a whole-of-government challenge, DNDO works with federal, state, local, tribal, territorial, and international partners as well as those in the private sector, academia, and the national laboratories to fulfill its mission.

Authorities

With the recognition of the need to focus efforts to detect nuclear and other radioactive materials that have become unsecured, DNDO was established in 2005 by National Security Presidential Directive (NSPD)-43 and Homeland Security Presidential Directive (HSPD)-14 and subsequently codified in Title V of the Security and Accountability For Every (SAFE) Port Act (Pub. L. No. 109-347), which amended the Homeland Security Act of 2002. Pursuant to section 1902 of the Homeland Security Act, DNDO is required to develop, with the approval of the Secretary and in coordination with the Departments of Energy (DOE), State (DOS), Defense (DoD), and Justice (DOJ), an enhanced global nuclear detection architecture (GNDA), and is responsible for implementing the domestic portion.

The architecture serves as a framework for detecting (through technical and non-technical means), analyzing, and reporting on nuclear and other radioactive materials that are out of regulatory control. Non-technical detection refers to an alert from law enforcement or intelligence efforts and collected by GNDA partners under their statutory authorities and consistent with national policy. DNDO is also charged to enhance and coordinate the nuclear detection efforts of federal, state, local, and tribal governments and the private sector to ensure a managed, coordinated response. To accomplish this, DNDO leads programs to conduct transformational research and development for advanced detection technologies, deploy nuclear detection capabilities, measure detector system performance, and ensure effective response to detection alarms.

In 2006, DNDO's National Technical Nuclear Forensics Center was established by NSPD-17/ HSPD-4 and later authorized by the 2010 Nuclear Forensics and Attribution Act (Pub. L. No. 111-140) with the mission of characterizing radiological and nuclear devices prior to detonation. DNDO was given responsibilities to provide centralized stewardship, planning, and integration for all federal nuclear forensics activities. The Act also established the National Nuclear Forensics Expertise Development program and required DNDO to lead the development and implementation of the National Strategic Five-Year Plan for Improving the Nuclear Forensics and Attribution Capabilities of the United States.

These authorities have directed our focus in preventing nuclear terrorism through the enhancement of nuclear detection and technical forensics capabilities. In both instances, we rely on the critical triad of intelligence, law enforcement, and technology. Thus, to maximize the Nation's ability to detect and interdict a threat, it is imperative that we apply detection technologies in operations that are driven by intelligence indicators, and place them in the hands of well-trained law enforcement and public safety officials. Similarly, to enhance attribution capabilities, the U.S. Government (USG) must ensure that information from law enforcement, intelligence, and technical nuclear forensics is synthesized to identify the origin of the material or device and the perpetrators.

While we have made significant improvements in both detection and forensics over the years, the threat of nuclear terrorism persists, and requires constant vigilance.

Developing the Global Nuclear Detection Architecture

Cited in Presidential Directive and legislation, the GNDA is a multi-faceted, layered, defense-in-depth framework, with the objective of making the illicit acquisition, fabrication, and transport of a nuclear or radiological device or material prohibitively difficult. DNDO relies on a well-conceived arrangement of fixed and mobile radiological and nuclear technical detection capabilities to present terrorists with many obstacles to a successful attack, including greatly increasing costs, difficulty, and risk.

To develop the architecture, DNDO assesses current and planned capabilities against the evolving radiological and nuclear threat, using rigorous risk assessments, for example. Since 2007, and as directed by HSPD-18 (Medical Countermeasures against Weapons of Mass Destruction), DNDO has collaborated with the DHS Science & Technology Directorate (S&T) to produce the Integrated Chemical, Biological, Radiological, and Nuclear Terrorism Risk Assessment. DNDO leads the biennial radiological and nuclear terrorism risk assessment, which is then combined with similar biological and chemical risk assessments. In order to better inform resource allocation decisions, DNDO has improved the threat models in the risk assessment by adding an adaptive, intelligent adversary model and is

working with DOE's National Laboratories to enhance improvised nuclear device models. DNDO has also supported DHS risk assessments such as the Strategic National Risk Assessment and the Homeland Security National Risk Characterization. DNDO is also working with operational partners to develop models that will provide vulnerability estimates for the risk assessment and more refined estimates for impacts to operations.

