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H.R. 2631, THE NUCLEAR FORENSICS AND ATTRIBUTION ACT

HEARING

BEFORE THE

SUBCOMMITTEE ON EMERGING THREATS, CYBERSECURITY, AND SCIENCE AND TECHNOLOGY

OF THE

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H.R. 2631, THE NUCLEAR FORENSICS AND ATTRIBUTION ACT

Wednesday, October 10, 2007

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON HOMELAND SECURITY,
SUBCOMMITTEE ON EMERGING THREATS, CYBERSECURITY,
AND SCIENCE AND TECHNOLOGY,
Washington, DC.

The subcommittee met, pursuant to call, at 2:14 p.m., in Room 311, Cannon House Office Building, Hon. James Langevin [chairman of the subcommittee] presiding.

Present: Representatives Langevin, Christensen, Etheridge, Green, McCaul, Pascrell, Jr and Broun, Jr.

Also present: Representative Berman.

Mr. ETHERIDGE. [Presiding.] The subcommittee will come to order.

The subcommittee is meeting today to receive testimony on the need to develop and maintain a national nuclear forensic capacity. Today, the subcommittee is meeting to discuss and subsequently mark up an amendment in the nature of a substitute to H.R. 2631, the Nuclear Forensic and Attribution Act.

I would like to congratulate my colleague, Congressman Schiff—he is not here right now, I don't think—for introducing this legislation and for working collaboratively with the committee to develop the amendment in the nature of a substitute that we will consider immediately after today's hearing.

To paraphrase the provisions of H.R. 2631, as I am sure will be echoed by witnesses here today, the threat of nuclear terrorism attack is the most serious threat to the U.S. homeland and to our interests abroad. We must do everything we can to prevent such an event. Nuclear forensics and attribution is one important tool in this effort. Through nuclear forensics, it may be possible to identify the source of nuclear or radiological weapons. A robust forensic capacity should also have a deterrent effect for those who might use a weapon or provide such a weapon or weapons materials to terrorists.

If the worse should happen and a nuclear attack is carried out, attribution is critical. In order to perform such, we must have the capacity for rapid sample acquisition, analysis, and characterization of the samples, and comparison of those samples to other known sample signatures. It is my belief that the provisions of this amendment in the nature of a substitute will help promote this capacity. I look forward to discussing this bill with our witnesses today.

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With that, I recognize the ranking member of the subcommittee, the gentleman from Texas, Mr. McCaul for an opening statement.

Mr. McCaul?

Mr. MCCAUL. I thank the chairman.

The detonation of a nuclear device in an urban area of this country would be catastrophic. Reducing the risk of nuclear or radiological terrorism requires a layered system of defenses that involves deterring, detecting, disrupting, and recovering from terrorist attacks.

We spend a great deal of time in this Congress discussing DNDO's efforts to deploy radiation portal monitors at our nation's ports of entry. These monitors, staffed by Customs and Border Protection officers are the nation's first line of defense against illicit trafficking of nuclear and radiological material.

I would like to take this opportunity to commend DNDO on their achievements in this area. Mr. Oxford, to me, I have been very impressed that in only 18 months, your organization has deployed radiation monitors which now screen 91 percent of cargo coming across the northern border, and 97 percent of cargo coming across the southern border.

In the next several months, Secretary Chertoff is expected to make a decision on the certification of the advance spectroscopic portal monitors. I hope this technology demonstrates a significant improvement over current radiation portal monitors, allowing Customs and Border Protection to improve accuracy, while maintaining this high percentage of cargo screening.

But even with the best possible detection systems, the possibility remains that terrorists could beat the system and sneak something past one of our detectors, or through a nonofficial port of entry. That is why defense against terrorism, especially nuclear terrorism, requires this multi-layered approach.

Today, we are here to discuss one of the layers in the government's strategy to defend against nuclear terrorism. That layer is the Interagency Program of Technical and Nuclear Forensics and the role it plays in attribution. While forensics is only one component of attribution, it is a key part of ensuring the nation has a robust program to accurately and rapidly identify perpetrators of nuclear or radiological terrorism.

The forensics program we have today includes programs in defense, the intelligence community, law enforcement, homeland security, and our national laboratories. I look forward to hearing on the progress DHS has made in coordinating this interagency program, and I also hope to hear the role each department plays in the acquisition, analysis, and characterization of radiological and nuclear material that would be necessary in the case of a successful nuclear attack.

The main concern of this committee is the pipeline of qualified people into the fields associated with nuclear forensics. In recent years, the number of young people entering scientific fields has decreased. The nuclear fields in particular are suffering, especially in fields relevant to nuclear forensics, which may have no commercial counterpart. I am very interested to know the panel's thoughts on this issue as well, and what is in store for technical programs such as this one if this trend continues.

I thank the panelists for being here. I yield back my time.

Mr. ETHERIDGE. I thank the gentleman.

I would like to welcome our panelists here today, our first panelists who are witnesses to the hearing. I look forward to discussing the topics of nuclear forensics with such a collection of dedicated public servants. Welcome and thank you for being here.

Our first witness is no stranger to this committee. Mr. Oxford is the director of the Domestic Nuclear Detection Office in the Department of Homeland Security. Welcome.

Next is Dr. Aoki—is that pronounced correctly?

Mr. AOKI. Aoki.

Mr. ETHERIDGE. Aoki. Okay, welcome. He is deputy under secretary of energy for counterterrorism at the Department of Energy. We welcome you.

We also have—I hope I get this right; let me try—Dr. Vahid Majidi.

Mr. MAJIDI. Sir, it is Vahid Majidi.

Mr. ETHERIDGE. Vahid Majidi. Thank you, sir. Welcome. He is assistant director for the Weapons of Mass Destruction Directorate of the Federal Bureau of Investigation.

And next is Dr. Andrew Grant, acting director of the WMD Terrorism Bureau of International Security and Nonproliferation, U.S. Department of State. Welcome.

And next we have Mr. Michael Evenson, who is the associate director for operations, Defense Threat Reduction Agency.

And finally, we have Dr. Carol Burns, currently serving as the Group Leader for the Nuclear and Radiochemistry in the Chemistry Division of Los Alamos National Laboratory.

Let me welcome each of you. Thank you for being here. Without objection, your full statement will be entered into the record.

I would recognize Mr. Oxford first and ask each one of you, as soon as the other one has finished, to move along. I won't introduce you again. It would take up time. Summarize your statement within the 5 minutes if possible.

I recognize you now, Mr. Oxford, for 5 minutes, for a summary. Thank you.

STATEMENT OF VAYL OXFORD, DIRECTOR, DOMESTIC NUCLEAR DETECTION OFFICE, DEPARTMENT OF HOMELAND SECURITY

Mr. OXFORD. Good afternoon, Chairman Etheridge, Ranking Member McCaul and other members of the subcommittee.

I would like to thank the committee for the opportunity to discuss the U.S. government's nuclear forensics program and the role of DNDO in coordinating and advancing the nuclear forensics efforts through our National Technical Nuclear Forensics Center.

I would also like to thank my colleagues who are joining me today from the Departments of Energy, Defense, State, FBI and Los Alamos National Laboratory.

Technical nuclear forensics is the analysis, characterization and interpretation of pre-and post-detonation nuclear and radiological samples and devices, as well as the output signals from *national* nuclear detonations. The U.S. government's nuclear forensics efforts provide the tools, techniques and expertise to potentially de-

termine the nature and origin of the materials and devices used in acts of terrorism and smuggling.

In the last year, the U.S. government has made great strides in forming an integrated interagency team. Together, we are planning, prioritizing, and exercising. Our goal is to achieve and maintain a proficient national nuclear forensics capability that is credible, reliable, and ready for any contingency, from interdiction of nuclear materials or devices at the border, to a nuclear detonation in the homeland or against U.S. interests abroad.

Nuclear forensics is now increasingly recognized as having the potential to serve as a central pillar of deterrence in the 21st century. Nuclear forensics underpins the attribution process by helping to identify the possible sources of materials or devices, the device design, or the pathway taken to the actual incident. Attribution will be derived form the fusion of technical nuclear forensics analysis, with all-source intelligence, and law enforcement information to enable the decision-making process.

DHS established the Forensics Center in DNDO on 1 October 2006. The center develops and advances capabilities to perform nuclear forensics on pre-detonation nuclear and radiological materials. In coordination with our partners, it implements national-level integration, centralized planning, exercising, evaluation and stewardship across the full spectrum of U.S. government nuclear forensics capabilities from pre-to post-detonation. In essence, the center serves as a system integrator for the end-to-end national capabilities.

The strategic goals for the center include improving our nuclear forensics capabilities, developing a national-level exercise program, developing strong international nuclear forensics cooperation, and developing a strategic communications plan.

Finally, it is important to note that most of the nation's scientific nuclear forensics capabilities exist in a relatively small cadre of experts at the national laboratories. We are all facing the challenges of recruiting and retaining the nuclear experts that we rely on so heavily to achieve our mission. We are working with our partners to assess the issues, identify solutions, and ultimately establish a stable and enduring workforce and career pipeline.

In conclusion, the importance of nuclear forensics cannot be understated. It is challenging and it is essential, another critical layer in our nation's strategy of layered defense against the nuclear threat.

Chairman Etheridge, Ranking Member McCaul and other members of the committee, this concludes my prepared statement. I will be happy to answer any questions you may have.

[The statement of Mr. Oxford follows:]

PREPARED STATEMENT OF VAYL S. OXFORD

Introduction

Good morning, Chairman Langevin, Ranking Member McCaul, and distinguished members of the subcommittee. I am Vayl Oxford, Director of the Domestic Nuclear Detection Office (DNDO), and I would like to thank the committee for the opportunity to discuss the U.S. Government's (USG) nuclear forensics program and the role of DNDO in coordinating nuclear forensics efforts through our National Technical Nuclear Forensics Center, (NTNFC) that was established in DNDO last October. I would also like to thank my partners who are joining me from the Departments of Energy (DOE), Defense (DoD), State (DOS), and Justice (DOJ).

Background

The USG's nuclear forensic efforts provide the tools and the expertise to potentially determine the nature and origin of the materials and devices used in acts of terrorism and smuggling. This information is used in the broader process of attribution, which couples intelligence and law enforcement information with the results of forensic analyses to aid in the identification of those who designed, built, supplied, transported and used an improvised nuclear device (IND), a stolen or acquired nuclear weapon, a radiological dispersal device (RDD), or nuclear/radiological material. Technical Nuclear Forensics, or TNF, refers to the thorough analysis, characterization, and interpretation of pre-detonation and post-detonation nuclear/radiological samples and devices, as well as prompt output signals from a nuclear detonation. TNF is a critical nuclear deterrence capability to demonstrate we can hold perpetrators accountable, and also to help find and prevent follow on attacks. The roots of this program are founded in the techniques that were used for many years in the U.S. nuclear weapons development and testing programs, arms control monitoring, and intelligence activities. Today, with the looming threat of nuclear terrorism, the requirements and timelines that drive our efforts are new and only began crystallizing in the last few years.

TNF is necessarily an interagency effort with respective lead and support roles and responsibilities assigned through a recent Presidential policy directive. In the last year the USG has made great strides in aligning itself in accordance with the directive, forming an integrated interagency team. Together we are planning, prioritizing, and exercising. DNDO's TNF goal is to achieve and maintain a proficient national nuclear forensics capability that is credible, robust, rapid, reliable, and ready for any contingency, from interdiction of nuclear materials at the border to a nuclear detonation in the homeland, or against U.S. interests abroad. Nuclear forensics is now increasingly recognized as having the potential to serve as a central pillar of deterrence in the 21st century, tied to new concepts of "nuclear accountability" (as Graham Allison calls it) for countries that might consider the "witting" transfer of nuclear materials or weapons to our adversaries, as well as to encourage improved safeguarding of those materials and weapons, to deter the "unwitting" transfer. We understand that effective strategic communications is fundamental to the deterrence equation. If deterrence fails, then nuclear forensics serves to underpin the attribution process by helping to identify the possible source of the materials or device, the device design type (after a detonation), and the pathway taken to the incident scene, utilizing both nuclear and traditional forensics techniques. Attribution will be derived from the fusing of the technical nuclear forensics conclusions with all source intelligence and law enforcement information, which in turn enables the decision-making process for assessing potential follow-on attacks, response options for the President, as well as prosecution deliberations.

NTNFC

The Department of Homeland Security (DHS) established the National Technical Nuclear Forensics Center (NTNFC) in DNDO on October 1, 2006. Like the broader DNDO, the Center is staffed with a mix of DHS federal employees and detailees from our partner agencies. DHS assumed this mission as a result of the classified Presidential policy directive that defined two core forensics missions for DNDO. First, the NTNFC is intended to serve as the national "capability provider" to develop and advance capabilities to perform nuclear forensics on pre-detonation nuclear and radiological materials. The second mission for the NTNFC is to implement national-level integration, centralized planning, exercising, evaluation, and stewardship across the full spectrum of USG nuclear forensics capabilities, from pre-to post-detonation—in essence to serve as the "System Integrator" for the end-to-end national capabilities. These missions are specifically directed to be carried out "in coordination" with our partners in the DoD, DOS, DOE, DOJ, and the Office of the Director of National Intelligence (DNI).

