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DETECTING NUCLEAR WEAPONS AND RADIOLOGICAL MATERIALS: HOW EFFECTIVE IS AVAILABLE TECHNOLOGY?

JOINT HEARING

BEFORE THE

SUBCOMMITTEE ON PREVENTION OF NUCLEAR AND BIOLOGICAL ATTACK

WITH THE

SUBCOMMITTEE ON EMERGENCY PREPAREDNESS, AND SCIENCE, AND TECHNOLOGY

OF THE

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DETECTING NUCLEAR WEAPONS AND RADIOLOGICAL MATERIALS: HOW EFFECTIVE IS AVAILABLE TECHNOLOGY?

Tuesday, June 21, 2005

HOUSE OF REPRESENTATIVES,
COMMITTEE ON HOMELAND SECURITY,
SUBCOMMITTEE ON PREVENTION OF NUCLEAR AND BIOLOGICAL ATTACK
WITH THE
SUBCOMMITTEE ON EMERGENCY PREPAREDNESS, SCIENCE, AND TECHNOLOGY,
Washington, DC.

The subcommittee met, pursuant to call, at 2:25 p.m., in Room 210, Cannon House Office Building, Hon. John Linder [chairman of the Subcommittee on Prevention of Nuclear and Biological Attacks] presiding.

Present: Representatives Linder, King, Lungren, Gibbons, Simmons, Pearce, Jindal, Reichert, McCaul, Dent, Langevin, Pascrell, Markey, Christensen, Etheridge, and Thompson.

Mr. LINDER. The joint hearing of the Committee on Homeland Security, Subcommittee on Prevention of Nuclear and Biological Attack and the Subcommittee on Emergency Preparedness, Science, and Technology will please come to order. I see we do not have enough seats for all of our guests, but those who can find a seat, please do.

I would like to thank our witnesses today and thank the distinguished gentleman from New York, Mr. King, who chairs the Subcommittee on Emergency Preparedness, Science, and Technology, for jointly holding this hearing. I look forward to your expert testimony regarding our efforts to deploy and develop technology to detect attempts by terrorists to smuggle a nuclear weapon or fissile material into the United States.

I am a strong believer in the power of technology, because it will be an important key to success in the war against terrorism. However, there is a dark side to the astounding progress of S&T. The rapid pace of technological development is the greatest single reason that terrorists must be taken more seriously than ever before, because terrorists will eventually have access to that technology. From the past seven hearings and classified briefings that my subcommittee has held on nuclear terrorism, it has been made obvious that terrorists have access to science, technology and to scientists.

Let me begin with a few facts about our borders. The U.S. shares a 2,000-mile border with Mexico and with Canada, 5,000 miles. We have 157 designated legal points of entry; 361 seaports, including 77 container seaports. We let 440 million visitors arrive by land, sea and air each year; 118 million vehicles, 11 million trucks, 2.5 million rail cars, 7 million cargo containers enter our ports annually. The length of the U.S. border, including coasts and lakes, is about 20,000 miles.

My greatest concern is that we are moving forward with deploying technology that may catch the inept terrorists that attempt to smuggle a nuclear device or fissile material through our legal points of entry and miss the smart one that will slip in illegally with a pickup truck or a small boat to then construct and detonate a bomb in the United States.

However, I firmly believe that we must invest in technology that would drastically limit avenues for smuggling a nuclear device into this country. I do not hold the notion that a terrorist that has gone to great lengths to acquire a nuclear device or fissile material is going to simply pack it in a random bale of marijuana and try to slip it into the country. Terrorists attempting to smuggle a nuclear weapon into the United States most likely only have one or a few weapons and will go to great lengths to limit the risk of being discovered.

We must intelligently invest in detection technology and its deployment. I hope that we will discuss here today what kinds of detection technology we should invest in and how to leverage our technology options to create an architecture that maximizes the probability that we will deter smuggling and intercept a nuclear device.

Our challenges are many. However, our investments in our national and academic labs, our strong partnerships with the private sector can and have provided us technological solutions. We must take this opportunity to invest wisely and not squander our scarce resources.

I look forward to the discussion with our experts and government witnesses to help this committee understand the many questions it has. Do we deploy plastics or the more expensive sodium iodide gamma ray detectors? Should we use active or passive interrogation? Should we invest in detectors for non-nuclear physical attributes? How can we use an array of these options to maximize detection?

It is not necessary to the terrorists' chance of success that they be on the cutting edge of technology. They will not need to have the world's most sophisticated technology in the year it comes out. They just need to know enough and have the sophistication to succeed in eluding us just once. However, to win the war on terrorism, we must constantly exploit our technological lead.

PREPARED OPENING STATEMENT OF THE HONORABLE JOHN LINDER

I would like to thank our witnesses today and recognize the distinguished Gentleman from New York, Mr. King, who chairs the Subcommittee on Emergency Preparedness, Science, and Technology for jointly holding this hearing.

I look forward to your expert testimony regarding our efforts to deploy and develop technology to detect attempts by terrorist to smuggle a nuclear weapon or fissile material into the United States.

I'm a strong believer in the power of technology, because it will be an important key to success in the war against terrorism. However, there is a dark side to the astounding progress of S&T. The rapid pace of technological development is the greatest single reason that terrorists must be taken more seriously than ever before. Because terrorists will eventually have access to technology that is being developed today.

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- The U.S. shares a 2,000 mile border with Mexico and the northern border with Canada stretches 5,000 miles.
- We have 157 designated legal ports of entry.
- 361 seaports, including 77 container seaports.
- About 440 million visitors arrive by land, sea, and air each year—118 million vehicles, 11 million trucks, 2.5 million railcars, and 7 million cargo containers cross through our ports annually.
- Length of the U.S. border including coasts and Lakes—about 20,000 miles

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The value of a nuclear weapon to the terrorist provides us an opportunity which can be exploited. This means we must intelligently invest in detection technology and its deployment. I hope that we will discuss here today what types of detection technology we should invest in and how to leverage our technology options to create an architecture that maximizes the probability that we will deter smuggling and intercept a nuclear device.

Our challenges are many, however, our investments in our National and Academic labs and our strong partnerships with the private sector can and has provided us technology solutions. We must take this opportunity to invest wisely and not squander our scarce resources.

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It is not necessary to the terrorist's chances of success that they be on the cutting edge of technology. They will not need to have the world's most sophisticated technology in the year it comes out. They just need enough sophistication to succeed to elude us once. However, we can win the war on terrorism if we constantly exploit our technological lead.

The Chair now recognizes the ranking member of the S&T subcommittee, Mr. Pascrell, for any comments he chooses to make.

Mr. PASCRELL. Thank you, Mr. Chairman. Thank you, Chairman King. On behalf of the minority, thank you for holding this hearing today on this very important subject of technology and equipment to monitor radiation at our Nation's ports.

Since 9/11, we have spent literally hundreds of millions of dollars on radiation portal monitors, and this fact alone demands rigorous oversight on the part of the Congress. I applaud both subcommittees for taking action.

While DHS should be commended for confronting the challenges of our changed world and taking immediate action to get this technology to our Nation's ports, an abundance of recent evidence suggests that the technology used may not actually meet the needs at hand. It is the responsibility of the Congress to ensure that we are getting our money's worth.