To guide the strategic direction of the GNDA, the USG interagency developed the first-ever Global Nuclear Detection Architecture Strategic Plan in December 2010. In April 2012, the Secretary of Homeland Security issued a DHS Global Nuclear Detection Architecture Implementation Plan, which identified priorities, necessary capabilities, and monitoring mechanisms to assess progress. Recently, DNDO has worked with interagency partners to update the Global Nuclear Detection Architecture Strategic Plan. The 2014 Strategic Plan presents an updated definition and vision for the GNDA, as well as a mission, goals, and objectives for interagency efforts to detect, analyze, and report on nuclear or other radioactive materials that are out of regulatory control.

While USG efforts and programs are critical, developing a *global* nuclear detection architecture relies largely on the decisions of sovereign foreign partners to develop and enhance their own national and regional detection programs. DNDO contributes to interagency efforts led by the Department of State by laying the groundwork to assist partner nations in developing defense-in-depth approaches to detecting illicitly trafficked nuclear or other radioactive materials. DNDO has also assisted in the development of guidelines and best practices through the Global Initiative to Combat Nuclear Terrorism and the International Atomic Energy Agency (IAEA) to outline the key characteristics of an effective architecture. To date, IAEA has used these guidelines and best practices in six regional training courses to help 42 nations initiate planning of national-level detection architectures, with over 100 planners trained in architecture development. To make the course available to a broad set of stakeholders, DNDO assisted the IAEA in conducting a train-the-trainer session to further expand the instructor pool to allow for English, Spanish, and French language versions of the course. This strategic partnership will continue to serve as a force multiplier for USG nuclear security efforts for years to come.

Conducting Transformational Research and Developing Systems

Pursuant to Presidential Directive and the law, DNDO is also responsible for conducting an aggressive, evolutionary, and transformational program of research and development to generate and improve technologies to detect nuclear and radioactive materials. DNDO's transformational research and development efforts seek to achieve dramatic advancements in technologies to enhance our national detection and forensics capabilities. These developments may also reduce the cost and operational burden of using advanced technology in the field to maintain an enhanced level of protection. Annually, DNDO updates its research and development strategy based on prevailing risk, advancements in technology, and the availability of funding. By supporting technological advancement for both nuclear detection and forensics, DNDO achieves a strategic and fiscal benefit for the government.

Although significant progress has been made in addressing the gaps and needs of the GNDA and nuclear forensics, several challenges remain that require sustained investment. DNDO's technical challenges include the need for systems that:

- Are cost-effective with sufficient technical performance to ensure widespread deployment;

- Can detect special nuclear material, such as plutonium and uranium, even when heavily shielded;
- Facilitate enhanced wide-area searches in a variety of scenarios, to include urban and highly cluttered environments;
- Can be used to monitor traffic in challenging pathways, such as between ports of entry along our land and sea borders; and
- Determine the origin and manufacturing process of seized material.

DNDO has and will continue to advance fundamental knowledge in nuclear detection and forensics through a sustained long-term investment in the Exploratory Research program and Academic Research Initiative. These efforts directly address the aforementioned challenges through basic and applied research to feed more mature research and development projects such as DNDO's Advanced Technology Demonstrations.

To develop essential technical expertise while advancing fundamental knowledge in nuclear sciences, DNDO invests in academic research through the Academic Research Initiative, supporting the next generation of scientists and engineers in areas such as advanced materials, nuclear engineering, radiochemistry, and deterrence theory. Since inception in 2007, DNDO has awarded 77 grants to 50 academic institutions, and supported over 400 students. On average, this program support results in over 50 journal papers per year. We are beginning to see these projects move up the technology pipeline. A new room temperature thallium-based semiconductor detector was transferred from Northwestern University to our Exploratory Research program and is now in its preliminary design review phase of development. Nuclear resonance cross sections measured at Duke University are being used in our shielded special nuclear material detection projects, and background radiation measurements performed by University of California at Berkeley are being used in support of programs across the interagency.