Strategic Goals

The strategic goals for the NTNFC include striving to continuously improve nuclear forensic capabilities through research & development, interagency program reviews, independent assessments, and exercising. We are developing a highly matrixed national-level exercise program—we know that strict protocols and intense timelines will be the rule after an event, and so we must exercise regularly to optimize our capabilities and readiness.

We are also working closely with our interagency partners to develop a strong international pillar of nuclear forensics cooperation—which means sharing best practices and information on materials and cases, developing personal relationships with international forensic scientists and law enforcement, and performing exercises in cooperation with other nations. The NTNFC provides considerable technical sup-

port to the DOS in order to engage other nations and develop the absolutely essential international aspects of our nuclear forensics programs.

The NTNFC will also be developing an in-depth strategic communications plan. We need to raise the awareness of others in the government and the public to garner the appropriate kinds of support and disseminate the right kinds of messages. With effective strategic communications, our nuclear detection and forensics missions can succeed in creating a new kind of deterrence for the 21st century.

It is important to note that most of the Nation's scientific nuclear forensics capabilities rest on the shoulders of a relatively small cadre of experts at the national labs. We are all facing the challenges of recruiting and retaining the nuclear experts that we rely on so heavily to achieve our mission. The NTNFC is working with our partners to assess the issues, identify solutions, and ultimately establish a stable and enduring workforce and career pipeline. This is a major strategic goal of not only DHS, but all of us here at the table today.

Accomplishments to date

In the short time since the NTNFC was established, we have been working quickly to create a small staff of in-house experts to coordinate with our federal and laboratory partners to meet the needs of our TNF mission. We have developed a baseline Nuclear Forensics Knowledge Management & Analysis System that underpins our capabilities to perform nuclear forensics on interdicted materials. This program entails the development of forensic information analysis tools, for example, multivariate pattern recognition tools; methods to deduce and link materials signatures to production processes; and development of historical nuclear material process and production timelines.

The NTNFC also chairs the Attribution Working Group of the Subcommittee on Nuclear Defense Research and Development, Committee on Homeland Defense and National Security, National Science and Technology Council. The purpose of this Subcommittee is to identify and recommend a prioritized investment strategy to continually increase the overall effectiveness and productivity of USG R&D related to developing a robust nuclear defense capability. Additional Subcommittee working groups include Nonproliferation, Interdiction, Render Safe, and Response and Recovery, resulting in effective integration of R&D needs analysis across the nuclear defense spectrum. With members from DHS, DoD, DOS, DOE, DOJ, as well as the Environmental Protection Agency (EPA) and Intelligence Community, the Attribution Working Group is developing six areas of R&D emphasis that define a USG coordinated forensics and attribution program. The Subcommittee has currently baselined the capabilities in nuclear defense, developed the vision of the desired end-state five years out, and prioritized gaps in R&D. Ultimately, the development and analysis of this roadmap will form the basis for an interagency coordinated program of prioritized R&D efforts to effectively address gaps without redundancy. This Roadmap is scheduled for completion in February 2008, in time for agencies to use the plan to develop FY 2010 budget requests.

The NTNFC has made significant strides in integrating the day to day workings of our interagency team. In addition to the joint Exercise Planning Group, we have established a few essential bodies to plan and direct nuclear forensics activities—we stood up a Nuclear Forensics Working Group at the action officer level; a Steering Committee at the program manager level; and just last month we launched a "Nuclear Forensics Executive Council" with senior executive membership across each department and the intelligence community. The Council was established to assure effective implementation and oversight, with enduring senior level focus and attention to the forensics mission. At our inaugural meeting last month, we were honored to have Secretary Chertoff join us and express his strong support for this critical mission.

Conclusion

The importance of nuclear forensics cannot be overstated. It is a field that seems to grow in visibility on a weekly basis. It is challenging, and it is essential—another critical layer in our Nation's strategy of layered defense against the nuclear threat. Our mandate requires that we develop, improve and sustain an enduring capability that is rapid and credible—that will meet the President's and Congress' expectations during an unprecedented catastrophe—and effectively support attribution conclusions, and potential responses. Moreover, nuclear forensics efforts may indeed help to prevent a follow-on attack—the issue that will be foremost on all of our minds in the wake of an attack. The nuclear forensics mission is a crosscutting effort throughout the USG and appropriate coordination through the DNDO's National Technical Nuclear Forensics Center will ensure that effective, integrated, and robust capabilities are developed and sustained.

The Secretary and I are committed to doing whatever it takes, as quickly and as prudently as possible, to prevent a nuclear 9–11, or a dirty bomb attack. Nuclear forensics is central to our efforts. And there is no doubt that our odds of success are magnified tremendously when we persevere with our partners across the board, through planning, exercising, and improving our national capabilities.

This concludes my prepared statement. With the committee's permission, I request my formal statement be submitted for the record. Chairman Langevin, Ranking Member McCaul, and Members of the Subcommittee, I thank you for your attention and will be happy to answer any questions that you may have.

Mr. ETHERIDGE. Thank you, sir.

STATMENT OF STEVEN AOKI, DEPUTY UNDER SECRETARY FOR COUNTERTERRORISM, NATIONAL NUCLEAR SECURITY ADMINISTRATION, DEPARTMENT OF ENERGY

Mr. AOKI. Thank you. Thank you, Mr. Chairman.

Mr. Chairman, Ranking Member McCaul, members of the committee, I greatly appreciate the opportunity to appear before you today to discuss the Department of Energy's efforts in the area of nuclear forensics. Along with our colleagues from other federal agencies, we are actively involved in developing and maintaining the technical expertise, scientific tools, and specialized facilities to help identify those involved in the theft of nuclear materials or those responsible for an act of nuclear terrorism.

I submitted a written statement, so I just will focus on a few key points here.

First, technical nuclear forensics really is only part of a broader process of attribution. Attribution really aims to answer the question "who did it" by looking at the full range of intelligence, law enforcement and scientific information available to the nation. Technical forensics may play a critical part in reaching that final judgment, but it is only a part.

Secondly, we must be prepared to provide technical forensics analysis in several different types of situations that have different characteristics. We may recover weapons-grade nuclear materials from a smuggler apprehended at a border crossing or as a result of a criminal investigation. Forensic tools can help identify where that material originated and perhaps tell us something about its history.

Alternatively, we might intercept an actual nuclear device before it can be detonated. In this case, in addition to the forensic analysis of the nuclear material, expert analysis of the design of the device could give us valuable clues about who built it and in particular whether there was any assistance from a foreign government. Of course, special procedures and facilities will be required to perform any operations of a potentially live nuclear weapon.

Finally, we must also prepare for the grim possibility that we will be called on to conduct forensic analysis after a terrorist nuclear device has detonated. In this case, it is possible to analyze the radioactive debris to determine the types of nuclear materials involved and perhaps reconstruct the device design, providing important clues to identify the responsible party.

In all three of these cases, the availability of a strong and capable national technical nuclear forensics program strengthens deterrence against those who might support an act of nuclear terrorism. We must, however, be realistic about the length of time required

for some of the analytical procedures involved in nuclear forensics. In some cases, weeks or months may be required to obtain reliable results. This is clearly an area where additional research is called for, but there are some inherent physics limits to what can be done in this field.

The complexity of the possible scenarios means that technical nuclear forensics is inherently a team effort, drawing expertise and specialized capabilities from across the federal government. The Department of Energy contributes broadly to this effort in line with the roles and responsibilities established by the president last August. Among our key contributions, let me mention a few here.

First, DOE's Office of Emergency Operations will take custody of a terrorist nuclear device after it has been rendered safe in the field. Once the device has been transported to a secure location at the Nevada test site, DOE will oversee the collection of material samples and other forensic data.

In the event of a nuclear detonation or nuclear material dispersion event in the United States, DOE on-the-ground teams will collect samples utilizing equipment and operational concepts developed by our colleagues at the Defense Threat Reduction Agency. The collection of samples for forensics purposes will be fully integrated with the other on-site activities carried out by DOE teams as part of their overall response to this catastrophic event.

To support these and other forensics responsibilities, DOE conducts research and development aimed at improving the speed and accuracy of radiochemical analysis, and at developing sensors to provide near real-time information about the nature of a terrorist nuclear device. Drawing on the expertise of its national laboratories, DOE sponsors analytical studies of potential nuclear device designs, using advanced modeling and simulation tools developed for our own nuclear weapons program, to understand how an improvised nuclear device might be constructed. These efforts allow the calculation of signatures, including expected radioactive debris that would be compared against forensic results.

An essential component of any forensics effort is a library of information against which to compare an unknown sample. DOE has been assigned responsibility for managing the Nuclear Materials Information Program, which is developing a database of information on nuclear materials worldwide to support technical nuclear forensics.

Perhaps most importantly, DOE is responsible for sustaining the national laboratory system that underlies most of the interagency efforts described at today's hearing. During the Cold War, we built specialized facilities, developed unique scientific techniques, and assembled teams of scientists and engineers to support the design, production and testing of our own nuclear weapons. I think it is fair to say that all of the nation's technical nuclear forensics capability ultimately rests on the underlying science base around the accumulated knowledge it represents.

As the national laboratory complex evolves to meet a new national security environment, it will be vitally important to ensure that maintain and strengthen this fundamental resource for the prevention of nuclear terrorism.

That concludes my prepared remarks. I look forward to your questions.

Thank you.

[The statement of Mr. Aoki follows:]

PREPARED STATEMENT OF DR. STEVEN AOKI

Chairman Langevin, Representative McCaul, members of the Subcommittee. Thank you for the opportunity to appear before you today to discuss nuclear terrorism and, in particular, the Department of Energy's efforts to sustain and improve our nation's capabilities to attribute threats involving nuclear weapons or weapons-usable nuclear materials introduced covertly into our country. I will begin by briefly addressing the specifics of the nuclear terrorism threat, the components of a national strategy to counter that threat, and the specific role that technical nuclear forensics and attribution can play in that strategy. I conclude by describing DOE's efforts to work with its interagency partners to strengthen national nuclear technical forensics and attribution capabilities.

Countering Terrorist Nuclear Weapons Threats to the Homeland

In this post-Cold War world, nuclear terrorism may be the single most catastrophic threat that this nation faces—we must do everything we can to ensure against its occurrence. The focus of my testimony today involves covert delivery by sub-national terrorist groups, either at the bidding of a state sponsor supplying the nuclear warhead or on their own via purchasing or stealing a warhead. There are three main threat variants identified below in decreasing order of likelihood, but increasing order of consequence in terms of deaths, injuries, cleanup costs, etc.:

- terrorists could acquire radioactive materials and construct devices for dispersal—so
- called radioactive dispersal devices (RDDs) or "dirty bombs",
- terrorists could acquire special nuclear materials (SNM)—plutonium or highly-enriched uranium (HEU)—and build an improvised nuclear device (IND),
- terrorists could acquire a nuclear weapon from a nuclear weapons state.

The overall strategy to protect the United States from terrorist nuclear weapons threats has six components:

- *Determine* terrorists' intentions, capabilities, and plans to develop or acquire nuclear weapons
- *Deny* terrorists access to the nuclear materials, expertise, and other enabling capabilities required to develop a nuclear device
- *Deter* terrorists from employing nuclear devices
- *Detect* and *disrupt* terrorists' attempted movement of nuclear-related materials, weapons, and personnel
- *Prevent and respond* to a nuclear terrorism attack
- *Define* the nature and source of a terrorist-employed nuclear device

Prevention

Although the focus of today's hearing is nuclear forensics and attribution, I must reiterate that our number one priority is to keep key fissile materials—plutonium or highly-enriched uranium—out of the hands of terrorists. Absent access to sufficient quantities of such materials there can be no bomb. We cannot overstate the importance of this point. Making a sophisticated nuclear weapon small enough to fit on a modern ballistic missile is difficult. Making a crude and inefficient one delivered by a rental truck may not be. We cannot be certain that we have controlled knowledge; thus we must control materials.