In fiscal year 2006, the administration requested $125 million to purchase an additional 279 radiation portal monitors, which the House agreed to do within its Homeland Security appropriations bill. DHS began deploying these monitors in 2002 to mail facilities on the northern border. But from the beginning, this equipment has been plagued by problems, problems that are so severe that the government is now testing technologies to upgrade or replace the equipment recently installed.

For example, the equipment that is currently in place cannot distinguish between a nuclear bomb and radiation that occurs naturally in items such as ceramic tile and cat litter. These nuisance alarms have caused some Border Patrol officials to adjust the sensitivity of the monitors downward, thus limiting their effectiveness.

In February of 2004, the Department of Homeland Security adopted standards for radiological and nuclear detectors. At the same time, Under Secretary for Customs and Border Protection Asa Hutchinson said that "These standards will facilitate our ability to ensure that equipment meets rigorous standards and supports the quick deployment of the best equipment available."

I always applaud the development of robust standards, but should these standards not have been developed before the equipment was deployed?

The committee will hear from representatives from three different Federal agencies. I am very interested in hearing from these witnesses about their roles and to what degree they can coordinate their efforts.

One of these agencies is the Domestic Nuclear Detection Office. The mission of this office is to address many radiological and nuclear protective measures, but it is predominantly focused on nuclear detection. This includes establishing strong relationships across multiple departments and levels of government. I hope that this office, this Domestic Nuclear Detection Office, will ensure that conflicts are minimized among the agencies involved in this issue.

I look forward to hearing from all of our witnesses, especially from Bethann Rooney from the New York–New Jersey Port Authority.

While we consider the deployment of radiation detection technology, it is imperative that we hear from the practitioners who are actually using the equipment. I am very interested in learning about the training that CBP inspectors or Port Authority police receive on this equipment as well. I am very interested in learning and hearing the Port Authority's experiences with the equipment.

It is my understanding that seaports have been the most difficult environment to deploy this equipment. How well did DHS work

with the Port Authority? Are they experiencing the same problems of false, nuisance alarms? Do they have any suggestions on how the deployment process could improve?

Again, thank you, Chairman King and Chairman Linder.

We have been joined by Ranking Member Jim Langevin.

Mr. LINDER. Thank you, Mr. Pascrell.

The Chair now recognizes the Chairman of the Subcommittee on Emergency Preparedness, Science, and Technology, the gentleman from New York, Mr. King, for any comments he might wish to make.

Mr. KING. Thank you, Chairman Linder. Let me commend you for your leadership on prevention issues, and Ranking Member Langevin and the ranking member of my subcommittee, Bill Pascrell, for their willingness to hold this joint hearing to examine the Federal Government's efforts to protect us from nuclear or radiological attacks.

I also want to welcome and thank our distinguished witnesses for appearing here today to discuss this issue which is of such vital importance to all of us.

Like Bill Pascrell, I want to acknowledge Bethann Rooney, the Manager of Security for the Port Authority. As a New York resident, I want to thank her for keeping us safe. I know that Bill, who is from New Jersey, both of us have a particular vested interest in you doing your job, and I want to thank you for the job that you have done.

In the interest of time, I am going to keep my remarks brief. But it goes without saying that the risk of a terrorist acquiring and detonating a nuclear or radiological device is one of the gravest threats to our Nation.

To prevent a catastrophic nuclear or radiological attack, the U.S. has begun implementing a three-tiered strategy focused on securing nuclear weapons and radiological materials at their source, detecting the illicit movement of nuclear or radiological materials overseas, and enhancing our domestic detection and interdiction efforts. The installation and use of radiation portal monitors, RPMs, and other radiation detection technologies is a key component of each tier of the strategy, and this fact is at the very heart of this afternoon's hearing.

Our Nation's reliance on RPMs and other detection devices, though, raises numerous questions, one, how effective is currently deployed technology at detecting certain radiological materials? What is the time frame for developing technologies that can detect illicitly trafficked nuclear material shielded by lead and other metals? How are the Federal agencies coordinating their RPM programs?

I am especially curious as to why the Departments of Homeland Security, Energy and Defense each need multiple separate test beds. Isn't such a duplication a waste of precious resources? Will the Department of Homeland Security's new Office of Domestic Nuclear Detention, DNDO, enhance coordination among Federal agencies or just add one more layer of bureaucracy?

Also—Congressman Pascrell commented on this—what kind of training does the Federal Government provide to port employees, border security personnel, first responders and others to operate

radiation detection equipment? It is a truism that technology is only as effective as the people operating it.

Even if radiation detection technology could be 100 percent effective, can RPMs guarantee our safety? Even with a domestic system in place, terrorists could detonate a nuclear device in a port before the cargo could be inspected. Wouldn't it be more sensible to check for radiation when the cargo ships are still out at sea?

Regardless of the technology's effectiveness, should the Federal Government be spending up to $1 billion to deploy such technology at every point of entry into the United States? Even with the most robust system, couldn't a terrorist simply just carry materials across an unprotected part of our land border with Canada or Mexico?

These are the various questions out there. No one suggests the answers are easy, but it is hearings such as this that get to the root of the problems which do affect our Nation.

So I am eager to hear your answers to these and other questions. I look forward to working with all of you on these important issues.

Mr. LINDER. I thank the gentleman.

The Chair now recognizes my partner on this committee, the ranking member, Mr. Langevin from Rhode Island.

Mr. LANGEVIN. Thank you, Chairman Linder. Let me just thank all of our witnesses for appearing today. I certainly look forward to hearing your testimony.

I continue to believe that the threat of nuclear terrorism is very real and that our government must move aggressively if we are going to prevent a nuclear or radiological attack on our shores.

This will be the subcommittee's fourth hearing on the nuclear threat. After listening to many experts in both open and closed sessions, who have testified before us, I believe that the administration is not doing enough in terms of moving with the sense of urgency required to stay ahead of the terrorists. Not only is the administration not moving fast enough, but in some ways it appears it is operating in a vacuum.

Today's hearing will focus on the effectiveness of the radiation equipment deployed at our ports of entry. I know a great deal of attention will focus on the technical limitations of the equipment, such as radiation portal monitors. I think in fairness, though, we should state that these machines can detect the materials used in a dirty bomb, including plutonium.

But what is more alarming to me than the device's limitations is the speed at which they are deployed. Also the lack of detection strategy and the lack of resources needed to ensure that the best technology is being used in the field.

Just 3 weeks ago, Secretary Chertoff was at the Port of Los Angeles–Long Beach, and he stated the port will have a full complement of radiation portal monitors by December 2005. That means that it would have taken the administration more than 4 years after 9/11 to ensure that two of the largest seaports in the country have the ability to screen containers for nuclear or radiological material. I also understand that the Port of New York–New Jersey still does not have full coverage, and this is simply unacceptable.

In addition, there is no overarching nuclear detection or interdiction strategy that drives the deployment or detection of equipment. Currently you have many government agencies involved in nuclear detection without a framework that ensures that all agencies are operating in an integrated fashion. We need a big-picture strategy to ensure that each layer in our defense is adequately covered.

The administration has created a Domestic Nuclear Detection Office, or DNDO, but it doesn't appear that this office is responsible for developing and executing a national strategy.