Several DNDO-sponsored research efforts have also led to new commercial products that provide enhanced operational capabilities to federal, state, and local law enforcement and public safety personnel. Even before a Helium-3 shortage was identified, DNDO teamed with the Defense Threat Reduction Agency to explore options for better, more cost-effective alternatives for neutron detection.[1] For portal systems, which require the largest quantities of this gas, DNDO worked with industry and is now deploying alternative detection technologies that do not require Helium-3. This enables the country to devote the scarce supplies of Helium-3 to those applications where no substitutes are possible. We have tested Helium-3 alternative technologies for use in mobile, backpack, and handheld radiation detectors, several of which have already shown performance superior to the current-generation technologies. Importantly, due to a collaborative USG-wide effort to address the shortfall, our USG strategic reserve of Helium-3 can meet demand beyond FY2040.

Other recent DNDO technological successes that transitioned from laboratories to commercially available products include:

[1] Helium-3 is a gas that is widely used to detect neutrons that are emitted by certain nuclear and other radioactive materials. Helium-3 results from the radioactive decay of tritium. As the need for tritium for nuclear weapons decreased, so too did the availability of Helium-3.

- Advanced radiation sensing materials such as cesium lithium yttrium chloride, strontium iodide, and stilbene, which have enhanced detection characteristics and can be used to build more capable systems featuring simplified electronics, low power requirements, and greater reliability;
- New electronics and advanced algorithms, for data processing for identifying radioisotopes that support networked radiation detection for improved wide area search capabilities;
- Compact dual-energy x-ray generators with improved density discrimination and higher shielding penetration that have been integrated into commercially available mobile radiography systems; and
- Software to automatically detect special nuclear material and shielding material in radiography images.

DNDO continues to develop breakthrough technologies that increase performance and reduce the operational burdens of our frontline operators and improve their mission performance. For example, we are collaborating with U.S. Customs and Border Protection's (CBP) Laboratories and Scientific Services to use machine learning to greatly reduce the number of nuisance alarms in radiation portal monitors. In addition, we work with the Massachusetts Port Authority, S&T's Border and Maritime Security Division, and the United Kingdom's Home Office to develop and evaluate the next generation non-intrusive inspection imaging equipment. Of particular note, the collaboration in this case is expected to produce the first wholly integrated system capable of detecting both nuclear material and contraband. Further, we jointly evaluate parameter-setting modifications to reduce the number of alarms from naturally occurring radioactive material. In fact, after a rigorous program of laboratory tests, modeling and simulation, field trials, and successful pilots at two ports of entry, CBP has deployed the new technique to 26 seaports and 7 land border crossings through January 2015. This technique, which involves adjustments to the settings on the radiation portal monitors, is yielding operational efficiencies by reducing alarm rates from benign sources and the associated time CBP officers would have needed to manually inspect that cargo.

In addition to CBP, DNDO worked closely with the U.S. Coast Guard (USCG), the Transportation Security Administration (TSA), and state and local partners to identify key operational requirements for the design of next-generation radioisotope identification devices that can be used by law enforcement officers and technical experts during routine operations to identify radioactive materials and adjudicate alarms. Based on the enhanced detection material lanthanum bromide and improved algorithms, this new handheld technology is easy-to-use, lightweight, and more reliable and, because it contains built-in calibration and diagnostics, has a much lower annual maintenance cost. An example of a successful acquisition program, the new system is receiving very positive reviews from operators in the field.