We are working hard to *prevent* terrorist acquisition of nuclear devices and fissile materials by:

- Strengthening physical security of U.S. nuclear weapons and weapons usable materials, Providing assistance to Russia to strengthen protection, control, and accounting of its nuclear weapons and materials,
- *Working with friends and allies to secure weapons-usable nuclear materials worldwide, and to strengthen security at civil nuclear facilities,*
- *Taking more aggressive steps to interdict illicit trafficking in weapons-usable nuclear materials and related technologies via strengthened export controls, cooperation with other countries through DOE's Second Line of Defense and MegaPorts programs, and the Proliferation Security Initiative.*

In July 2006, at the G–8 summit, Presidents Bush and Putin announced that they would create a Global Initiative to Combat Nuclear Terrorism to strengthen cooperation worldwide on nuclear materials security and prevention of terrorist acts involving nuclear or radioactive substances. Keeping nuclear materials out of the

hands of terrorists—and where possible, eliminating potentially vulnerable weapons-usable materials—is the most effective means of prevention. Paired with UNSCR 1540, we now have both the legal mandate and practical means necessary for concrete actions to secure nuclear material against the procurement efforts of terrorists.

Barriers to acquisition also provide an important element of *deterrence.* If terrorists believe that it will be extremely risky, or impossible, to acquire weapons or materials, they may be deterred from seeking them, or perhaps seek other avenues of attack. While we, of course, want to prevent all types of terrorism, deterring a devastating nuclear detonation has particular urgency.

Nuclear Forensics and Attribution

Attribution—a capability to rapidly characterize and identify the source of a nuclear warhead or weapons usable nuclear materials either before or after an attack—is a key component of an overall strategy to deter nuclear terrorism. States will not provide nuclear weapons to terrorists if they know that we will find out and, under certain conditions (e.g., a witting transfer from a state sponsor to terrorists), retaliate. Moreover, post-attack attribution would provide critical information to help prevent follow-on attacks.

Attribution involves the rapid fusion of information obtained via three sources: domestic law enforcement investigations of nuclear terrorist threats, associated collateral foreign intelligence received about those threats, and the technical analysis of the nuclear device or materials interdicted prior to detonation, or the debris and signals that result from a detonation. This latter source of information is called *technical nuclear forensics.* The elements of a nuclear forensics capability involve (1) collection of technical forensics data from the device or event, (2) lab analysis and reporting including comparison of collected data with a materials data base, and (3) interpretation and evaluation coupled with appropriate technical peer review.

The types of questions that we want to answer in technical nuclear forensics and, more broadly via the attribution process include: What material is it? Is it U.S. material? If not, where did it come from and how did it get here? How, when and where was it produced? For nuclear devices: Was it an RDD or a nuclear explosive device? What fissile materials were used? What was the yield? What was the design?

Post-detonation nuclear event forensics can provide key information about both the design and sophistication of a warhead, and about the origin of its fissile materials. During the period of nuclear testing, we gained much experience and critical information evaluating radioactive debris from Soviet above-ground nuclear tests, and from our own underground tests in Nevada. Covert delivery by terrorists presents a different challenge. For this challenge, a comprehensive international fissile materials data base would assist nuclear forensics efforts to correlate debris data with a particular reactor or enrichment facility that produced the material. It should be in every nation's interest to contribute to such a data base, both to help deter nuclear terrorism worldwide and to build confidence that it is a responsible steward of weapons usable fissile materials.

One point I want to emphasize: during the Cold War, post-detonation analysis was carried out over a period of several months—it was important but not time-urgent to complete it. We recognize that a nuclear detonation in a U.S. city would create enormous pressures to get solid information out in the shortest possible timeframe. As a result, our efforts to sustain and improve nuclear forensics capabilities include substantial efforts to shorten analytical timelines.

DOE contributions to technical nuclear forensics

The United States recently has made important progress, both in policy and technology, towards establishing a national technical nuclear forensics capability. As pointed out in Vayl Oxford's testimony, roles and responsibilities for various U.S. government agencies were established by the President last August and are being implemented. DHS is working to coordinate efforts among agencies, and identify capability gaps, in national technical nuclear forensics capabilities. This includes close coordination with the law enforcement and intelligence communities. At the initiative of the DoD, a national capability for post-detonation forensics became operational at the end of 2005. DHS is working to develop a concept of operations and to advance and ensure appropriate capabilities related to forensic analysis of interdicted nuclear materials. DOE has responsibility to develop a concept of operations and ensure appropriate capabilities to assess an interdicted nuclear device.

DOE has been engaged in a wide range of activities in support of this interagency effort. Its role has been key because most, if not all, of the capabilities that the nation draws upon for technical nuclear forensics reside at DOE's national laboratories. To date, forensics capabilities relating to such areas as nuclear weapons de-

vice modeling, nuclear materials production, radiochemistry and associated specialized facilities, advanced computations and simulations, and the physics and chemistry of fissile materials have been sustained in large part by leveraging off activities carried out in NNSA's nuclear weapons program. In the following discussion, we address some of the details of DOE's efforts in support of technical nuclear forensics.

Pre-and Post-Detonation Nuclear Device Missions

NNSA's Office of Emergency Operations provides operational capabilities and support in the following areas in addition to its direct support to the Attorney General in the render safe mission for interdicted nuclear devices in the United States:

- *Develop and sustain pre-detonation nuclear device forensics concept of operations and associated capabilities.*
- *Take custody of the rendered safe nuclear explosive devices and support the collection of material samples and other forensic data from such devices.*
- *As part of the DoD-developed concept of operations for the post-detonation mission, support ground sample collection after a nuclear detonation or dispersion of nuclear material within the United States. This includes providing a reliable capability to deploy, support domestic ground sample collection, and deliver post-detonation nuclear debris samples for shipment to designated laboratories.*

Nuclear Forensics R&D—Post-detonation analysis

NNSA's Defense Nuclear Nonproliferation (DNN) organization is sponsoring advanced R&D activities at our national laboratories to improve techniques for radiochemical analysis of bomb debris and has also sponsored ground-breaking work on other diagnostics tools. It is developing the next generation of post-nuclear detonation ground based forensics capabilities. Emphasis is on reducing timelines for producing analytical results. This work includes advanced sampling technology and collection tools for rapid, safe, precise post-detonation nuclear sample collection and analysis. It also includes nuclear event modeling to predict activation and entrainment of contaminants, deposition pattern of debris, remote sample collection/recovery concepts and rapid in-field analytical capabilities.

Nuclear Forensics R&D—Prompt output diagnostics measurements

DNN is also sponsoring work to improve capabilities to determine nuclear device information directly through collection and analysis of the prompt radiation diagnostics from a detonation. Hi-fidelity, near-field, prompt diagnostics capabilities are being developed that will provide greater sensitivity and thus greater insight into a terrorist nuclear device design than the current suite of satellite and seismic sensors used for world-wide nuclear event reporting, attack assessment and treaty monitoring.

Nuclear Counterterrorism Design Support

NNSA's Nuclear Counterterrorism Design Support (NCDS) program is focusing the talent, capabilities, and resources of our nuclear weapons program on the threat of nuclear terrorism. In place since 2000, the NCDS program provides an essential element of technical support to our nation's efforts to prevent the detonation of a terrorist nuclear device. Under NCDS, weapons designers at our national laboratories analyze and model potential IND designs, drawing on computational tools, experimental data, and expertise originally developed in the nuclear weapons program. The knowledge gained is applied to nuclear search and detection, forensic analysis, nuclear device render-safe, nuclear facility security, and intelligence assessments.

NCDS analysis is drawn on extensively by other DOE components as well as by other United States government agencies with associated responsibilities.

Nuclear Forensics R&D—Calculation of IND output and rad-chem signatures

In addition to its NCDS work, NNSA's Defense Programs organization is carrying related work in the following areas:

- Via device modeling studies of INDs, identification and characterization of signatures that discriminate various IND designs from traditional U.S. and foreign warheads.

- For pre-detonation forensics work, assessment of signatures associated with plutonium and HEU samples derived from domestic and foreign sources. Work currently includes physical and chemical analysis to associate materials processing knowledge to product material signatures.
- Support to attribution and forensics communities by providing IND experts to participate in exercises, more accurately identify the range of threats, and provide education on IND design.

Defense Programs, including through its Science Campaign, is seeking to improve capabilities to calculate and assess weapon outputs—both prompt (gamma rays, neutrons, x-rays, and debris kinetic energy) and long-lived radionuclide debris—released from a nuclear detonation. The Advanced Simulation and Computations (ASC) program is improving computer simulation capabilities for technical nuclear forensics. Improved physics models will enable the ASC codes to be applied more reliably to model the breadth of threats, including low-technology INDs, and provide predictions regarding the post-explosion radionuclide debris isotopes. This work facilitates more timely and responsive nuclear forensics capabilities.

Nuclear Materials Information Program (NMIP)

Last year, the President established the Nuclear Materials Information Program (NMIP)—an interagency effort managed by DOE's Office of Intelligence and Counterintelligence to:

- Develop an integrated system of information from all sources concerning worldwide nuclear material holdings and their security status;
- As part of this effort, collect signatures of nuclear materials to support forensics and attribution assessments; and
- Identify opportunities to work with international partners directly to share information on nuclear materials characteristics and security. International Cooperation

Defense Nuclear Nonproliferation is advancing international nuclear forensics cooperation in Central Asia, which remains a focus of engagement due to the region's integral role in the former Soviet weapons complex and the willingness of the current governments to work with NNSA and U.S. laboratory personnel. This international collaboration focuses on joint collection and characterization of uranium ore, ore concentrate and tailings, which expands the U.S. knowledge base and contributes to the overall nuclear counterterrorism effort. To date, work has focused on uranium mining and milling sites in the Central Asian nations of Tajikistan and Kyrgyzstan. NNSA coordinates its Central Asia work closely with the DHS, which is conducting similar international outreach activity in Kazakhstan.

Search and Render Safe

Should we detect nuclear materials or a suspected nuclear device, the DOE—through its national laboratory system—deploys highly-trained teams of experts to search for clandestine nuclear materials or warheads and, if necessary, to disarm and dispose of a terrorist nuclear device. These teams work in close partnership with the DoD, DHS and the FBI in managing our national response to nuclear terrorism. The DOE has a robust research program to support its nuclear search and render-safe mission and a complementary technology integration program that develops tools for use by its emergency response teams in the field.

Sustaining Key Capabilities

A key challenge is to ensure that we sustain and strengthen nuclear forensics capabilities in support of nuclear counterterrorism in an era when our nuclear weapons program is undergoing substantial change. This includes sustaining the people at our national laboratories involved in these efforts and the specialized laboratory facilities and experimental and analytical tools that they employ to carry out their job. Along these lines, in coordination with DHS and DOD, the DOE has initiated a study to be conducted by the National Academy of Science to examine the nation's nuclear forensics capabilities and provide findings and recommendations to sustain and improve them including technical, infrastructure, and human resource elements, and international collaboration, cooperation and information sharing.

Finally, while we have made great progress over the past several years, more remains to be done in fleshing out the technical and policy dimensions of nuclear forensics and attribution.

Thank you for your attention; I would be happy to take questions.

Mr. ETHERIDGE. Thank you, sir.

Let me just say to the other panelists, it looks like we are going to have a vote call somewhere between 2:30 p.m. and 2:45 p.m., so we are going to try to get through this part with your help before they call the vote. We will stay around and try to finish the testimony and do the questions after the vote, because it could take up to 45 minutes to 1 hour with the vote.

STATEMENT OF MIKE EVENSON, ASSOCIATE DIRECTOR FOR OPERATIONS, DEFENSE THREAT REDUCTION AGENCY, DEPARTMENT OF DEFENSE

Mr. EVENSON. Mr. Chairman and distinguished members of the subcommittee, it is an honor to be here today to address the Department of Defense's role, responsibility and capabilities in support of the National Technical Nuclear Forensics program. I have already submitted my written statement and will summarize my remarks.

First, I believe that international cooperation is critical to the success of any attribution effort. However, to date there has been limited international collaboration. International cooperation can help improve certainty of attribution by expanding the information and data available to investigators, and help increase public confidence in an attribution conclusion. This would serve to deter and dissuade potential enemies by reinforcing this strategic message. U.S. government policy needs to be developed for the sharing of forensically valuable nuclear data without compromising U.S. government nuclear secrets.

Second, in order to meet the very severe timelines required of the technical forensics, we must move past the traditional radiochemistry technology we use today. While DTRA and its partners represented at this table have made huge improvements in our timelines—approximately a 93 percent improvement—we are still judged as too slow. Thus, we must find new technologies that allow much more rapid and certain technical conclusions.

Third, despite my belief that technical and nuclear forensics will provide major, perhaps critical, information, we all need to recognize that the classical forensics work that the FBI has always done and is renowned for is mostly like to yield the definitive answer of who did it. We must not lose sight of that as we collect radioactive debris. We must be guided by the on-scene FBI lab personnel and make sure that we collect the other debris that may yield fingerprints, trucks axles, or other definitive evidence.

My last point concerns strategic communications. During a recent National Defense University-sponsored workshop on nuclear attribution, attendees, including congressional staff, stressed the incredible pressure the president and his advisors would be under to make a rapid attribution determination, both for response purposes and to prevent a potential follow-on attack. Policy advisors acknowledged the need to develop further the nation's strategic communication of attribution capabilities for deterrence, dissuasion and assurance purposes.