Finally, our detection capability will only be as good as the resources that are dedicated to it. Much more must be done from an R&D standpoint.

The administration's request for the new DNDO is $227 million. That is $273 million less than what is spent in Iraq in one day. If we are going to adequately deal with this threat, we have to ensure that our government is investing in the research required to develop and deploy the best technology available to our borders and our ports. This cannot be a case where our technology goes to the lowest bidder. The threat is too serious, and we all know that the terrorists are not going to wait for us to act. We must move with a sense of heightened urgency to deal with this threat now.

I think today's hearing is a good start, and I look forward to hearing from our witnesses.

Thank you, Mr. Chairman. I yield back.

Mr. LINDER. I thank the gentleman. Did the gentleman from Mississippi wish to make a statement?

Mr. THOMPSON. No, Mr. Chairman. I have a statement for the record.

Mr. LINDER. Okay. I would like to remind the rest of the members, statements for the record on your behalf are welcome.

[The information follows:]

PREPARED OPENING STATEMENT OF THE HONORABLE CHRISTOPHER COX, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA, AND CHAIRMAN, COMMITTEE ON HOMELAND SECURITY

Thank you, Mr. Chairman. And I would also like to welcome and thank our witnesses for appearing today before this joint Subcommittee hearing to discuss this important issue and answer our questions.

The risk of a terrorist acquiring and using a nuclear or radiological device is one of the greatest threats to our Nation. To prevent such an attack, we have sought to develop a robust layered defense—recognizing that there is no single, 100 percent solution. Under President Bush's leadership, our Nation's efforts to date include eliminating excess stocks of nuclear materials and weapons, protecting existing stocks from theft or diversion, detecting the illicit movement of nuclear or radiological materials overseas through both active and passive efforts, enhancing our detection and interdiction efforts here at home, and improving the security of our borders, ports, and cargo transportation systems.

Today, we will focus on one part of this multi-pronged strategy—the deployment of radiation and nuclear detection technologies at key transit points at home and abroad. For the first time, representatives from the Department of Homeland Security (DHS), the Department of Energy (DOE), and the Department of Defense will be at the same witness table to talk about the various efforts the Federal government has underway to detect nuclear or radiological materials and prevent them from entering the United States. Each Department has its own program and area of responsibility, but today we will explore the level of coordination and harmonization among these programs.

In particular, each of the Departments represented here today has its own initiative to install or deploy, whether at home or abroad, Radiation Portal Monitors (RPMs) and other radiation detection equipment at seaports, land border ports of

entry and crossings, international airports, international mail facilities, and other critical facilities in an effort to detect smuggled nuclear or radiological materials.

DHS, alone, plans to deploy a domestic, nationwide system of RPMs in an attempt to screen 100 percent of all incoming goods and cargo for such materials. While its initial plan called for a total cost of under $500 million and had a 2005 completion date, the latest revisions suggest a much costlier and lengthy project execution plan, with many unanswered technology questions. We need to fully understand this strategy and plan, and how it relates to DOE's efforts overseas, before proceeding further.

Each of the Departments represented here today also has a slightly different idea about which RPM technology is best and how it should be deployed. We need to know why. Does this make sense? Are our various Federal efforts sufficiently coordinated?

Currently, we have numerous National laboratories and research facilities working on similar nuclear detection technology issues, under the direction of several different Federal agencies. While competition is useful to a point, we also need to ensure that we are leveraging these R&D investments most effectively.

Similarly, there are questions regarding the efficacy of current and next-generation RPMs, as well as other radiation detection technologies such as Personal Radiation Dectectors (PRDs), and handheld isotope identifiers. Various elements of DHS are deploying these devices at significant cost, but are these investments worth it, and do the CBP and Coast Guard officers using these devices fully understand their limits?

Mr. Chairman, let me close by emphasizing that we must never forget that the common denominator in all terrorist acts, of whatever kind or consequence, are the terrorists. Since there is no technology plan or strategy that will provide 100% protection against nuclear smuggling, these passive detection efforts—while important—must continue to be part of an integrated strategy that puts appropriate emphasis on offensive and active tracking, detection, and interdiction of the terrorists themselves. And it is within this broader context that radiation detection technology deployment must be considered.

Thank you, Mr. Chairman. I look forward to hearing from our witnesses and examining these important issues today, and as we continue to explore them in the future.

Mr. LINDER. We will now turn to our panel of expert witnesses. Mr. Gene Aloise is the Director of Natural Resources and Environment at the GAO. He is the GAO's recognized expert on international nuclear nonproliferation and safety issues.

Dr. Richard Wagner is a Senior Staff Member with the Los Alamos National Laboratory, based in D.C. He was a founding member of the Threat Reduction Advisory Committee of the Office of the Secretary of Defense and Chair of the Defense Science Board Task Force on the Prevention of, and Defense Against, Clandestine Nuclear Attack.

Ms. Bethann Rooney is the Manager of Port Security for the Port Authority of New York and New Jersey. She is responsible for implementing and managing a comprehensive port security program and setting the strategy for the future of port security.

Dr. Ben Tannenbaum is a Senior Program Associate with the Center For Science, Technology and Security at the American Association for the Advancement of Science. He received his Ph.D. in particle physics from the University of New Mexico.

We welcome you all. Thank you for being here. We are happy to have you.

Mr. LINDER. Mr. Aloise, if you would like to begin. We would like to try and have you keep within the 5-minute rule. We have your written statement for the record. You can start out how you choose.

STATEMENT OF GENE ALOISE, DIRECTOR, NATURAL RESOURCES AND ENVIRONMENT, GOVERNMENT ACCOUNTABILITY OFFICE

Mr. ALOISE. Thank you, Mr. Chairman.

Mr. Chairman and members of the subcommittee, I am pleased to be here today to discuss our work assessing U.S. efforts to combat nuclear smuggling at home and in other countries through the deployment of radiation detection equipment at border crossings and other ports of entry.

The threat that nuclear or radiological material can be smuggled across our borders is a real one and could happen in several ways. Nuclear material could be hidden in a car, truck, train or ship, carried in personal luggage through an airport, or walked across an unprotected border.

My remarks today, which are based on our previous work in this area, will focus on the activities of U.S. Federal agencies deploying radiation detection equipment at home and in other countries, problems with coordination and planning among these agencies, and the effectiveness of radiation detection equipment deployed in the United States and other countries.

Four U.S. agencies—DOE, DOD, State and DHS—are deploying radiation equipment and training border security personnel. Over the past 10 years, the Congress has appropriated about $500 million for international efforts and about $300 million for domestic efforts.

Initial concerns about the threat posed by nuclear smuggling were focused on the former Soviet Union and Central and Eastern Europe. As a result, in 1998, DOE created the Second Line of Defense program which, through the end of 2004, had installed equipment at 66 sites, mostly in Russia. In 2003, DOE implemented its Megaports Initiative, which focuses on major foreign seaports and, to date, has completed work at two ports and is equipping five others.

Regarding the installation of this equipment at U.S. ports of entry, the U.S. Customs Service began providing inspectors with radiation detection pagers in 1998 and expanded its efforts after 9/11. Just last month, DHS reported that it has installed more than 470 portal monitors nationwide. Efforts to deploy radiation detection equipment at home and abroad did not start smoothly, and lacked effective coordination and planning.