Characterizing System Performance

DNDO's technology development efforts are coupled with a rigorous test and evaluation program. Over the years, DNDO's test program has grown and matured. To date, we have conducted more than 100 test and evaluation campaigns at more than 40 laboratory and operational venues, and evaluated systems including pagers, handhelds, portals, backpacks, and vehicle-, boat-, aircraft,- and crane-mounted detectors, as well as next-generation radiography technologies. To ensure the equipment is evaluated in the manner in which it will be used, these test campaigns are always planned and executed with

operational users. In addition, we include interagency partners and use peer-reviewed processes. The results from DNDO's test campaigns have informed federal, state, local, and tribal partners on the technical and operational performance of detection systems, allowing them to select the most suitable equipment and implement the most effective concepts of operation for their unique needs.

Pursuant to the law, DNDO leads the development of technical capability standards, and in collaboration with the National Institute of Standards and Technology, also supports the development, publication, and adoption of national consensus standards for radiation detection equipment. A total of 24 standards, including 11 U.S. standards with the American National Standards Institute, 10 international standards with the International Electrotechnical Commission, and 3 technical capability standards now exist for homeland security applications. We have assessed commercially available detection systems against national and international standards and in various operational scenarios. Notably, we completed the Illicit Trafficking Radiation Assessment program, a collaboration with the European Commission's Joint Research Center and the IAEA to evaluate nearly 80 instruments against consensus standards. The results enabled our stakeholders to compare the performance of commercially available radiation detection equipment and provided manufacturers with constructive feedback on their products.

Implementing the Domestic Component of the Global Nuclear Detection Architecture

DNDO is instrumental in implementing the domestic component of the global nuclear detection architecture. In conjunction with federal, state, local, tribal, and territorial operational partners, DNDO applies a disciplined approach to procure small and large-scale radiation detection and/or identification systems and deploy them at ports of entry, along our land and maritime borders, and in the interior of the United States. In addition, as part of DHS's Strategic Sourcing efforts, DNDO is the Department's commodity manager for handheld radiological and nuclear detection equipment. This enables us to take advantage of technical advancements and achieve cost savings by leveraging the volume demand of Department-wide and other federal users.

DNDO's collaborative system acquisition efforts have ensured that all USCG boarding parties have radiation detection equipment; all incoming general aviation flights are met by CBP officers with radiation detectors; 100 percent of trucks and cars entering our Nation at land ports of entry are scanned for nuclear and other radioactive materials; almost 100 percent of maritime containerized cargo is similarly scanned at our sea ports of entry; and the TSA's Visible Intermodal Prevention and Response teams are equipped with radiation detectors.

While technology acquisition and deployments are critical, we must also ensure that the training, exercise, and cross-jurisdictional protocols integral to mission success are adopted and sustained by operational partners. As such, DNDO provides program assistance services to federal, state, local, tribal, and territorial stakeholders who are developing or enhancing radiological and nuclear detection capabilities. This support includes assistance in developing and integrating local or regional programs into the global nuclear detection architecture, guiding the development of concepts of operations and standard operating procedures, and developing training and exercise products to ingrain those procedures into day-to-day activities.

DNDO has made considerable progress in enhancing national radiological and nuclear detection capabilities in the following ways:

- We are on schedule to complete discussions on the establishment, maintenance, and sustainment of radiological and nuclear detection programs in all 50 states by the end of 2015.
- In conjunction with regional partners, we have developed robust detection capability in the New York City region, through the Securing the Cities program, where more than 19,450 personnel have been trained in nuclear detection operations and more than 8,800 pieces of detection equipment have been deployed. National program implementation began with expansion to Los Angeles/Long Beach in 2012, and they are beginning to train personnel and receive detection equipment. In 2014, the National Capital Region was selected as the third Securing the Cities site.
- DNDO's Assistance Program is currently engaged with 33 states, two major Urban Area Security Initiative regions (non-Securing the Cities), and 28 U.S. Coast Guard Area Maritime Security Committees.
- Since 2008, DNDO has deployed Mobile Detection Deployment Units over 200 times to provide radiological and nuclear detection and communications equipment for federal, state, and local agencies to augment their capabilities during special events or in response to elevated threat conditions.