Our NTNF capability must be able to respond and deliver the initial and final technical conclusions necessary to protect the na-

tion and make well-informed decisions. We have made noteworthy progress, but still have a long way to go in refining the U.S. government technical nuclear forensics capabilities, such as more robust collection capabilities and improved rapid analysis and data evaluation capabilities, to meet the threat posed by nuclear terrorism.

No single-agency effort can ensure success. Meeting this threat requires the focused integration and coordination of our full NTNF capabilities, as well as international capabilities and expertise.

Mr. Chairman, this concludes my remarks. I look forward to answering your questions.

[The statement of Mr. Evenson follows:]

PREPARED STATEMENT OF MICHAEL K. EVENSON

Introduction

Mr. Chairman and distinguished members of the subcommittee, it is an honor to be here today to address the Department of Defense's (DoD) support to the National Technical Nuclear Forensic (NTNF) program. I am the Associate Director for Operations within the Defense Threat Reduction Agency (DTRA), the primary organization within the Department of Defense (DoD) charged solely and full-time with reducing the threat of weapons of mass destruction (WMD). Countering chemical, biological, radiological, and nuclear weapons is the reason for the agency's existence. We perform research and development and provide operational support to enhance DoD nonproliferation, counterproliferation, and consequence management capabilities. Our primary customers are the Combatant Commanders. Our mission is guided by the National Strategy to Combat WMD, the National Strategy for Combating Terrorism, and direction provided by the Secretary of Defense and the Chairman of the Joint Chiefs of Staff.

DTRA works closely with partners across DoD, the United States Government (USG), academia, and the private sector, as well as with our allies and friends in the performance of our mission. Our efforts in support of the national nuclear forensics capability are conducted in close collaboration with the Department of Homeland Security (DHS), Department of Energy (DOE) and its National Laboratories, Department of State, Department of Justice, and the office of the Director of National Intelligence.

Policy advisors have underscored the importance of international cooperation both to attribution and prevention; however, to date there has been limited international collaboration. International cooperation can make attribution more certain by expanding the information and data available to investigators, and increase confidence in an attribution decision. This would serve to deter and dissuade by reinforcing the strategic message. However, we must balance the need for the sharing of forensically valuable nuclear data without compromising US nuclear secrets.

Background

The Defense Department's interest in nuclear forensics and attribution rests on more than the need to provide information that would guide the appropriate national response to a nuclear event. We believe that highly capable forensics and attribution would enable this nation to stop follow-on attacks, and serve to deter states that may assist nuclear terrorists, thereby making nuclear use more difficult for terrorists. As noted in the 2000 Defense Science Board report on Unconventional Nuclear Warfare Defense, one of the strongest elements of protection is deterrence through the threat of reprisal. The goal of stopping subsequent attacks serves to define the timelines for accomplishment of attribution and substantially increases the need for a rapid and authoritative attribution system which, in turn, requires exquisite nuclear forensics capabilities.

Nuclear forensics is not a new mission for DoD. The department's existing nuclear forensics capability is the result of programs that span six decades and includes activities to assess foreign nuclear weapons testing activities, monitor and verify nuclear arms control treaties, and to support intelligence and law enforcement activities. During the Cold War, attribution was a simpler matter as we knew who would be the likely aggressor, and had the means for detecting attacks and confirming the origin of attack. However, nuclear proliferation and the global threat of terrorism mean that we are more likely to face covert rather than readily observable means of nuclear attack. In today's security environment, post-detonation forensics to sup-

port attribution requires much faster answers to different questions under the pressure of an extreme crisis without prior notice.

In 2000, DTRA initiated the Domestic Nuclear Event Attribution (DNEA) program to improve USG post-detonation nuclear forensics capabilities and develop a focused system for rapid and accurate attribution of a domestic nuclear or radiological event. DNEA was created as a joint effort of military, intelligence, technical and law enforcement communities. In 2005, DTRA conducted a successful concept demonstration of DNEA capabilities, and continues its efforts to operationalize a process and capabilities for producing technical nuclear forensics information to fulfill DoD's global responsibilities under the National Technical Nuclear Forensics (NTNF) program. This effort to "operationalize" post-event nuclear forensics is focusing on collection of samples, scientific analysis of the samples, and subsequent reporting of findings that meet legal and scientific requirements.

The DoD Role

The recent signing of the NTNF policy by the President specifically assigns DoD the responsibility to ensure a worldwide post-detonation NTNF capability, including ground and air sample collection, analysis of post-detonation debris, developing and sustaining a concept of operations, and supporting enhancements to post-detonation scientific and technical capabilities. DoD support to NTNF is being led by the Assistant to the Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs. DTRA and other DoD elements, such as the Air Force Technical Applications Center, provide specific, supporting operational capabilities.

DTRA maintains the capabilities developed under the DNEA program, including a ground sample collection capability, a forensics laboratory process, and an exercise program to sustain post-detonation NTNF capabilities. DTRA will partner with DOE to provide support in domestic incidents with DTRA developed capabilities including= a ground sample collection capability, a forensics laboratory process, and as mentioned earlier, an exercise program to sustain post-detonation NTNF capabilities. We also maintain a special cadre of select personnel and equipment to respond globally to any nuclear or radiological incident.

The DTRA Nuclear Forensics R&D Program is an integral component of a coordinated interagency effort, rather than different potential paths to meet similar requirements. Our investment areas include: Prompt Nuclear Effects Data Collection and Analysis, which is key to the precise measurement of nuclear yield; Debris Sample Collection and Field Measurements to develop more robust ground robotic, unmanned aerial vehicle and manual collection capabilities; Debris Analysis to develop novel approaches and new technologies to achieve rapid and precise isotopic measurements; Data Evaluation and Knowledge Management to improve the application and management of signatures, databases, models, calculations and expertise to produce consensus results; Integration to bring efficient, full national post-detonation NTNF capabilities to bear across the interagency in a crisis environment providing accurate and rapid initial and final results; and other DoD nuclear forensics missions, which may be non-NTNF, but support development of foundational capabilities to provide technical conclusions.

Additionally, DTRA manages and sponsors DoD NTNF exercise and evaluations, is working to fully integrate DoD's exercise and evaluation program into the DHS NTNF exercise program, and has begun crafting DoD's integrated NTNF concept of operations. DTRA supports the DHS and the FBI with hardware, systems, training, exercises and evaluations, and planning for a response to a nuclear incident.

I would like to note that NTNF capabilities rely on the aging physical infrastructure and human expertise that support the USG nuclear weapon programs. While the interagency effort described here today makes a small investment in revitalizing aspects of this national treasure, further erosion in the nuclear weapons program will severely impact our nuclear forensic analysis and evaluation capabilities. A deliberate and concerted effort is needed to ensure these critical capabilities will be available when the nation needs them most.

In addition, I would like to emphasize that neither DTRA nor DoD performs the forensics mission in a vacuum. Many components in the USG, including the DNDO, DOE, FBI, and the Intelligence Community all play a vital role in that effort.

Conclusion

During a recent National Defense University sponsored workshop on nuclear attribution, attendees, including Congressional staff, stressed the incredible pressure that the President and his advisors would be under to make a rapid attribution determination, both for response purposes and to prevent a potential follow-on attack. Policy advisors acknowledged the need to develop further the nation's strategic communication of attribution capabilities for deterrence, dissuasion, and assurance purposes. Our NTNF capability must be able to respond and deliver the initial and final

technical conclusions necessary to protect the nation and make well informed decisions.

We have made noteworthy progress, but still have a long way to go in developing and fielding capabilities, such as more robust collection capabilities and improved rapid analysis and data evaluation capabilities, to meet the threat posed by nuclear terrorism. No single Agency or effort can ensure success. Meeting this threat requires the focused integration and coordination of full NTNF capabilities, as well as international capabilities and expertise.

Mr. Chairman, this concludes my remarks. I would be pleased to respond to your questions.

Mr. LANGEVIN. [Presiding.] Thank you very much.

STATEMENT OF VAHID MAJIDI, ASSISTANT DIRECTOR, WEAPONS OF MASS DESTRUCTION DIRECTORATE, FEDERAL BUREAU OF INVESTIGATION, DEPARTMENT OF JUSTICE

Mr. MAJIDI. Good afternoon, Chairman Langevin, Ranking Member McCaul and members of the subcommittee. I am pleased to be here today to demonstrate the commitment of the FBI to strengthening our nation's ability to conduct effective technical nuclear forensics.

Our number one priority is to protect the nation from terrorist attack. Within that priority, the weapons of mass destruction threat is our most pressing concern. The FBI established a WMD Directorate in 2006 to develop a comprehensive approach for combating WMD proliferation.

We began by consolidating the units within the FBI that were addressing the response, investigation, intelligence, analysis, dissemination and countermeasures program into one unified structure. Paramount to our prevention effort is a strong forensic program that includes all aspects of WMD and traditional forensic expertise.

We also recognize that it is through an effective interagency cooperation that the WMD threat is best addressed. The FBI Laboratory Division is central to our support to the interagency effort in nuclear forensics. The laboratory provides the personnel, equipment and know-how to effect the safe and secure collection of radiological and nuclear materials. Furthermore, the laboratory provides training on WMD crime scene awareness so that our personnel can properly enter, exit and work within any scene where biological, chemical, radiological or nuclear materials might be present.

Beginning this fall, we are pleased to be offering WMD crime scene awareness training to selected personnel from the Department of Defense, Department of Homeland Security, and Department of Energy to strengthen our interagency collaboration.

No agency has the necessary resources and capabilities to independently perform technical WMD forensics. The FBI laboratory leverages the capability of the interagency community to conduct and direct the forensic examination of the evidence that is contaminated or contains hazardous material. To that end, the FBI has formalized partnerships with a variety of government, academic and private labs to carry out specific examination of our evidence.

For example, we have formal agreements in place with Savannah River National Laboratory, Lawrence Livermore National Laboratory, the U.S. Air Force Technical Applications Center for forensic analysis of recovered radiological material, special nuclear mate-

rials, recovered improvised nuclear devices, and debris resulting from a detonated device.

The laboratory support for technical nuclear forensics is culminated through our ability to conduct traditional forensics on radiological and nuclear materials—in other words, to perform the very forensic examination for which the FBI laboratory is world renowned. The FBI laboratory has taken the lead by developing and implementing the hazardous evidence analysis team, or HEAT program.

Normally, we transport evidence from the crime scene to the FBI laboratory. For WMD crimes, however, we have made the conscious decision to refrain from transporting any such evidence to our laboratory until we demonstrate that no residual WMD contamination exists. Nonetheless, the investigation process requires prompt traditional forensic signatures such as latent prints, human DNA analysis, and trace evidence.

To ensure timely traditional forensic examination of evidence, we transport the examiners to the evidence at one of the partner laboratories. The HEAT program provides additional training for qualified forensic examiners and technicians, which allows them to operate in a WMD laboratory environment such as a hot cell for nuclear materials at biosafety level three or four suite for pathogens or a chemical surety facility for toxic chemicals.

In short, the FBI is proud to be a member of the dedicated interagency community focused on WMD forensic issues to protect our nation.

Thank you for your time. I look forward to answering your questions.

[The statement of Mr. Majidi follows:]

PREPARED STATEMENT OF VAHID MAJIDI, PH.D.

Good morning, Chairman Langevin, Ranking Member McCaul, and members of the Subcommittee. I am pleased to be here today to demonstrate the commitment of the Federal Bureau of Investigation (FBI) to strengthening our nation's ability to conduct effective technical nuclear forensics.

The number one priority of the FBI is to protect the nation from terrorist attacks. Within that priority, the Weapons of Mass Destruction (WMD) terrorist threat is clearly our most pressing concern. The FBI established the WMD Directorate in 2006 to bring together the units within the FBI that were addressing the response, investigation, intelligence dissemination and analysis and countermeasures programs into one unified structure. This unity of leadership has strengthened the FBI's ability to prevent a WMD terrorist attack significantly. Key to our prevention efforts is a strong forensic program that includes all aspects of WMD and traditional forensic expertise. Additionally, we at the FBI recognize that it is through interagency cooperation that the WMD terrorist threat is best addressed.

The FBI Laboratory Division is central to our support to Interagency efforts of the DOJ, DHS, DOE, DOD and members of the Intelligence Community (Interagency) in nuclear forensics. We view our Laboratory as the world's premiere forensics laboratory and are proud of the role it fulfills in preventing WMD terrorism and in responding to crimes when they occur. The Laboratory's Hazardous Materials Response Unit (HMRU) provides the personnel, equipment, and know-how to effect the safe and secure collection and transport of radiological and nuclear materials and debris to an appropriate facility for analysis and characterization These capabilities include the people who work at HMRU in Quantico, Virginia, and their gear, as well as those of 27 Hazardous Materials Response Teams (HMRTs) that are trained, equipped and certified by HMRU. These teams are located throughout the United States (US) with various FBI Field Divisions and provide over 400 personnel to augment our operational response capabilities.