On the international side, one of the most troubling consequences of lack of coordination is that DOE and DOD were installing better equipment in some countries than the State Department installed in others. Specifically, DOE installed equipment in one country and DOD installed similar equipment in another country that is better able to detect weapons, usable HEU and plutonium than the less-sophisticated radiation detection equipment State has installed in more than 20 other countries.

Since our report was issued, coordination has improved, though it is still a concern; and while better planning has occurred, in March of this year we reported that DOE's Megaports Initiative did not include a comprehensive, long-term plan to guide its efforts.

On the domestic front, we found that DHS had not coordinated with other Federal agencies and DOE national laboratories on

long-term goals, including improving the radiation technology and portal monitors.

This brings me to the subject of the effectiveness of the current generation of radiation detection equipment. It is well known that the equipment now being deployed in the United States and abroad has limitations. Furthermore, the ways in which the equipment is deployed, operated and maintained can also limit its effectiveness.

Our work has identified problems not only with the equipment, but the way the inspectors have used the equipment as well, including allowing vehicles to pass through portals at high speeds, excessively reducing the sensitivity of portal monitors to limit the number of nuisance alarms, and using radiological detection pagers for purposes they were not designed for. In addition, environmental conditions, such as cold climates, high winds and sea spray can affect the equipment's performance.

It is important to note that radiation detection equipment is only one of the tools that Customs inspectors and border guards use to combat nuclear smuggling. Proper training and intelligence are key and are vital.

Furthermore, our first line of defense are U.S. programs to secure nuclear material at its source, both in the former Soviet Union and the United States. Radiation detection programs complement these other programs.

Thank you, Mr. Chairman and members of the subcommittee. That concludes my statement. I would be happy to respond to any questions you may have.

Mr. LINDER. Thank you, Mr. Aloise.

[The statement of Mr. Aloise follows:]

United States Government Accountability Office

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Testimony

Before the Subcommittees on the Prevention of Nuclear and Biological Attack and on Emergency Preparedness, Science, and Technology, Committee on Homeland Security, House of Representatives

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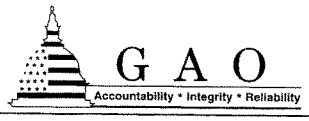
COMBATING NUCLEAR SMUGGLING

Efforts to Deploy Radiation Detection Equipment in the United States and in Other Countries

Statement of Gene Aloise, Director
Natural Resources and Environment



GAO-05-840T

June 21, 2005

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Highlights

Highlights of GAO-05-840T, a testimony before the Subcommittees on the Prevention of Nuclear and Biological Attack and on Emergency Preparedness, Science, and Technology, Committee on Homeland Security, House of Representatives

COMBATING NUCLEAR SMUGGLING

Efforts to Deploy Radiation Detection Equipment in the United States and in Other Countries

Why GAO Did This Study

According to the International Atomic Energy Agency, between 1993 and 2004, there were 650 confirmed cases of illicit trafficking in nuclear and radiological materials worldwide. A significant number of the cases involved material that could be used to produce either a nuclear weapon or a device that uses conventional explosives with radioactive material (known as a "dirty bomb"). Over the past decade, the United States has become increasingly concerned about the danger that unsecured weapons-usable nuclear material could fall into the hands of terrorists or countries of concern. In the aftermath of September 11, 2001, there is heightened concern that terrorists may try to smuggle nuclear materials or a nuclear weapon into the United States.

My testimony today summarizes the results of our previous reports on various U.S. efforts to combat nuclear smuggling both in the United States and abroad. Specifically, I will discuss (1) the different U.S. federal agencies tasked with installing radiation detection equipment both domestically and in other countries, (2) problems with coordination among these agencies and programs, and (3) the effectiveness of radiation detection equipment deployed in the United States and other countries.

www.gao.gov/cgi-bin/getrpt?GAO-05-840T.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Gene Aloise at (202) 512-3841 or aloisee@gao.gov.

What GAO Found

Four U.S. agencies, the Departments of Energy (DOE), Defense (DOD), State, and Homeland Security (DHS), are implementing programs to combat nuclear smuggling by providing radiation detection equipment and training to border security personnel. From fiscal year 1994 through fiscal year 2005, the Congress has appropriated about $800 million for these efforts, including about $500 million to DOE, DOD, and State for international efforts and about $300 million to DHS for installing radiation detection equipment at U.S. points of entry. The first major initiatives to combat nuclear smuggling concentrated on deploying radiation detection equipment at borders in countries of the former Soviet Union. In particular, in 1998, DOE established the Second Line of Defense program, which has installed equipment at 66 sites mostly in Russia through the end of fiscal year 2004. In 2003, DOE began its Megaports Initiative to focus on the threat posed by nuclear smuggling at major foreign seaports and to date has completed installations at two ports. Regarding efforts at U.S. points of entry, the U.S. Customs Service began providing its inspectors with portable radiation detection devices in 1998 and expanded its efforts to include larger-scale radiation detection equipment after September 11, 2001. This program is continuing under DHS, which reported in May 2005 that it has installed more than 470 radiation portal monitors nationwide at mail facilities, land border crossings, and seaports.

A common problem faced by U.S. programs to combat nuclear smuggling is the lack of effective planning and coordination among the responsible agencies. For example, we reported in 2002 that there was no overall governmentwide plan to guide U.S. efforts, some programs were duplicative, and coordination among U.S. agencies was not effective. We found that the most troubling consequence of this lack of effective planning and coordination was that the Department of State had installed less sophisticated equipment in some countries leaving those countries' borders more vulnerable to nuclear smuggling than countries where DOE and DOD had deployed equipment. Since the issuance of our report, the agencies involved have made some progress in addressing these issues. Regarding the deployment of equipment in the United States, we reported that DHS had not effectively coordinated with other federal agencies and DOE national laboratories on longer-term objectives, such as attempting to improve the radiation detection technology. We found that a number of factors hindered coordination, including competition between DOE national laboratories and the emerging missions of various federal agencies with regard to radiation detection.

The effectiveness of the current generation of radiation detection equipment is limited in its ability to detect illicitly trafficked nuclear material, especially if it is shielded by lead or other metal. Given the inherent limitations of radiation detection equipment and difficulties in detecting certain materials, it is important that the equipment be installed, operated, and maintained in a way that optimizes its usefulness. It is also important to note that the deployment of radiation detection equipment—regardless of how well such equipment works—is not a panacea for the problem of nuclear smuggling. Rather, combating nuclear smuggling requires an integrated approach that includes equipment, proper training of border security personnel in the use of radiation detection equipment, and intelligence gathering on potential nuclear smuggling operations.

Messers. Chairmen and Members of the Subcommittees:

I am pleased to be here today to discuss our work assessing U.S. government efforts to combat nuclear smuggling both at home and in other countries through the deployment of radiation detection equipment at border crossings and other points of entry.[1] According to the International Atomic Energy Agency, between 1993 and 2004, there were 650 confirmed cases of illicit trafficking in nuclear and radiological materials worldwide. A significant number of the cases involved material that could be used to produce either a nuclear weapon or a device that uses conventional explosives with radioactive material (known as a "dirty bomb"). Over the past decade, the United States has become increasingly concerned about the danger that unsecured weapons-usable nuclear material[2] from the former Soviet Union or other countries could fall into the hands of terrorists or countries of concern. In the aftermath of September 11, 2001, there is heightened concern that terrorists may try to smuggle nuclear materials or a nuclear weapon into the United States. This could happen in several ways: nuclear materials could be hidden in a car, train, or ship; carried in personal luggage through an airport; or walked across an unprotected border. If terrorists were to smuggle a nuclear weapon or dirty bomb into the United States, the consequences could be devastating to our national and economic interests.