DNDO provides training products and support to develop, enhance, and expand radiological and nuclear detection capabilities. In partnership with the Federal Emergency Management Agency (FEMA), the Federal Law Enforcement Training Center, DOE, and DOJ, DNDO develops and implements protocols and training standards for the effective use of radiation detection equipment and associated alarm reporting and resolution processes. Since 2006, DNDO has developed 49 training courses listed in the federal course catalog. In collaboration with interagency partners, including the Federal Law Enforcement Training Center, more than 33,500 law enforcement personnel and public safety officials from 35 states have participated in DNDO-supported radiological and nuclear detection training.

DNDO also assists state and local partners in developing, designing, and conducting exercises that are compliant with the Homeland Security Exercise and Evaluation program methodology. The exercises provide valuable hands-on experience for personnel performing radiological and nuclear detection operations and assist decision makers in integrating the detection mission into their daily operations, while fostering the exchange of ideas and best practices amongst state and local partners. Since 2006, DNDO has conducted exercises with 21 states and annually supports up to 20 exercises. In FY2014, DNDO conducted 19 domestic exercises with state and local partners, as well as two international exercises.

DNDO fields a unique Red Team that can objectively assess the operational effectiveness and performance of DNDO programs and deployed radiological and nuclear detection capabilities at the federal, state, and local levels. Our Red Team works across the interagency employing a whole-of-government approach to improve our national capabilities. At the federal level we partner with DoD, DOE, and DOJ; within DHS with CBP, FEMA, TSA, USCG, and U.S. Secret Service; and with a myriad of state and local agencies across the United States. The Red Team evaluates deployed systems and operations and their associated tactics, techniques, and procedures, in as-close-to-realistic-environments as possible. As covert and overt assessments are generally the only opportunity for operators of radiological and nuclear detection systems to gain experience detecting uncommon nuclear sources, these operations provide valuable feedback on the performance of tactics, techniques, and

procedures. This feedback enables operators to improve their concepts of operation and readiness. For the past five years, DNDO's Red Team has averaged more than 25 overt and covert assessments per year, successfully conducting 33 evaluations in FY2014 in support of operational partners.

DNDO is responsible for enhancing and coordinating the nuclear detection efforts of federal, state, local, and tribal governments and the private sector to ensure a managed, coordinated response. We also coordinate across the interagency to establish protocols and procedures to ensure that the technical detection of unauthorized nuclear explosive devices, fissile material, or other active radioactive material is promptly reported to the Secretaries of Homeland Security, Defense, and Energy, the Attorney General, and others as appropriate for action by law enforcement, military, emergency response, or other authorities.

DNDO's Joint Analysis Center is essential in enhancing situational awareness, as well as providing technical support and informational products, to federal, state, and local partners. The Joint Analysis Center maintains and provides awareness for mission partners of deployed detection capabilities, monitoring ongoing events or threats, and maintaining historical data. Using the Joint Analysis Center Collaborative Information System, DNDO facilitates nuclear alarm adjudication and the consolidation and sharing of information through geographic information system displays and databases. This system is available for direct access by our state and local partners, providing them with the ability to manage, document, and execute a radiological and nuclear detection program. This includes the ability to electronically maintain training and certification, and consolidates and maintains a database of detector equipment and Nuclear Regulatory Commission state licensees. Through this information system, we connect to the Triage system, maintained by DOE's National Nuclear Security Administration, to enable a seamless transition when national-level adjudication assistance is required. To increase awareness of lost and stolen sources and other relevant information, DNDO's Joint Analysis Center publishes unclassified weekly information bulletins, summarizing relevant news articles and providing useful facts about radioactive materials. This weekly information bulletin currently reaches every DHS Fusion Center and over 2,000 global nuclear detection architecture stakeholders.