HMRU also provides training on WMD Crime Scene Awareness so that our personnel will know how to properly enter, exit and work within any scene where bio-

logical pathogens, toxic chemicals and radiological or nuclear materials might be present. This training, which historically has been directed toward our own personnel, has recently been adapted to provide WMD crime scene awareness training for personnel from the Interagency. We are pleased to be offering the training beginning this fall to selected personnel from the Department of Homeland Security (DHS), Department of Defense (DOD), and Department of Energy (DOE). In keeping with the importance we attach to nuclear forensics, we have targeted those DHS, DOD, and DOE elements most directly involved in nuclear activities as the first priority to receive this training from the FBI.

No one agency has the necessary resources, experience and capabilities to solely perform technical WMD forensics. The Laboratory leverages the capabilities of the Interagency through the efforts of its Chemical Biological Science Unit (CBSU), an all-discipline WMD analysis unit. CBSU develops and maintains the Laboratory's ability to conduct and/or direct the forensic examination of evidence that either contains or is contaminated with hazardous chemical, biological or radiological material. To that end, CBSU has formalized partnerships with a variety of government, academic and private labs to carry out specific examinations of FBI evidence.

We have formal agreements in place with Savannah River National Laboratory (SRNL), Aiken, South Carolina for recovered radiological materials and detonated radiological dispersal devices (RDDs); with Lawrence Livermore National Laboratory (LLNL), Livermore, California, for recovered Special Nuclear Materials as well as intact improvised nuclear devices (INDs); and with the US Air Force Technical Applications Center (AFTAC) for debris resulting from the detonation of an IND.

In November 2006, we began operations at SRNL of the Radiological Evidence Analysis Laboratory Suite (REALS), which was stood up with our funds plus funding from DHS. REALS provides dedicated space at SRNL for our forensic examiners and technicians to perform selected activities, including the storage of evidence. The joint DHS/FBI funds also enabled us to begin planning and designing a unique set of fully functional forensic laboratory spaces that we refer to as the Radiological Evidence Examination Facility (REEF). Thanks to specifically-targeted Congressional funding received this past Fiscal Year (FY), we began renovations of existing space at SRNL to create REEF. It is projected to become fully functional in FY 2009, thereby allowing our Laboratory examiners and technicians to conduct a full range of traditional forensic examinations on evidence that is contaminated with nuclear materials.

The final pillar to our Laboratory's support for technical nuclear forensics speaks to our ability to conduct traditional forensics on radiological and nuclear materials—in other words, to perform the very forensic examinations for which the FBI Laboratory is so well-known. In this case, CBSU has also taken the lead, both domestically and internationally, by developing and implementing the Hazardous Evidence Analysis Team or HEAT program. That program responds to the altered operational dynamic that prevails when we investigate a crime or suspicious event involving WMD. Normally, we transport evidence from a crime scene to the FBI Laboratory. For WMD crimes, though, we have made the conscious decision to refrain from transporting any such evidence to our Laboratory in Quantico until we can demonstrate that no residual WMD contamination exists.

But the needs of the investigation to process the evidence for traditional signatures of interest—such as latent fingerprints, human DNA analysis, and trace evidence—are immediate. To ensure we begin such traditional examinations promptly, we have flipped the dynamic, and we transport the examiners to the evidence at one of partner laboratories. The HEAT program takes our trained and qualified forensic examiners and technicians from across the Laboratory and provides additional training which allows them to operate in a WMD laboratory, such as in a hot cell for nuclear materials, a Biosafety Level 3 or 4 Suite for biological pathogens or a Chemical Surety Materiel laboratory for toxic chemicals. We certify our personnel through the HEAT program as qualified examiners and technicians in their discipline. We believe HEAT has been a success, with more than 60 examiners and technicians trained and certified, representing the various forensic disciplines in our Laboratory. Our examiners and technicians profit, gaining the confidence and skills needed to conduct their demanding tasks in an altered environment. The investigation is supported by ensuring we have a cadre of such trained and certified personnel who are ready to deploy immediately when the need arises. Through this training and certification process, we are learning what modifications, if any, are needed to conduct traditional forensic techniques when the work must be performed in a radiological or nuclear laboratory or, in the more general case, in any WMD laboratory, such as those of our partners with DHS at NBACC and with DOD at the Edgewood Chemical Biological Center. Again, as with our novel nuclear forensic examiner program, we are unaware of any program similar to HEAT with any of

our international partners, but we are certainly anxious to share our experiences with them.

Thank you for time, I look forward to answering your questions.

Mr. LANGEVIN. Thank you, Dr. Majidi.

Before we go to the next witness, you heard the buzzers going off. That means that there is a vote on right now. My plan is to finish the testimony of the last two witnesses. We will recess and then return for questions, and then go to the second panel.

Before I do that, I want to thank Mr. Etheridge for stepping in and chairing and opening the hearing for me. I was in a markup in the House Intelligence Committee, and obviously couldn't be here. So I want to thank the witnesses for being here today.

PREPARED OPENING STATEMENT OF THE HONORABLE JAMES R. LANGEVIN, CHAIRMAN, SUBCOMMITTEE ON EMERGING THREATS, CYBERSECURITY, AND SCIENCE AND TECHNOLOGY

The subcommittee will now move on to the markup of an amendment in the nature of a substitute to HR 3621. The Nuclear Forensics and Attribution Act. I would like to again congratulate my colleague Congressman Schiff for introducing this legislation and for working collaboratively with me to develop the amendment in the nature of a substitute we will consider today.

The Nuclear Forensics and Attribution Act expresses the sense of Congress that the President should:

- purse bilateral and multilateral agreement to establish an international framework for determining the source of any confiscated nuclear material or weapon, as well as the source of any detonated weapon and the nuclear material used in such a weapon;
- develop protocols for the dissemination of sensitive information relating to nuclear materials to the extent required by such agreements; and
- develop expedited protocols for the dissemination of sensitive information needed to publicly identify the source of a nuclear detonation.

It also amends the Homeland Security Act of 2002 to task the Secretary with the development of methods to attribute nuclear or radiological material—both within the Domestic Nuclear Detection Office and in partnership with other Federal agencies—to its source when such material is intercepted by the United States, foreign governments, or international bodies or dispersed in the course of a nuclear terrorist attack or other nuclear or radiological explosion. The Amendment in the nature of a substitute builds on and strengthens these ideas by:

- Emphazing that the development of a robust nuclear forensics capability will depend chiefly on an expertly trained workforce in this area, and the recognition that our workforce in this area is currently waning and that we must turn this trend around.
- It also tasks the Secretary of Homeland Security to act as the integrator and steward of our national nuclear forensics capabilities. While it is a certainty that the cooperation of all the agencies represented here is needed for success in this mission, clearly specifying this duty for the Secretary should provide the needed leadership for success.
- The amendment further requires the Secretary to report annually to Congress on the activities of the interagency group as well as the development and maintenance of the needed expert workforce;
- And finally, it authorizes $20 million per year for the next three fiscal years for this effort.

I would also like to thank Ranking Member McCaul for his contributions on many of the topics just mentioned to strengthen the underlying bill. I appreciate his efforts and am pleased that this subcommittee continues to be a model of bipartisanship.

Mr. LANGEVIN. Mr. Grant, you are now recognized for 5 minutes.

STATEMENT OF ANDREW GRANT, ACTING DIRECTOR FOR WMD TERRORISM, BUREAUS OF INTERNATIONAL SECURITY AND NONPROLIFERATION, DEPARTMENT OF STATE

Mr. GRANT. Good afternoon, Chairman Langevin, Ranking Member McCaul and distinguished members of the subcommittee. Thank you for the opportunity to provide remarks on the State Department's role in supporting the U.S. government's nuclear forensics program.

As others have stated already, the U.S. government is working to develop the appropriate cooperation with its international partners so that each day we are improving our ability to conduct effective nuclear forensics when and where it is needed. The Department of State supports this in a variety of ways. The Department of State has always contributed to the policy and program development of the U.S. nuclear forensics effort and State Department personnel today work at the Domestic Nuclear Detection Office and assist in operations at the National Technical Nuclear Forensics Center in the Department of Homeland Security.

Also, the Department of State interacts regularly with the IAEA through participation in the Illicit Trafficking Database program. Finally, the Department of State builds international support to improve nuclear forensics, and where necessary coordinates deployment of U.S. technical or investigative teams for forensics.

The president has made clear his view on the importance of building international partnerships to carry out nuclear forensics, with specific commitments in the Global Initiative to Combat Nuclear Terrorism and the Bratislava initiative. These initiatives highlight the need to improve capabilities for response, mitigation and investigation, including development of technical means to identify nuclear material or other radioactive materials in substances that are or may be involved in a nuclear incident. Through the Global Initiative, over 60 partner nations have committed to this objective as a key element of global capacities to combat nuclear terrorism.

Supporting our political commitment to strengthen nuclear forensics, the Department of State also chairs the Interagency Nuclear Trafficking Response Group, or NTRG. The NTRG coordinates the U.S. government's response to international forensics and radioactive material trafficking incidents. If deemed necessary, the Department of State also leads coordination for the Foreign Emergency Support Team, or FEST, an interagency team that can quickly deploy anywhere in the world to assist U.S. embassies in our responses to acts of terrorism, including incidents involving nuclear or radiological material.

Although nuclear forensics is often associated with activities conducted in post-detonation environments, nuclear forensics is also extremely important to combat nuclear smuggling. As part of a shared commitment with our international partners to improve control of nuclear materials, shut down trafficking networks and routes, and prosecute nuclear smugglers, we are assisting other government to strengthen their own nuclear forensics capacity, and thus strengthen our collective nuclear forensics effort.

Our work with the Georgians in a successful prosecution of a 2006 case involving highly enriched uranium, or HEU, is a note-

worthy example. This month, a U.S. team went to Georgia to help the Georgian government align its nuclear forensics procedures with recent IAEA guidance on nuclear forensics which we helped create.

The U.S. government also coordinates with the international community on technical nuclear forensics activities through the International Technical Working Group, or ITWG. The ITWG also works closely with the IAEA to provide member countries with support for forensics analysis. Priorities include the development of common protocols for the collection of evidence and laboratory investigations, organization of forensics exercises, and technical assistance to requesting nations. Through the ITWG, the U.S. can provide technical assistance on nuclear forensics to countries in response to specific requests.

The Department of State will continue to support and lead in many areas to further develop our own nuclear forensics capacity. We will also continue to identify and maximize opportunities where our partners can assist us in our efforts to strengthen our nuclear forensics capacity. In doing so, we save lives and strengthen our chances to identify threats.

This concludes my summary. I have also submitted a formal statement. Distinguished members of the subcommittee, I thank you and I am happy to answer any of your questions.

[The statement of Mr. Grant follows:]

PREPARED STATEMENT OF ANDREW F. GRANT

Introduction

Good afternoon Chairman Langevin, Ranking Member McCaul, and distinguished members of the subcommittee. Thank you for the opportunity to provide remarks on the Department of State's role in supporting the U.S. government's nuclear forensics program. As others have noted, the U.S. government is working to develop the appropriate cooperation with international partners so that each day we are improving our ability to conduct effective nuclear forensics when and where it is needed.

Roles and Responsibilities

The U.S. government aims to establish global capacity to conduct pre-detonation and post detonation nuclear forensics anywhere necessary to support U.S. interests. The Department of State supports this in a variety of ways. The Department of State has always contributed to the policy and program development of the U.S. nuclear forensics effort and State Department personnel also work at the Domestic Nuclear Detection Office and assist in operations at the National Technical Nuclear Forensics Center. The Department of State supports the Department of Homeland Security's efforts to integrate and coordinate the full spectrum of U.S. nuclear forensic activities, as well as efforts to develop and advance nuclear forensic capabilities for pre-detonation nuclear materials. Also, the Department of State interacts regularly with the IAEA through participation in the Illicit Trafficking Database Program. Finally, the Department of State leads many U.S. government efforts overseas for nuclear forensics, which include building international support to improve nuclear forensics and, where necessary, coordinating for deployment of U.S. technical or investigative teams for nuclear forensics.

The President has made clear his view of the importance of building international partnerships to carry out nuclear forensics with specific commitments in the Global Initiative to Combat Nuclear Terrorism and the Bratislava Initiative. These initiatives highlight the need to improve capabilities for response, mitigation, and investigation, including the development of technical means to identify nuclear material or other radioactive materials and substances that are, or may be, involved in a nuclear incident. Through the Global Initiative, over sixty partner nations have committed to this objective as a key element of global capabilities to combat nuclear terrorism.