My testimony today summarizes the results of our previous reports on various U.S. efforts to combat nuclear smuggling both in the United States and in other countries. Specifically, I will discuss (1) the activities of the various U.S. federal agencies tasked with installing radiation detection equipment both domestically and in other countries, (2) problems with coordination and planning among these agencies and programs, and

[1]See GAO, *Preventing Nuclear Smuggling: DOE Has Made Limited Progress in Installing Radiation Detection Equipment at Highest Priority Foreign Seaports*, GAO-05-375 (Washington, D.C.: March 31, 2005); *Customs Service: Acquisition and Deployment of Radiation Detection Equipment*, GAO-03-235T (Washington, D.C.: October 17, 2002); *Nuclear Nonproliferation: U.S. Efforts to Help Other Countries Combat Nuclear Smuggling Need Strengthened Coordination and Planning*, GAO-02-426 (Washington, D.C.: May 16, 2002); and related GAO products cited at the end of this testimony.

[2]Weapons-usable nuclear material is (1) uranium that has been enriched to consist of 20 percent or more of uranium-235 or uranium-233 isotopes and (2) any plutonium containing less than 80 percent of the isotope plutonium-238 and less than 10 percent of the isotopes plutonium-241 and plutonium-242. These types of materials are of the quality used to make nuclear weapons.

(3) the effectiveness of radiation detection equipment deployed in the United States and other countries.

Summary

Four U.S. agencies, the Departments of Energy (DOE), Defense (DOD), State, and Homeland Security (DHS), are implementing programs to combat nuclear smuggling in the United States and other countries by providing radiation detection equipment and training to border security personnel. From fiscal year 1994 through fiscal year 2005, the Congress has appropriated about $800 million for these efforts, including about $500 million to DOE, DOD, and State for international efforts and about $300 million to DHS for installing radiation detection equipment at U.S. points of entry. Initial concerns about the threat posed by nuclear smuggling were focused on nuclear materials originating in the former Soviet Union. As a result, the first major initiatives to combat nuclear smuggling concentrated on deploying radiation detection equipment at borders in countries of the former Soviet Union and in Central and Eastern Europe. In particular, in 1998, DOE established the Second Line of Defense program, which, through the end of fiscal year 2004, had installed equipment at 66 sites mostly in Russia. In 2003, DOE implemented a second program, the Megaports Initiative, to focus on the threat posed by nuclear smuggling at major foreign seaports. The Megaports Initiative has completed installations at two foreign seaports and is currently working to equip five others with radiation detection equipment. Regarding efforts to combat nuclear smuggling at U.S. points of entry, the U.S. Customs Service (now called the Bureau of Customs and Border Patrol) began providing its inspectors with portable radiation detection devices in 1998, and expanded its efforts to include larger-scale radiation detection equipment after September 11, 2001. This program is continuing under DHS. In May 2005, DHS reported that it has installed more than 470 radiation portal monitors nationwide at sites including international mail and package handling facilities, land border crossings, and seaports.

A common problem faced by U.S. programs to combat nuclear smuggling both domestically and in other countries is the lack of effective planning and coordination among the agencies responsible for implementing these programs. For example, regarding U.S. efforts to deploy radiation detection equipment in other countries, we reported in 2002 that there was no overall governmentwide plan to guide U.S. efforts, some programs were duplicative, and coordination among the various U.S. agencies involved with these efforts was not effective. We found that the most troubling consequence of this lack of effective planning and coordination was that different agencies had pursued separate approaches to installing radiation

detection equipment at other countries' borders, and some agencies were installing better equipment than others. As a result, some countries' border crossings were more vulnerable to nuclear smuggling than others. Since the issuance of our report, a governmentwide plan encompassing U.S. international efforts to combat nuclear smuggling has been developed; duplicative programs have been consolidated; and coordination among the agencies, although still a concern, has improved. Regarding the deployment of equipment in the United States, we reported that DHS had not coordinated with other federal agencies and DOE national laboratories on longer-term objectives, such as attempting to improve the radiation detection technology used in portal monitors. We found that a number of factors hindered coordination, including competition between the DOE national laboratories and the emerging missions of various federal agencies with regard to radiation detection. DHS agreed with our assessment and told us that it is taking corrective actions to address these concerns.

The effectiveness of the current generation of radiation detection equipment is limited in its ability to detect illicitly trafficked nuclear material, especially if it is shielded by lead or other metal. In addition, the manner in which radiation detection equipment is deployed, operated, and maintained can also limit its effectiveness. For example, in October 2002, we testified that radiation pagers—small radiation detection devices worn by inspectors on their belts—have severe limitations and are inappropriate for some tasks. DOE officials told us that radiation pagers have a limited range and are not designed to detect weapons-usable nuclear material. Given the inherent limitations of currently deployed radiation detection equipment and difficulties in detecting certain dangerous nuclear materials, it is important that the equipment be installed, operated, and maintained in a way that optimizes its usefulness. We reported that the manner in which DHS had deployed radiation detection equipment at some U.S. points of entry reduced its effectiveness. For example, at one site we visited, DHS was allowing trucks to pass through portal monitors at speeds higher than what experts consider optimal for detecting nuclear material. Regarding U.S. assistance to help other countries combat nuclear smuggling, we found that serious problems with the installation, operation, and maintenance of equipment had undermined U.S. efforts. For example, we reported in 2002 that about half of the radiation portal monitors provided to one country in the former Soviet Union were never installed or were not operational. Additionally, we reported in March 2005, that DOE's Megaports Initiative faces technical challenges related to deploying radiation detection equipment at foreign seaports. For example, environmental conditions at many ports, such as the existence of high

winds and sea spray, can affect radiation detection equipment's performance and sustainability.

It is important to note that the deployment of radiation detection equipment—regardless of how well the equipment performs—is not a panacea for the problem of nuclear smuggling. Rather, as we have noted in our past work, combating nuclear smuggling requires an integrated approach that includes equipment, proper training of border security personnel in the effective use of radiation detection equipment, and intelligence gathering on potential nuclear smuggling operations.

Background

Radiation detection equipment can detect radioactive materials used in medicine and industry; in commodities that are sources of naturally occurring radiation, such as kitty litter; and in nuclear materials that could be used in a nuclear weapon. The capability of the equipment to detect nuclear material depends on many factors, including the amount of material, the size and capacity of the detection device, the distance from the detection device to the nuclear material, and whether the material is shielded from detection. Detecting actual cases of illicit trafficking in weapons-usable nuclear material is complicated because one of the materials that is of greatest concern—highly enriched uranium—is among the most difficult materials to detect because of its relatively low level of radioactivity. In contrast, medical and industrial radioactive sources, which could be used in a radiological dispersion device (or "dirty bomb"), are highly radioactive and easier to detect. Because of the complexities of detecting and identifying nuclear material, customs officers and border guards who are responsible for operating detection equipment must also be trained in using handheld radiation detectors to pinpoint the source of an alarm, identify false alarms, and respond to cases of nuclear smuggling.