In addition to direct interaction with individual states and law enforcement agencies, DNDO hosts biannual State and Local Stakeholder Working Group meetings and Executive Steering Council meetings with law enforcement and other supervisory personnel to exchange best practices and to obtain feedback on DNDO's initiatives. The State and Local Stakeholder Working Group provides a forum for DNDO to meet with our stakeholders to discuss their current activities, lessons learned, and planned detection initiatives. This forum also provides state and local leaders an opportunity to convey their perspective on mission needs and radiation detection requirements, so that DNDO can develop the necessary products and services to support their efforts. The Executive Steering Council provides policy coordination and implementation between DNDO and senior-level state and local leaders regarding radiation detection programs, and serves as a mechanism to solicit input from senior leaders on their successes, evolving requirements and challenges, as well as for DNDO to apprise them of ongoing efforts to support their jurisdictions. Both the Stakeholder Working Group and the Executive Steering Council have been received favorably and continue to reinforce the relationship between DNDO and key stakeholders.

Acquisition Process Improvements

To enhance mission delivery and improve investment management, DNDO designed the Solution Development Process. Aligned with DHS Acquisition Management Directive 102-01, the Solution Development Process institutes an integrated governance approach to program and project oversight throughout the systems engineering lifecycle. The process brings all programs and projects under leadership governance—establishing a shared language, with common practices to increase efficiencies, promote programmatic and budgetary transparency, and bolster accountability. It aligns with DHS enterprise architecture, acquisition management, and capital planning and investment processes. A critical component of the process is the active involvement of operational partners, who serve as Lead Business Authorities, and requires rigorous technical reviews at each programmatic stage. In adhering to the process, DNDO ensures current and future programs are appropriately structured and have the necessary oversight for success. DNDO will continue to incorporate lessons learned and process improvements as the process matures, sharing them throughout DHS to strengthen departmental unity of effort—one of the Secretary's top priorities.

Based in part on lessons learned from the cancelled Advanced Spectroscopic Portal program, DNDO has significantly bolstered acquisition management policy and strengthened its implementation via robust and disciplined governance and program management processes. DNDO closely collaborated with CBP to complete a post-implementation review and identified 32 lessons learned, including findings in acquisition management. These efforts have enabled us to ensure that programs are selected based on sound business cases and are well-managed, resulting in an efficient and effective use of DNDO's appropriated funds.

Finally, recognizing the important contributions and innovations of private industry, national laboratories, and academia, DNDO has evolved its acquisition focus from one that is predominantly fueled by a government-funded, government-managed development process to one that relies upon industry-led research and development. As such, DNDO technology development programs now proceed with a "commercial first" approach; engaging first with the private sector for solutions and only moving to a government-sponsored and managed development effort if necessary. This approach leverages private sector innovation, taking advantage of industry's innate flexibility and ability to rapidly improve technologies. In some cases, shifting to commercial-based acquisitions will even reduce the total time to test, acquire, and field technology.

Forensics Capabilities

An act of nuclear terrorism or an interdiction of a nuclear threat would necessitate rapid, accurate attribution. Any USG response would need sound scientific evidence supporting the determination of the responsible parties. Nuclear forensics would support leadership decisions. DNDO's National Technical Nuclear Forensics Center focuses on continuously evaluating and improving the nuclear forensics capabilities with specific responsibilities to:

- Improve the readiness of the overarching USG nuclear forensic capabilities, from pre- to post-detonation, through centralized stewardship, planning, assessment, exercises, improvement, and integration;
- Advance the technical capabilities of the USG to perform forensic analyses on pre-detonation nuclear and other radioactive materials; and
- Build and sustain an expertise pipeline for nuclear forensic scientists.

Operational readiness of USG nuclear forensics capabilities has improved markedly in recent years. Efforts of the nuclear forensics community are integrated through the alignment of program capabilities, coordination of research and development and operational activities, and accelerated capability development through synchronized interagency investments. The interagency uses two primary DNDO-led mechanisms, the Nuclear Forensics Executive Council and Steering Committee, to facilitate consistent coordination across the USG. DNDO led the interagency effort to update and extend the National Strategic Five-Year Plan for Improving the Nuclear Forensics and Attribution Capabilities of the United States, completing it in December 2014, and continues to synchronize resources among partner agencies through an established budget crosscut. Requirements are now regularly identified and developed by the Nuclear Forensics Requirements Center, co-chaired by DNDO and the FBI.