Supporting our political commitment to strengthen nuclear forensics, the Department of State chairs the interagency Nuclear Trafficking Response Group, or

(NTRG). The NTRG coordinates the U.S. government's response to international nuclear and radioactive material trafficking incidents. If deemed necessary, the Department of State also leads coordination for the Foreign Emergency Support Team (FEST), an interagency team that can quickly deploy anywhere in the world to assist U.S. embassies in our responses to acts of terrorism, including incidents involving nuclear or radiological material.

International Coordination to Combat Nuclear Smuggling

Although nuclear forensics is often associated with activities conducted in post-detonation environments, nuclear forensics is extremely important to combat nuclear smuggling. As part of a shared commitment with our international partners to improve control of nuclear materials, shut down trafficking networks and routes, and prosecute nuclear smugglers, we are assisting other governments to strengthen their own nuclear forensics capacity and thus, strengthen our collective nuclear forensics effort. Our work with the Georgians in the successful prosecution of the 2006 case involving highly-enriched uranium (HEU) is a noteworthy example. This month a U.S. team went to Georgia to help the Georgian government align its nuclear forensics procedures with recent International Atomic Energy Agency (IAEA) guidance on Nuclear Forensics, which we helped create. The U.S. government also coordinates with the international community on technical nuclear forensics activities through the International Technical Working Group, or ITWG. The ITWG also works closely with the IAEA to provide member countries with support for forensic analyses. Priorities include the development of common protocols for the collection of evidence and laboratory investigations, organization of forensic exercises, and technical assistance to requesting nations. Through the International Technical Working Group, the U.S. can provide technical assistance on nuclear forensics to countries in response to specific requests.

Conclusion

The Department of State will continue to support and lead in many areas to further develop our nuclear forensics capacity. We will also continue to identify and maximize opportunities where our partners can assist us in our efforts to strengthen our nuclear forensics capacity. In doing so, we save lives and strengthen our chances to identify threats.

This concludes my prepared statement. With the committee's permission, I request that my formal statement be submitted for the record. Chairman Langevin, Ranking Member McCaul, and the other distinguished members of this Subcommittee, I thank you and I am happy to answer any of your questions.

Mr. LANGEVIN. Thank you, Mr. Grant.

The chair now recognizes Dr. Burns for 5 minutes.

STATEMENT OF CAROL BURNS, GROUP LEADER, NUCLEAR AND RADIOCHEMISTRY, CHEMISTRY DIVISION, LOS ALAMOS NATIONAL LABORATORY

Ms. BURNS. Good afternoon, Chairman Langevin, Ranking Member McCaul and distinguished members of the subcommittee. It is an honor to appear before you today to discuss this important legislation. In particular, I have been asked to focus my remarks on the workforce needs required to meet the challenges of technical nuclear forensics.

My name is Carol Burns. I am the group leader for the Nuclear and Radiochemistry Group at Los Alamos National Laboratory. I have more than 20 years of experience investigating the chemistry of radioactive elements. I also served on detail to the Office of Science and Technology Policy, working on issues associated with nuclear threats.

There are three main points I would like to convey to you this afternoon. First, the national laboratories underpin the nation's nuclear forensics capability. Second, we face a challenge in sustaining our workforce. And finally, I would like to offer some ideas on how we can go about bringing in the next generation of forensic experts.

My first point is that Los Alamos and the other DOE national laboratories are major contributors to our nation's capability for nuclear and radiological forensics funded by the agencies represented here today. The laboratories offer unique expertise and special facilities for handling radiological and nuclear materials. I staff and maintain our radioanalytical group capability, and as such am a consumer of the product of our educational pipeline.

Many disciplines are involved in the different facets of technical nuclear forensics. Chemists and material scientists evaluate signatures to distinguish the origin of interdicted materials. Nuclear physicists and engineers develop tools to rapidly characterize the threat presented by a suspect device. Radiochemists separate and characterize the composition of complex mixtures of isotopes in debris in the wake of a nuclear or radiological explosion.

To speak to my second point, the laboratories face challenges in recruiting and retaining a qualified workforce to carry out elements of this important work. Statistics from DNDO indicate that most employees who work solely on nuclear forensics at the laboratories are more than 50 years old. Some requisite knowledge cannot be acquired through formal education, but must be learned first-hand or taught by experienced workers.

For instance, few radiochemists remain who have analyzed the debris from a nuclear explosion. It takes years working with senior staff and retirees to build this competence in a new worker even if he or she starts with a sound knowledge of radiochemistry.

Another concern is the depth of our capability. At our current staffing levels, we will tax the capacity of the system with the surge of samples that might be expected after a major event, such as the detonation of a nuclear device.

It has been well documented that some of our traditional feeder disciplines are on the decline. As highlighted in a 2004 report from the Department of Energy and the National Science Foundation, the number of Ph.D.s granted in nuclear science disciplines has declined by 20 percent since the mid-1990s and by 50 percent since the mid-1970s. The number of radiochemistry and nuclear chemistry Ph.D.s awarded by U.S. universities has declined by more than a factor of five since 1970, as has the number of chemistry departments offering even one course in these disciplines.

My third and final point is that there are many things that can and are being done to improve this situation. Many studies offer ideas for drawing students to the field, including training centers, faculty fellowships, summer undergraduate programs, and postdoctoral programs. We see progress, for example, in the establishment of the new DNDO–NSF Academic Research Initiative. We need sustained funding for research in a broad range of nuclear-related fields to encourage the commitment of faculty to the area.

The laboratories are also responding. Los Alamos is initiating efforts to build relationships with partner universities to develop and recruit this next workforce through our National Security Education Center. In the end, drawing from traditional disciplines will not be enough. We need to enlist scientists from other fields and provide them with the means to conduct work on radioactive materials not easily handled in most university environments. This

could occur through cooperative programs at the national laboratories.

In conclusion, if the nation succeeds in developing this workforce, the benefits will extend beyond nuclear forensics. A stronger educational pipeline in nuclear disciplines will help the nation meet the challenges of nonproliferation, nuclear energy, and nuclear medicine.

I thank you for your attention and will be happy to answer any questions.

[The statement of Ms. Burns follows:]

Testimony of
Dr. Carol J. Burns
Group Leader, Nuclear and Radiochemistry
Los Alamos National Laboratory

Before the U.S. House of Representatives
Committee on Homeland Security
Subcommittee on Emerging Threats, Cybersecurity and Science and Technology

Hearing on H.R. 2631, the Nuclear Forensics and Attribution Act

October 10, 2007

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Introduction

Good afternoon Chairman Langevin, Ranking Member McCaul, and distinguished members of the Subcommittee. It is an honor to appear before you today to discuss the important legislation before the Committee. In particular, I have been asked to focus my remarks on the workforce needs required to meet the challenges of technical nuclear forensics programs.

My name is Carol Burns and I am the Group Leader for the Nuclear and Radiochemistry Group at Los Alamos National Laboratory. Employees in this group contribute to our nation's capability for nuclear and radiological forensics. I have more than 20 years of experience investigating the chemistry of radioactive elements. I also served on detail to the Office of Science and Technology Policy, providing technical and policy support on issues associated with nuclear threats. I staff and maintain our radioanalytical capability, and as such, am a "consumer" of the product of our educational pipeline.

There are three main points I would like to convey to you this afternoon. First, the national laboratories underpin the nation's nuclear forensics capability. Second, we face a challenge in sustaining our workforce, and finally, I'd like to offer some ideas on how we can go about bringing in the next generation of forensics experts.

Forensics: Role of the National Laboratories

The Department of Energy's National Nuclear Security Administration (NNSA) and the NNSA laboratories, of which Los Alamos National Laboratory is one, contribute to the nation's security through their primary mission of ensuring the safety and reliability of the nation's strategic nuclear deterrent. Building upon the NNSA's core nuclear weapons mission, the DOE and NNSA national laboratories are important technical providers to a number of national security sponsors who have relied on our unique capabilities since the days of the Atomic Energy Commission. These capabilities have grown in importance and relevance since September 11, 2001, in meeting the mission requirements of a number of agencies involved in combating weapons of mass destruction, homeland security, and homeland defense.

More specifically, Los Alamos and the other DOE national laboratories are major contributors to our nation's capability for nuclear and radiological forensics. This work is currently funded at Los Alamos and partner laboratories by the Department of Energy, the Department of Homeland Security, and other agencies.

Many disciplines are involved at Los Alamos in the different facets of technical nuclear forensics. Chemists and materials scientists evaluate signatures that will distinguish the origin of interdicted nuclear or radiological materials. Nuclear physicists and engineers develop tools to rapidly characterize the threat presented by a suspect device in the field. Radiochemists separate and characterize the composition of complex mixtures of isotopes in debris in the wake of a nuclear or radiological explosion. Scientists at LANL also develop ways to interpret the radiation and other signatures from a nuclear event, provide expertise on nuclear materials production methods and signatures, and model potential improvised nuclear devices.

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These activities are strongly supported both by unique knowledge (e.g. device design) and special facilities for handling radiological and special nuclear materials spanning the spectrum from environmental samples to significant quantities of interdicted material.

It is important to see that much of this current capability resides in the national laboratories, but it is also important to understand whether the need for these skills will extend into the future. Qualitative information has been compiled which identifies the continuing demand for workers in disciplines pertinent to nuclear and radiological forensics. In 2004, the National Science and Technology Council (NSTC) Interagency Working Group on Critical Workforce Needs, led by NNSA, collected data from 38 participating organizations spanning the defense, homeland security and the intelligence communities on hundreds of critical skills and the expected difficulty that would be encountered in hiring these skills over the next 5-10 years. Among the thirty critical skills ranked highest by the national security community as those in which they expected to have difficulty hiring are physical science areas such as radiation effects, radiation damage, nuclear instrumentation, health physics, nuclear physics, nuclear forensics, and nuclear and radiochemistry (data compiled by Dr. Beverly Berger, NA-11, NNSA). While this survey is not quantitative, it indicates a continuing need for these critical skills.

Challenges: Recruitment, Retention, Depth and Facilities

The laboratories face challenges in recruiting and retaining a qualified workforce to carry out elements of this important work. The overall aging demographic of the NNSA workforce is well known. In 2006 NNSA indicated that about 40% of nuclear weapons program technical staff members were eligible for retirement. An independent estimate provided by the Department of Energy/National Science Foundation Nuclear Science Advisory Committee (NSAC) report issued in 2004 (http://www.sc.doe.gov/np/nsac/docs/NSAC_CR_education_report_final.pdf) entitled "Education in Nuclear Science" suggests that within ten years "more than three quarters of the workforce in nuclear engineering and at the national laboratories will reach retirement age." More specific information is available in the form of a survey conducted by the National Technical Nuclear Forensics Center within DNDO of national laboratory demographics specific to technical nuclear forensic programs. Of those workers the laboratories identified as working on nuclear forensic efforts for more than 50% of their effort, the majority are more than 50 years old. A true need exists to replenish this workforce.

Although the workforce does need to be replenished, my experience at Los Alamos demonstrates that some requisite knowledge cannot be acquired through formal education, but must be learned first-hand or taught by experienced workers. For instance, both at Los Alamos and nationwide, we have a dwindling number of radiochemists who have analyzed the debris from a nuclear explosion and worked with designers to assess the nature of a device. It takes years working with senior staff and retirees to build this competence in a new worker, even if he or she starts with a sound knowledge of radiochemistry.

Another concern is the depth of our capability and the physical limits of some of our infrastructure. At our current staffing levels, we will tax the capacity of our people with the surge of samples that might be expected in the case of a major event such as the detonation of a

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nuclear device. Of equal concern is the sustainability of the facilities in which these dedicated researchers work. Across the DOE complex, many of the facilities where we conduct radiological work are greater than 50 years old and are coming close to the end of their useful lifetime.

An additional issue is whether the academic pipeline exists to provide a source of workers. Several recent studies have been conducted that point to the overall decline in research and education infrastructure in traditional "feeder" disciplines. As an example, the previously mentioned NSAC report evaluated national trends in the production of doctoral degrees in nuclear science (principally nuclear physics and nuclear chemistry). This report found that the level of Ph.D. production had decreased by about 20% since the mid-1990s and was down by "about half of the all-time highs reached in the mid-1970s" (Figure 1).

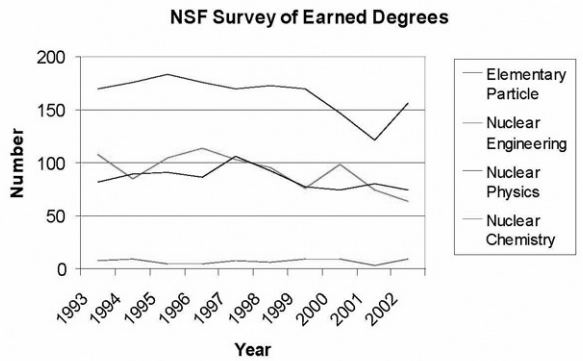

Figure 1. Number of Ph.D.s per year in selected disciplines

The report further indicated that U.S. colleges and universities were losing faculty positions in nuclear physics and nuclear chemistry.