Several U.S. Agencies Have Programs to Combat Nuclear Smuggling

Four U.S. agencies have implemented programs to combat nuclear smuggling both domestically and in other countries by providing radiation detection equipment and training to border security personnel. From fiscal year 1994 through fiscal year 2005, the Congress has appropriated about $800 million for these efforts, including about $500 million to DOE, DOD, and State for international efforts and about $300 million to DHS for installing radiation detection equipment at U.S. points of entry. Initial concerns about the threat posed by nuclear smuggling were focused on nuclear materials originating in the former Soviet Union. As a result, the first major initiatives to combat nuclear smuggling during the late 1990s concentrated on deploying radiation detection equipment at borders in

countries of the former Soviet Union and in Central and Eastern Europe. Assistance included providing these countries with commercially available radiation detection equipment such as portal monitors (stationary equipment designed to detect radioactive materials carried by pedestrians or vehicles) and smaller, portable radiation detectors. In addition, U.S. agencies provided technical support to promote the development and enforcement of laws and regulations governing the export of nuclear-related technology and other equipment and training to generally improve these countries' ability to interdict nuclear smuggling.

One of the main U.S. efforts providing radiation detection equipment to foreign governments is DOE's Second Line of Defense program, which began installing equipment at key border crossing sites in Russia in 1998. According to DOE, through the end of fiscal year 2004, the Second Line of Defense program had completed installations at 66 sites, mostly in Russia. Additionally, in 2003, DOE began its Megaports Initiative, which seeks to install radiation detection equipment at major foreign seaports to enable foreign government personnel to screen shipping containers entering and leaving these ports for nuclear and other radioactive material. In March 2005, we reported that the Megaports Initiative had completed installations at two foreign ports and is currently working to equip five others with radiation detection equipment. Other U.S. agencies also have programs to provide radiation detection equipment and training to foreign governments, including two programs at the Department of State—the Nonproliferation and Disarmament Fund and Export Control and Related Border Security program—and two programs at DOD—the International Counterproliferation Program and the Weapons of Mass Destruction Proliferation Prevention Initiative.

In addition to these efforts at foreign borders, the U.S. Customs Service began providing its inspectors at U.S. borders and points of entry with small handheld radiation detection devices, known as radiation pagers, in fiscal year 1998. After September 11, 2001, this effort was expanded by DHS's Bureau of Customs and Border Patrol. In the spring of 2002, DHS conducted a pilot project to test the use of radiation portal monitors-larger-scale radiation detection equipment that can be used to screen vehicles and cargo. In October 2002, DHS began its deployment of portal monitors at U.S. points of entry. In May 2005, DHS reported that it has installed more than 470 radiation portal monitors nationwide at sites including international mail and package handling facilities, land border crossings, and seaports.

U.S. Programs to Combat Nuclear Smuggling in the United States and Other Countries Have Lacked Effective Planning and Coordination

A common problem faced by U.S. programs to combat nuclear smuggling both domestically and in other countries is the lack of effective planning and coordination among the agencies responsible for implementing these programs. Regarding assistance to foreign countries, we reported in 2002 that there was no overall governmentwide plan to guide U.S. efforts, some programs were duplicative, and coordination among the U.S. agencies was not effective. We found that the most troubling consequence of this lack of effective planning and coordination was that DOE, State, and DOD were pursuing separate approaches to enhancing other countries' border crossings. Specifically, radiation portal monitors installed in more than 20 countries by State are less sophisticated than those installed by DOE and DOD. As a result, some border crossings where U.S. agencies have installed radiation detection equipment are more vulnerable to nuclear smuggling than others.[3] We found that there were two offices within DOE that were providing radiation detection equipment and two offices within State that have funded similar types of equipment for various countries. We made several recommendations to correct these problems and, since the issuance of our report, a governmentwide plan encompassing U.S. efforts to combat nuclear smuggling in other countries has been developed; some duplicative programs have been consolidated; and coordination among the agencies, although still a concern, has improved.

Regarding efforts to deploy radiation detection equipment at U.S. points of entry, we reported that DHS had not coordinated with other federal agencies and DOE national laboratories on longer-term objectives such as attempting to improve the radiation detection technology used in portal monitors. We also noted that DHS was not sharing data generated by portal monitors installed at U.S. points of entry with DOE national laboratories other than Pacific Northwest National Laboratory, which is DHS's primary contractor for deploying radiation detection equipment at U.S. points of entry. Experts from DOE's national laboratories told us that achieving improvements to existing radiation detection technologies largely depends on analyzing data on the types of radioactive cargo passing through deployed portal monitors. We found that a number of factors hindered coordination, including competition between the DOE national laboratories and the emerging missions of various federal

[3]Portal monitors installed by the Department of State do not have the ability to detect neutron radiation, which translates into a decreased ability of those monitors to be able to detect plutonium, one of the nuclear materials of greatest proliferation concern.

agencies with regard to radiation detection. DHS agreed with our assessment and told us that it would be taking corrective actions.

Additionally, other DOE national laboratories and federal agencies are independently testing numerous different radiation portal monitors using a variety of nuclear and radiological materials and simulating possible smuggling scenarios. However, they are not sharing lessons learned or the results of these tests with other federal agencies. For example, DOD's Defense Threat Reduction Agency has a large testing facility near Sandia National Laboratories in New Mexico and has pilot tested radiation detection equipment at entrances to certain military bases. However, it is unclear how and with whom the results of such testing are shared to facilitate the development of improved radiation detection technologies. In April 2005, DHS announced its intent to create the Domestic Nuclear Detection Office (DNDO) to coordinate U.S. efforts to develop improved radiation detection technologies. DHS has requested over $227 million in fiscal year 2006 to initiate this effort. Through DNDO, DHS plans to lead the development of a national test bed for radiation detection technologies at the Nevada Test Site.

Currently Deployed Radiation Detection Equipment Has Limitations

Recently, concerns have been raised about the ability of radiation detection equipment to detect illicitly trafficked nuclear material. As we have reported in the past, certain factors can affect the general capability of radiation detection equipment. In particular, nuclear materials are more difficult to detect if lead or other metal is used to shield them. For example, we reported in March 2005 that a cargo container containing a radioactive source passed through radiation detection equipment that DOE had installed at a foreign seaport without being detected because of the presence of large amounts of scrap metal in the container. Additionally, detecting actual cases of illicit trafficking in weapons-usable nuclear material is complicated because one of the materials of greatest concern in terms of proliferation—highly enriched uranium—is among the most difficult materials to detect due to its relatively low level of radioactivity.

The manner in which radiation detection equipment is deployed, operated, and maintained can also limit its effectiveness. Given the inherent limitations of currently deployed radiation detection equipment and difficulties in detecting certain nuclear materials, it is important that it be installed, operated, and maintained in a way that optimizes authorities' ability to interdict illicit nuclear materials. In our past reports, we have noted many problems with the radiation detection equipment currently

deployed at U.S. and foreign borders. Specifically, in October 2002, we testified that radiation detection pagers have severe limitations and are inappropriate for some tasks. DOE officials told us that the pagers have a limited range and are not designed to detect weapons-usable nuclear material. According to U.S. radiation detection vendors and DOE national laboratory specialists, pagers are more effectively used in conjunction with other radiation detection equipment, such as portal monitors.