Since the Nuclear Security Summit in 2010, international partnerships in nuclear forensics have greatly expanded, resulting in stronger national and international capabilities. DNDO provides subject matter expertise to numerous initiatives, including multinational nuclear forensics tabletop exercises, to enhance understanding among policy makers, law enforcement officials, and scientists, and to encourage and assist other nations in developing their national capabilities.

Forensics exercises have become increasingly realistic and complex, with intensive multiagency planning among the FBI, DOE, Army, Air Force, and DNDO. Many of the exercises now include state and local law enforcement. Other exercises have involved the Federal law enforcement and intelligence communities in order to plan and synchronize the fusion of intelligence, law enforcement, and technical forensics information, leading to a more efficient and effective attribution process. In the international context, DNDO was involved in the "@tomic 2014" table-top exercise in February of last year, bringing together 31 nations and several international organizations to enhance knowledge and awareness of how nuclear forensics can be used in nuclear smuggling cases. The exercise served as a side event leading up to and informing the Nuclear Security Summit 2014.

Technical nuclear forensics capabilities for analysis of nuclear and other radioactive materials have steadily advanced. DNDO's efforts are focused on continually improving the accuracy, precision, and timeliness of material characterization information, and linking that information to the process and place of that material's origin. To date, DNDO has developed seven radiological and nuclear certified reference materials, which are forensically-relevant calibration standards used by the national laboratories to improve confidence in analytical conclusions. Additionally, DNDO has developed the first-ever laboratory-scale uranium processing capability that allows us to determine forensic signatures associated with specific variations in uranium manufacturing processes. This capability enables us to determine forensics signatures without having direct access to samples from foreign fuel cycles. We are now developing a similar plutonium processing capability. Further, in cooperation with DOE and DoD, DNDO has developed and installed a nuclear forensics data evaluation capability at Sandia National Laboratories that enables forensic scientists to develop and test data analysis tools and evaluate large sets of data in order to identify distinguishing characteristics of specific nuclear materials. DNDO remains focused on advancing the national ability to trace nuclear materials back to their source.

DNDO's efforts to restore the national expertise pipeline have also shown substantial success to date. The Congressionally mandated National Nuclear Forensics Expertise Development program is a comprehensive effort to grow and sustain the scientific expertise required to execute the national technical nuclear forensics mission. Launched in 2008, this effort is a key component in assuring a

robust and enduring nuclear forensics capability and its contribution to the Nation's efforts at preventing nuclear terrorism. In close partnership with eight National Laboratories, the program has provided support to more than 300 students and faculty and 27 universities in partnership with 11 national laboratories. We are steadily progressing toward adding 35 new Ph.D. scientists to the nuclear forensics field by 2018 to revitalize the pipeline and replace anticipated attrition or retirements from the DOE National Laboratories. Twenty-four new nuclear forensics scientists have come through the National Nuclear Forensics Expertise Development program and been hired by the national laboratories and federal agencies since the program's inception.

Closing

Thank you again for the opportunity to discuss the ongoing efforts of DNDO to prevent and protect against radiological threats.

While DNDO has made considerable progress since it was established in 2005, much remains to be done. It will be a challenge to remain one step ahead of the adversary – particularly one that is intelligent and adaptable. We must ensure our efforts are robust so that the obstacles terrorists face are many. DNDO's detection and forensics programs, in concert with those of our partners and stakeholders, both in these areas and along the spectrum of nuclear security, are foundational elements in creating these impediments. Together, we can build upon DNDO's integrated approach to architecture planning, testing and assessments, research and development, operational support, and nuclear forensics to strengthen the Nation's capabilities to deter, detect, and interdict the nuclear threat and to hold those responsible accountable for their actions. We remain committed to this challenge and deeply appreciate this Subcommittee's sustained interest and support in our shared goals to secure the Homeland.