The picture is starker in some disciplines. Figure 2 depicts the number of degrees awarded in nuclear and radiochemistry. Indeed, nuclear chemistry is no longer even tracked as a chemistry degree subcategory by the National Science Foundation. The number of faculty in nuclear and radiochemistry has also declined significantly; an evaluation of the 2005 *Directory of Graduate Research* entries indicates that 75% of faculty in nuclear or radiochemistry in that year were over 50 years of age.

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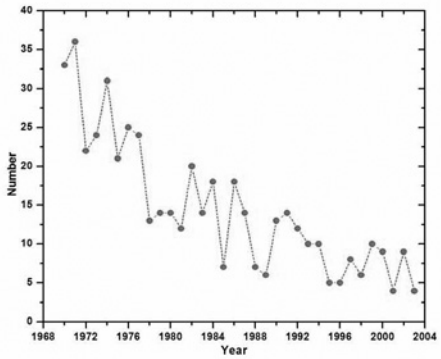

Figure 2. Radiochemistry & Nuclear Chemistry Ph. D.s Earned at U. S. Universities: 1970-2003 (data derived from ORISE 1970-72; NSF 1994-2003)

The overall status of these fields was summarized in a 2007 National Research Council Report, "Future of U.S. Chemistry Research: Benchmarks and Challenges." This report finds that U.S. preeminence in chemistry research is threatened, and in particular, "in some core subareas, such as main group chemistry and nuclear and radiochemistry, the U.S. position has already noticeably diminished based on publication and citation rates."

Competition between the workforce needs of technical nuclear forensics and those of other technology areas could exacerbate shortages. A National Academy of Sciences report on the state of science in nuclear medicine (http://www.nap.edu/catalog.php?record_id=11985) highlights a shortage of trained scientists, and the American Physical Society has recently initiated a review through the Panel on Public Affairs of the workforce and educational facilities' readiness to meet the challenges of nuclear energy.

Seeking Solutions--Some Progress

My third, and final point is that there are things that can and are being done to improve this situation. Given that few students are likely to encounter courses in nuclear science at the undergraduate level, programs such as the American Chemical Society-sponsored and DOE-funded summer schools in nuclear and radiochemistry are a welcome venue for undergraduate students to be exposed to the disciplines. These programs have seen a steadily growing number of applicants since their inception, and approximately 70% of participants go on to physics or chemistry graduate school, most who concentrate on nuclear chemistry or radiochemistry.

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The DOE national laboratories are also responding to the need to integrate students into these disciplines, and have provided summer educational experiences for students and postdoctoral fellowships for a number of years. We are now seeking to formalize broader-scale partnerships with universities. Los Alamos National Laboratory has formed the National Security Education Center, which is comprised of a number of academic institutes, partnerships with universities, and consortia of universities. The institutes serve LANL and our sponsors by recruiting new staff and providing educational opportunities that will enhance retention at the Laboratory. Through the LANL consortium's Institute for Advanced Studies, we are currently developing proposals for summer programs in forensics, and research partnerships with universities in relevant technical disciplines such as radiochemistry. Successful models in other fields exist at LANL's institutes that have addressed educating and recruiting staff in information technology, engineering, and materials science.

While I think there is room for optimism in terms of some of the new programs that are being developed, there is an important caution to be noted. It takes two things to produce a Ph.D. student: both the student, and sustained funding for research in a relevant subject to generate a thesis. Research is the primary means of training graduate students. In addition to recruiting students, we must provide a sustained base of research funding in a broader range of nuclear-related fields. It is likely, however, that we will not be able to build a sufficient base of employees trained academically in these disciplines. It is important to enlist scientists from other disciplines in solving the technical challenges of nuclear forensics. In order to broaden our technical base, we will need to compensate for the fact that most U.S. universities do not have the infrastructure to routinely train scientists and engineers in the handling of radioactive materials. We must provide a broader range of scientists with access to the facilities and tools to conduct work on radiological and nuclear, perhaps through cooperative programs at the national laboratories.

Conclusion

In conclusion, I'd like to say that it is gratifying that the agencies active in the nuclear forensics field have recognized and are responding to the need to sustain and build our nuclear forensics capabilities. I look forward to the partnerships we will build between the DOE laboratory system and the academic community to implement these approaches.

If the nation succeeds in developing this workforce, the benefits will extend beyond nuclear forensics. A stronger educational pipeline in nuclear disciplines will help the nation meet the challenges of nonproliferation, nuclear energy, nuclear medicine, and environmental management.

I thank you for your attention, and will be happy to answer any questions.

Mr. LANGEVIN. Thank you, Dr. Burns.

As I said, there is a vote on right now. There are four votes. That should take us at least 1/2 hour, so we will stand in recess until approximately 3:15 p.m.

[Recess.]

Mr. LANGEVIN. The subcommittee will come to order. In the interests of time, and I know my colleague from California, Mr. Schiff, is in the middle of a markup in another committee. We are going to go to the second panel, and Congressman Schiff will testify. Once that testimony is concluded, we will go back to the first panel for questions, and then proceed from there with the markup after that.

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So again, in the interest of time, I am going to forego an opening statement for the second panel. I want to commend my colleague from California for his hard work and his thought and insight into working on this nuclear forensics issue. I think it is obviously important to the country, and I am proud to be a cosponsor in support of this effort.

With that, I will yield to the ranking member for any comments, and then go to the witness.

Mr. MCCAUL. I echo the chairman's comments. I want to thank you for being here, and thank you for introducing this important piece of legislation. I, too, am proud to be a cosponsor.

Mr. LANGEVIN. I thank the ranking member.

With that, the chair now recognizes the gentleman from California, Congressman Adam Schiff.

STATEMENT OF HON. ADAM B. SCHIFF, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. SCHIFF. Thank you, Mr. Chairman and Ranking Member McCaul. I greatly appreciate your support for this legislation. I also appreciate your consideration in taking me out of order. My apologies to your first panel, and I thank them for their indulgence as well.

Today, I would like to speak with you very briefly about the Nuclear Forensics and Attribution Act. We all recognize nuclear terrorism as a threat so serious in its consequences, but we often shrink from contemplating it. A medium-size weapon detonated in downtown Manhattan would destroy every building across the width of the island and destroy homes as far away as Brooklyn and Hoboken. Hundreds of thousands of lives would be lost. The area would be uninhabitable for decades.

But ignoring the problem won't make it go away. In fact, ignoring the possibility of terrorists getting a hold of a nuclear device makes that awful prospect more likely to happen. Illicit nuclear material has been intercepted in transit many times since the end of the Cold War, and the material we catch may be a small fraction of the total that is trafficked.

President Bush has declared nuclear terrorism the number one national security threat facing the country, and this Congress and this subcommittee have made it more difficult to smuggle a weapon into the United States in an ongoing effort to strengthen the border. However, given the difficulties of securing our extensive border, we must take a layered approach to the problem.

During the Cold War, we deterred the Soviet Union with the threat of overwhelming nuclear attack. Unfortunately, the decentralized flexible terror networks that we face today are not as easily deterred. There is little doubt that if al-Qa'ida acquired a nuclear weapon, they would attempt to use it against us. Osama bin Laden has termed the acquisition of weapons of mass destruction a "religious duty," and there is no question that using such a weapon against America is consistent with the group's contempt for human life.

Although al-Qa'ida may not be deterred, there are other groups and nations that can be dissuaded from helping them, but only if their participation can be traced back to them. This bill is designed

to help shut down the international trade in nuclear material by deterring those parts of the trafficking network that can be deterred. Nuclear attribution would allow us to identify the provenance of nuclear material intercepted in transit or, God forbid, in the aftermath of a detonation. That knowledge would help us decide how to respond.

It would also provide a deterrent. If nations around the world knew that they could be identified as the source of material used in a nuclear attack, even irresponsible nations would be disinclined to proliferate. For the more responsible nations, it would be a strong incentive to improve their security. Individuals would know that they could be found and prosecuted if they tried to help terrorist acquire nuclear materials. By developing a robust attribution capability, we can usher in an era where proliferation is not just discouraged, but deterred, because those responsible would be found and punished.

The bill you are considering today supports our nuclear attribution capability by strengthening our nuclear forensics ability. Nuclear forensics involves studying the mix of isotopes and other features of nuclear material that give it a particular signature. There can also be information in the packaging and accompanying materials that could allow an expert to pinpoint the source.

Nuclear forensics activities have historically taken place in a variety of government agencies, but primarily in the Departments of Defense and Energy. The new National Technical Nuclear Forensics Center in the Department of Homeland Security will support and coordinate these efforts. Experts in this office will consider how to develop a database of information on nuclear material that can assist in tracing traffic, technology or materials, organize the forensic response to nuclear detonation, ensure that the right research is being done to counter threats to our security at home, and make certain that enough scientists and engineers are entering fields like radiochemistry which are the key to our forensic capability.

When a detective finds fingerprints, they must be matched against the database to identify possible culprits. Nuclear attribution works similarly, but there is no database of nuclear fingerprints. It can be difficult to obtain the needed information because it is considered sensitive in many countries, including our own. However, little of this information is of direct use to our adversaries, and in many cases the risk of not sharing the data is much greater than the risk of sharing it. Certainly, in the wake of a nuclear terrorist attack, no one will be reassured to hear that we couldn't shut down the smuggling networks because we didn't trust our allies.

In addition, new and innovative approaches may allow countries to confidently match samples without having direct access to sensitive information. This bill asks the president to negotiate agreements with other nations to share information on the makeup of their nuclear materials. These could be bilateral agreements with our allies, or multilateral treaties with the IAEA. We could even begin the database with just civilian reactor materials where security is less of an issue.

The important thing is to get started now. The National Technical Nuclear Forensics Center should play a key role in negotiations, since in the end the data we obtain must be the data the experts need. Nuclear terrorism is a threat of paramount danger and uncertain probability. It is not a threat we can measure in brigades, ships or warheads, but it is no less pressing for that. I believe this bill is a modest, but effective effort to reduce the risk of attack at the root of the problem. I am confident, after hearing from the experts, you will agree.

Mr. Chairman and Ranking Member, I want to thank you again.

[The statement of Mr. Schiff follows:]

PREPARED STATEMENT OF THE HONORABLE ADAM B. SCHIFF, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. Chairman, Members of the Subcommittee, thank you for having me here today to speak about the Nuclear Forensics and Attribution Act.

Nuclear terrorism is a threat so serious in its consequences that we often shrink from contemplating it. A medium-sized weapon detonated in downtown Manhattan would destroy every building across the width of the island and destroy houses as far away as Brooklyn and Hoboken. Hundreds of thousands of lives would be lost, and the area would be uninhabitable for decades. But ignoring the problem will not make it go away—in fact, ignoring the possibility of terrorists getting hold of a nuclear device makes that awful prospect more likely to happen. Illicit nuclear material has been intercepted in transit many times since the end of the Cold War, and the material we catch is probably a small fraction of the total trafficked.

President Bush has declared a nuclear terrorist attack on the United States the number one national security threat facing the country. This Congress and this Subcommittee have made it more difficult to smuggle a weapon into the United States in the ongoing effort to strengthen our border. However, given the difficulties of securing our extensive border, we must take a layered approach to the problem.

During the Cold War, we deterred the Soviet Union with the threat of overwhelming nuclear attack. Unfortunately, the decentralized, flexible terror networks that we face today are not as easily deterred. There is little doubt that if Al-Qa'ida acquired a nuclear weapon, they would attempt to use it against us. Osama bin Laden has termed the acquisition of weapons of mass destruction "a religious duty" and there is no question that using such a weapon against America is consistent with the group's contempt for human life.

Although Al-Qa'ida may not be deterred, there are other groups and nations that can be dissuaded from helping them, but only if their participation can be traced back to them. This bill is designed to help shut down the international trade in nuclear material by deterring those parts of the trafficking network that can be deterred.

Nuclear attribution would allow us to identify the provenance of nuclear material intercepted in transit, or, God forbid, in the aftermath of a detonation. That knowledge would help us decide how to respond and it would also provide a deterrent. If nations around the world knew that they could be identified as the source of material used in a nuclear attack, even irresponsible nations would be disinclined to proliferate. For the more responsible nations, it would be a strong incentive to improve their security. Individuals would know that they could be found and prosecuted if they tried to help terrorists acquire nuclear materials. By developing a robust attribution capability, we can usher in an era where proliferation is not just discouraged, but deterred, because those responsible would be found and punished.

The bill you are considering today supports our nuclear attribution capability by strengthening our nuclear forensics ability. Nuclear forensics involves studying the mix of isotopes and other features of nuclear material that give it a particular "signature." There can also be information in the packaging and accompanying materials that could allow an expert to pinpoint a source.