In addition, the manner in which DHS had deployed radiation detection equipment at some U.S. points of entry reduced its effectiveness. Specifically, we identified a wide range of problems, such as (1) allowing trucks to pass through portal monitors at speeds higher than what experts consider optimal for detecting nuclear material, (2) reducing the sensitivity of the portal monitors in an attempt to limit the number of nuisance alarms from naturally occurring radioactive materials, such as kitty litter and ceramics, and (3) not deploying enough handheld radiation detection equipment to certain border sites, which limited the ability of inspectors to perform secondary inspections on suspicious cargo or vehicles.

Regarding problems with the U.S. programs to deploy radiation detection equipment in other countries, we reported that:

- About half of the portal monitors provided to one country in the former Soviet Union were never installed or were not operational. Officials from this country told us that they were given more equipment than they could use.
- A radiation portal monitor provided to Bulgaria by the Department of State was installed on an unused road that was not expected to be completed for 1-1/2 years.
- Mobile vans equipped with radiation detection equipment furnished by the Department of State have limited utility because they cannot operate effectively in cold climates or are otherwise not suitable for conditions in some countries.
- DOE has found that environmental conditions at many seaports, such as the existence of high winds and sea spray, can affect radiation detection equipment's performance and sustainability.

Environmental conditions are not the only challenge facing DOE and DHS in installing radiation detection equipment at seaports in the United States and other countries. One of the biggest challenges at seaports is adapting the equipment to the port environment while minimizing the impact on the flow of commerce and people. DOE's Megaports Initiative had made limited progress in installing radiation detection equipment at foreign seaports it had identified as highest priority largely due to concerns of some countries about the impact of radiation detection equipment on the flow of commerce through their ports. DHS has faced similar concerns from port operators in the United States.

It is important to note that radiation detection equipment is only one of the tools in the toolbox that customs inspectors and border guards must use to combat nuclear smuggling. Combating nuclear smuggling requires an integrated approach that includes equipment, proper training, and intelligence gathering on smuggling operations. In the past, most known interdictions of weapons-usable nuclear materials have resulted from police investigations rather than from detection by radiation detection equipment installed at border crossings. However, there have been recent reports of incidents where radioactive materials were discovered and seized as a result of alarms raised by radiation detection equipment. Because of the complexity of detecting nuclear material, the customs officers or border guards who are responsible for operating radiation detection equipment must also be well-trained in using handheld radiation detectors to pinpoint the source of an alarm, identifying false alarms, and responding to cases of nuclear smuggling. Without a clear understanding of how radiation detection equipment works and its limitations, inspectors may not be using the equipment as effectively as possible.

Although efforts to combat nuclear smuggling through the installation of radiation detection equipment are important, the United States should not and does not rely upon radiation detection equipment at foreign or U.S. borders as its sole means for preventing nuclear materials or a nuclear warhead from reaching the United States. Recognizing the need for a broad approach to the problem, the U.S. government has multiple initiatives that are designed to complement each other. For example, DOE is securing nuclear material at its source through the Material Protection, Control, and Accounting program, which seeks to improve the physical security of nuclear facilities in the former Soviet Union. In addition, DHS has other initiatives to identify containers at foreign seaports that are considered high risk for containing smuggled goods, such as nuclear material and other dangerous materials. Supporting all of these programs is intelligence information that can give us advanced notice of nuclear

material smuggling and is a critical component to prevent dangerous materials from entering the United States.

This concludes my prepared statement. I would be happy to respond to any questions that you or other Members of the Subcommittees may have.

Contact and Staff Acknowledgments

For further information about this testimony, please contact me at (202) 512-3841 or at aloisee@gao.gov. R. Stockton Butler, Julie Chamberlain, Nancy Crothers, Christopher Ferencik, Emily Gupta, Jennifer Harman, Winston Le, Glen Levis, F. James Shafer, Jr., and Gene Wisnoski made key contributions to this statement.

Related GAO Products

Preventing Nuclear Smuggling: DOE Has Made Limited Progress in Installing Radiation Detection Equipment at Highest Priority Foreign Seaports. GAO-05-375. Washington, D.C.: March 31, 2005.

Weapons of Mass Destruction: Nonproliferation Programs Need Better Integration. GAO-05-157. Washington, D.C.: January 28, 2005.

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Container Security: Current Efforts to Detect Nuclear Materials, New Initiatives, and Challenges. GAO-03-297T. Washington, D.C.: November 18, 2002.

Nuclear Nonproliferation: U.S. Efforts to Combat Nuclear Smuggling. GAO-02-989T. Washington, D.C.: July 30, 2002.

Nuclear Nonproliferation: U.S. Efforts to Help Other Countries Combat Nuclear Smuggling Need Strengthened Coordination and Planning. GAO-02-426. Washington, D.C.: May 16, 2002.

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Mr. LINDER. Dr. Wagner.

STATEMENT OF DR. RICHARD L. WAGNER, JR., CHAIR, DEFENSE SCIENCE BOARD TASK FORCE ON PREVENTION OF, AND DEFENSE AGAINST, CLANDESTINE NUCLEAR ATTACK

Dr. WAGNER. Thank you, Mr. Chairman. I am gratified that your two subcommittees are addressing this problem. I have worked on this problem now, the problem of defending the country against—

Mr. LINDER. Doctor, your mike is not on.

Dr. WAGNER. I am sorry. I thought it was. Is it working now?

Thank you very much.

I am gratified that these subcommittees are working on this problem. I have, for 33 years now, I think it is, been involved in activities to defeat this threat, until about—well, unfortunately, it took the events of 9/11 before the government and the country began to pay attention to it. So I am gratified to see your committee and the executive branch are now finally trying to pay attention to it.

You have my prepared statement. It is clear to me from your statements that you are thinking ahead of this problem. So what I would like to do in my few minutes allotted here is not paraphrase my prepared statement, but try to address two or three of the points you made. I may regret this, because I am not sure I am going to be articulate enough to do it well, but I will try.

Chairman Linder, you used the word "deterrence," and I think that since no defense, no matter how much money we spend on the technology and the deployments, is going to be perfect, it is important for us to build it and deploy it and operate it in such a way that it enhances deterrence. That means creating an uncertainty in the mind of the attacker as to what the best way to penetrate the defense is. That uncertainty can be created either by accident or by deliberate actions.

I think that those developing this system ought to put more attention than I believe they are putting on methods to deliberately deploy and operate the system in ways that create uncertainty on the part of the detector. I think that is an important subject for the Congress to look at. It would have to be done in closed hearings.

Second, Chairman King, you asked how fast can we get to improved detectors? In my prepared statement and the Defense Science Board Task Force that I chaired, both assert that it is possible to improve detection technology by a lot, think a factor of 10 better, although the metric for exactly what you mean by a factor of 10 is a little fuzzy.

But, Chairman King, you asked, how fast can we get to better technology. And, Mr. Pascrell, you suggested that developing better standards should be done before the equipment is deployed.