Nuclear forensics activities have historically taken place at a variety of government agencies, but primarily in the Departments of Defense and Energy. The new National Technical Nuclear Forensics Center in the Department of Homeland Security will support and coordinate these efforts. Experts in this office will consider how to develop a database of information on nuclear material that can assist in tracing trafficked technology or material, organize the forensic response to a nuclear detonation, ensure that the right research is being done to counter threats to our security

at home, and make certain that enough scientists and engineers are entering fields like radiochemistry which are the key to our forensic capability.

When a detective finds fingerprints, they must be matched against a database to identify possible culprits—nuclear attribution works similarly, but there is no database of nuclear fingerprints. It can be difficult to obtain the needed information because it is considered sensitive in many countries, including ours. However, little of this information is of direct use to adversaries, and in many cases the risk of not sharing the data is much greater than risk of sharing it. Certainly, in the wake of a nuclear terrorist attack, no one will be reassured to hear that we couldn't shut down the smuggling networks because we didn't trust our allies. In addition, new and innovative approaches may allow countries to confidently match samples without having direct access to sensitive information.

This bill asks the President to negotiate agreements with other nations to share information on the makeup of their nuclear materials. These could be bilateral agreements with our allies or multilateral treaties through the International Atomic Energy Agency (IAEA). We could even begin the database with just civilian reactor materials, where security is less of an issue. The important thing is to get started now. The National Technical Nuclear Forensic Center should play a key role in the negotiations, since in the end, the data we obtain must be the data that the experts need.

Nuclear terrorism is a threat of paramount danger and uncertain probability. It is not a threat we can measure in brigades, ships or warheads, but it is no less pressing for that. I believe that this bill is a modest but effective effort to reduce the risk of attack at the root of the problem, and I am confident that after hearing from the experts, you will agree.

Mr. LANGEVIN. I thank the gentleman from California for his testimony, and look forward to continuing to work with you on this important issue. I know you have a markup and we will forego questions at this time.

Unless there is any further business, this panel is concluded. Thank you very much.

The chair now calls up the first panel so that we can reconvene.

Okay, the committee will come to order. Since the panel has given their statements, it is my intention now to go into questions. Let me begin, if I could, with Director Oxford, and then let other members of the panel add on to his answer.

Director Oxford, could you please explain the organization mission and the role of each agency represented here in the National Technical Nuclear Forensics Center?

Mr. OXFORD. Mr. Chairman, first of all, the Technical Nuclear Forensics Center resides inside my office. It was established as a central integrator for U.S. government efforts in forensics. It was predicated on the same model that DNDO was established initially to serve, which was a centralized planning function with decentralized execution in the other departments.

So besides being the central integrator, we serve a role as also being responsible for the pre-detonation material and device characterization, with other responsibilities then flowing to the other departments as part of their implementation responsibilities.

Mr. LANGEVIN. Very good.

Anyone else care to comment?

One of the key assets for nuclear forensics obviously would be a secure, yet accessible, database containing signatures and other information about domestic and international samples, again starting with you, Director Oxford—and I would welcome comments, of course, from anyone else as well—what is the current state of our domestic database or databases for chemical isotopic or radiological signatures for these materials? What about international databases? Do we have access to international databases? Do other

countries or international agencies have access to any of our databases?

Mr. OXFORD. Let me start by saying a lot of that information needs to be discussed in a closed setting where we can talk about classified information and the actual status and health of both the domestic material database, as well as the international database.

The agreement within the interagency is that database will reside within the Department of Energy in what we call the Nuclear Material Information Program that Dr. Aoki can reference. Within DNDO and the Forensic Center, we are responsible for creating some of the knowledge management and data mining tools that would allow us to quickly make access of that data in the actual event. I would let Dr. Aoki talk about the actual, what we call the NMIP.

Mr. LANGEVIN. Okay. Before we do that, do you get the sense from our international partners that they are as interested in creating this type of a database as we are? Without getting into classified information, is there a sense or demonstrated measures that have been taken to ensure that we have this cooperation?

Mr. OXFORD. There are signs of progress since the interagency has come together here, to start working on the international aspects. Again, Andrew Grant can probably address that more adeptly from the State Department. But we have started some work with the Russians, for example, and some database structure that will allow us to share, as Mr. Schiff was saying, at least starting with some of the reactor material, the non-military kind of isotopes that would allow us to share that kind of information in a pre-event environment. I think the problem will be in an immediate post-event, if we are talking about nuclear weapons material, that is going to take a little bit longer to actually get those agreements in place.

Mr. LANGEVIN. Good point. Thank you.

Dr. Aoki, did you want to comment?

Mr. AOKI. Yes. Let me just say a few words about the Nuclear Materials Information Program, or NMIP. As originally conceptualized, the first problem was that we had was to identify where nuclear materials are located, even before you get to the question of actually having samples or detailed physical information. So the first job NMIP has taken on is identifying what the holdings of other countries are. This is actually a somewhat dynamic process since materials are generated and separated on a daily basis. So simply keeping track of where the stuff is is actually the first job.

The way in which NMIP has approached the task has really been to create what is in effect a database of databases. That is, there is a lot of information and Mr. Oxford referred to some of this as being classified information. There is a lot of information that is potentially available to the U.S. government through various agencies.

So one thing that NMIP is trying to do is just establish itself as an entry point that allows questions to be routed to the places where the information is located, and the data fed back in a proper form. Again, there is quite a bit of historical record, much of it created for purposes other than nuclear forensics. So simply getting a handle on that has been the first task that we have been involved in.

Mr. LANGEVIN. Good. Thank you.

Do other witnesses care to comment?

Mr. GRANT. Just two quick comments from the Department of State's perspective. Number one, we do see a lot of support for the ITB, the illicit trafficking database that the IAEA manages. In fact, we do have also awareness of the database and we use it where we can. It is limited in scope, and it is a completely voluntary effort. It does not include all members of the IAEA to submit material to that database, but it is a start.

Secondly, through the Global Initiative, there is interest, and in fact there will likely be activity on databasing of radiological sources and other material. These are all starts, but these are importantly led by other countries who are sharing this interest with us.

Mr. LANGEVIN. Right. Thank you.

My time has expired. I will now yield to the ranking member for question for 5 minutes.

Mr. MCCAUL. Thank you, Mr. Chairman.

This raises a lot of serious issues. This committee is always involved with very serious issues, but when you look at the world today, when you look at Pakistan, the A. Q. Khan network, that Pakistan has the capability. We have Musharraf in power, but there are a lot of hostile forces to him. The thought of that capability being turned over to more extreme forces gives me great pause.

You have Iran on the quest for nuclear weapons, and North Korea. You have the former Soviet Union, and I am not quite sure to this day if we have a handle or accountability of the nuclear weapons that they had. So proliferation is a huge issue. And so detecting and deterring is very, very important. I think the focus of this hearing I guess with forensics is more after it is apprehended, or God forbid, after it has been detonated, where does it come from?

And so, getting back to the database, because I share the chairman's concern about, and I understand some of this could be in a different setting, but the level of cooperation with many of these suspect countries I assume is very limited, if zero. So it raises the issue of the effectiveness of us, the United States, the administration, and the IAEA to effectively put some teeth into developing a database, so that we can truly trace back where this comes from if, God forbid, it happens.

If this has already been answered, I apologize, but it is a question that I think is worth asking again in terms of any pressure that can be put on the IAEA or the United Nations to expand the database and have more cooperation throughout the world. That is for anybody on the panel.

Mr. GRANT. I will just answer one element of that that I think will provide you a little insight. Recently, in fact, Pakistan has decided to volunteer database material to the illicit trafficking database. Now, that is one of the only and few, really, standing databases where they can, if you will, demonstrate their cooperation for this issue. Also, just in the last couple of months, Pakistan has also become a Global Initiative partner. We expect them to participate in our Global Initiative activities on this particular issue.

Again, these are very modest beginnings, but I think in that particular space recognizing the concerns for that country, along with the others who also participate, that is showing important steps forward for sharing our support and interest in this area.

Mr. MCCAUL. Is there anything we in the Congress can be doing? Mr. Oxford, would you answer that? In addition to that question, is there anything we in the Congress can be doing to apply leverage?

Mr. OXFORD. First of all, to get to your latter question, I think just having this hearing and raising this subject is an important step. The interagency has been working hard the last year to identify what the gaps in capabilities are that we need to proceed with.

Getting back to what Mr. Grant was saying, when the announcement of the Global Initiative first took place, there was a modest number of countries. I think there were about 13 that first subscribed to that initiative. The number of countries now subscribing to the Global Initiative is 55. So we are seeing a willingness to at least start the dialogue. As Mr. Grant says, there is a lot of work yet to be done, but forensics is part of the work package that is being brought into the Global Initiative, and we think that is encouraging.

Mr. MCCAUL. It certainly is.

Dr. Burns, a specific question for you, the training of talent and expertise on this area of expertise is very challenging. Can you speak to the level of the workforce in this area, and also to retirements? I think most people that have had a lot of experience in nuclear forensics, we don't have that young talent that I think we need to have in this country.

Ms. BURNS. There has been some information that was self-professed by the laboratory, so this is self-reporting data now, that indicates if you try and identify the number of people who spend most of their time working on technical forensics problems, it is probably on the order of 20 to 30, a small number. Then if you look at the broader community within the laboratories that are spending a portion of their time working on technical forensics, it reaches to about 200.

Now, if you look at the demographics associated with that, we find that in fact there is a challenge in that of the people who are spending full-time on the effort, those tend to be predominantly over 50, and in fact in some cases we have retirees staffing significant roles. So I think that proves that over the next 10 years, we will have a concern.

Mr. MCCAUL. Any solution to that?

Ms. BURNS. Well, part of the solution is to identify additional people we can bring in and perhaps some of the education will go on through our educational system. But something else perhaps we can in fact do is make sure that our senior staff are provided with some time working on the programs specifically to mentor younger staff. That is very challenging financially for programs to support people who are largely serving in that sort of training function, but that knowledge transfer I think is going to be critical in the short term.

Mr. MCCAUL. I agree.

Thank you, Mr. Chairman.

Mr. LANGEVIN. I thank the gentleman.

The chair now recognizes the gentleman from Texas for 5 minutes.

Mr. GREEN. Thank you, Mr. Chairman.

I thank the ranking member as well. I thought that the ranking member acquitted himself well this morning. I caught your performance.

[Laughter.]

Friends, it would seem to me that it is in the best interests of the communities of the world, meaning the nation-states, to work together on this type of endeavor. Can someone give me an indication as to how much cooperation we are receiving from the nation-states? And more specifically, which seem to find it an issue that they don't want to work cooperatively on or with us on?

Mr. GRANT. Just in review of the illicit trafficking database and the ITWG, the standing Technical Working Group that focuses on this issue, there are 28 countries that are participating in the ITWG right now. Now, the ITWG is establishing practices in these countries—and again, it is on a voluntary basis—to work with us and others who have perhaps a more robust capacity.

In terms of pointing to challenging areas, I think many of us are aware of where those spaces might be. The Black Sea region we are most interested in. We are certainly interested in the Middle East as well. Some of those countries have been less supportive to be involved in technical nuclear forensics, but it is a list that includes members from all continents. Additionally, I think there is strong acceptance to recognizing the need to provide more detailed technical support or practices, if you will, procedurally to assist countries to develop their technical nuclear forensics capability.

So these two forms—the ITV, the illicit trafficking database as it grows, based on the voluntary nature of the database, and then the ITWG, are good forums to be strengthened and for participation from global partners.

Mr. GREEN. This may be beyond the scope of what you are here for, but it would help me if you can answer the question. It would seem to me that the detonation of a device of the magnitude that we are talking about would be harmful to the planet Earth as opposed to someplace on the planet Earth. Is there some truth to what I have said?

Mr. AOKI. Certainly. Leaving aside the political impact, which would be devastating, and the local impact which would be devastating, there would also be measurable effects that could be detected around the world. Again, we have some history of nuclear testing in the atmosphere. We know that even at locations that were many hundreds of miles away from the test site, it was possible to identify radiation. So in that sense, certainly it will be true that there would be effects that would be observable and measurable a long distance away. Once one gets beyond a certain radius from the site of the event, those are not catastrophic effects, but they are something that people would be aware of and would have real effects on human health.

Mr. GREEN. Thank you, Mr. Chairman. I yield back.

Mr. LANGEVIN. I thank the gentleman.

I am told that other members are returning and we may have enough for the markup. So with that, I am going to go to a second round.

Well, with that, I am told we are going to as soon as we conclude at this point and then move to the markup, we will have enough time to conclude our business for the day.

So with that, I want to thank the panel for their testimony here today. I will remind the panel that the panel may have additional questions. I would ask that the witnesses respond as expeditiously as possible to those questions in writing.

At this time, the first panel of witnesses is dismissed. Again, I thank you for your time, your effort, and your service to the country. Thank you very much.

[Whereupon, at 4:29 p.m., the subcommittee was adjourned.]