To me, the administration in its management of this work and the Congress are going to have to walk a fine line between exercising too little and too much oversight. To develop standards too soon means that they won't be right. The standards will have to be developed in an iterative way, where systems are put in the field, worked with, the flaws are seen and then preliminary standards are developed; and then the next generation of testing the

equipment in the field to those preliminary standards will lead to firmer standards. So that is an iterative process.

I believe you and the executive branch are going to have to recognize that there will be false starts and there will be money wasted. If you and they try too hard to eliminate all mistakes, we will not end up with a system that protects this country, or we will end up with it in 500 years and we won't have it when we need it.

So I believe you are going to have to find some way—and I don't have a prescription for you—for finding just the right degree of oversight, but not too much. The same for the executive branch. The key to that is getting some good people in place, leaving them in place and building trust between yourselves and them; and that is a two-way street.

Let me comment on Mr. Langevin's comment on the amount of money that is available. I am not carrying a brief for the administration's programs here, I think they have been too slow, not just for the last 4 years, but for the last 20-something years, but I believe the administration's request for R&D in this area for fiscal 2006 is about right. That will be really kind of the first year, in which if the Appropriations Committees fund at the appropriate level, at that level, it will be really the first year for a serious program.

I think you could expect, however, that the administration requests for R&D might go up in the years beyond that in order to reach what I will call the "technology limit," as opposed to the funding limit approach to developing these technologies.

Chairman King, you mentioned also that you would prefer to see checks for radiation while the cargo ships are at sea. I think that is a crucially important theme to pursue. I think that there have been two or three approaches brought to my attention, one by a graduate student—no, he was an undergraduate student at the time, at MIT—for doing that job in a pretty clever way. I think that more attention should be devoted to developing methods of detection at sea. And, in general, the farther out we can beat this threat, the better. I don't want them to get even as close as the ports, and I would prefer they not get the threat objects onto the ship to begin with.

To do that, to defend as far forward as possible, DOE has programs for second lines of defense and their Material Protection and Control programs, and the Nunn-Lugar activities are crucially important and have to be woven into an overall global architecture for dealing with this problem.

Then, finally, let me say with regard to beating the threat far away from our shores, the Department of Defense is going to have to play an important role in doing that. Many of the scenarios, I think, that could lead to attacks like this will involve failed regimes, let's say, in which DOD might want to take action forward, should have the capability to take action forward.

The DOD is beginning to step up to this problem in several ways. I chaired the Defense Science Board Task Force, which reports to the Secretary of Defense, so I am involved in this. DOD has recently assigned the responsibility for their programs for combating WMD to the United States Strategic Command at Omaha. I am on their advisory committee as well, and I think it is crucially impor-

tant for DOD to continue to step forward on this problem, and I would suggest that your committee might want to help them do that.

Thank you.

Mr. LINDER. Thank you, Dr. Wagner.

[The statement of Mr. Wagner follows:]

PREPARED STATEMENT OF DR. RICHARD L. WAGNER

Mr. Chairman, Mr. Chairman, members of the committees, I am honored to be here to speak to you about the effectiveness of available technology for detecting nuclear weapons and radiological materials, and the potential for improving effectiveness in the future with new technology resulting from research and development. I am encouraged that the House Committee on Homeland Security and its subcommittees have focused so strongly on the crucial task of protecting our nation against clandestine nuclear attack.

I represent the 2002/2003 Defense Science Board Task Force on Prevention of, and Defense Against, Clandestine Nuclear Attack. I am a senior staff member with the Los Alamos National Laboratory, although I do not represent the laboratory here today.

Nearly forty-five years ago, my Ph.D. thesis experiment in physics involved radiation detection. Since then, on several occasions, I have done additional scientific work, or managed programs, that involved advanced radiation detection. Over thirty years ago, I helped form, at the national laboratories, what later became the DOE's Nuclear Emergency Search Team (NEST). In the winter of 1978, I was co-scientific-leader of the NEST deployment to northern Canada to search for radioactive debris from the Soviet Union's Cosmos 954 satellite. In the 1980s, as Assistant to the Secretary of Defense for Atomic Energy, I brought NEST capabilities into the Department of Defense, and was involved in various activities to detect nuclear weapons. In 1997, and again in 2002/2003, I chaired Defense Science Board (DSB) Task Forces related to defense against smuggled nuclear weapons.

I want to make the following six points to you today:

1. Radiation detection at portals is but one part of what must be a multilayered, multi-component, civil/military, global architecture to prevent smuggling of nuclear weapons into the US. Effective detection at portals will require detection of other signatures than radiation, but effective radiation detection is essential.

2. Currently installed radiation detection systems, or systems which could be procured in quantity in the next year or two, are quite limited in their capabilities and, in general, are insufficient to the task. Substantial research and development (R&D) is needed to improve detection capabilities. But deployment of even the limited near-term capabilities should be significantly expanded to: (1) provide some degree of added protection for the nation in the near term, (2) expand the experience base in operations with radiation detection systems in order to help guide research and development of greatly improved capabilities for the future, and (3) build the necessary industrial base.

- When I speak of radiation detection capabilities, I mean not only the detectors themselves, but networks of detectors, communications and signal processing, protocols for resolving alarms, and operational concepts for detection and response-to-detection systems.

3. With an expanded, spiral, research and development (R&D) program, carried out in the aggressive style that characterized certain highly successful R&D programs in other areas over the past few decades, capabilities to detect the presence or transit of nuclear weapons can be improved greatly, within about five years, before reaching the limits imposed by the physics involved.

- Capabilities of specific detectors against specific weapon designs are classified. Appendix #1 is an unclassified excerpt from the report of the most recent DSB Task Force that I chaired, which describes in general terms current and potential future detection capabilities.

4. I cannot provide you with a detailed prescription for how to apportion resources, over time, among near-term deployments with limited capability, R&D, and later deployments of improved capability. Such time-phasing must be worked out in some detail, and must be allowed to change flexibly, even within budget cycles, as operational experience is gained and as early results of R&D come in. But it might be useful for you to think in terms of four generations of capabilities, as follows:

- Currently installed detection systems.
- Modest but worthwhile improvements that might be developed and deployed within a year or two.

- A first generation of greatly improved detection systems that would be quite expensive, but which should nevertheless be deployed in limited quantities to protect some crucial locations and to try them out in the field.
- A generation that achieves greatly improved detection at greatly reduced cost, which would be widely deployed in the mature, objective architecture.

5. Even with the best detection systems, the overall future protection architecture will not be perfect. No defense can be perfect. But a less-than-perfect defense can be effective if it has enough capability to:

- Cause prospective attackers to have serious doubts as to whether they will succeed.
- Create synergies with other system elements, for example by forcing the attacker to mount a larger operation which is more likely to be discovered so that warning can allow the defense to surge its capability.

I believe that, with an aggressive R&D program, we can achieve that level of capability. The utility of a less than perfect defense is discussed in Appendix #2, which is also excerpted from the DSB report.

6. The establishment, by the administration, of the Domestic Nuclear Detection Office (DNDO) is a big step in the right direction. It should be strongly supported by the Congress, along with especially strong support for "transformational R&D". But work on transformational capabilities is unlikely to be effective unless it is carried out in the style that characterized certain highly successful R&D programs in other areas over the past several decades. In Appendix #3, which is derived from recent discussions on this subject among me and a few broadly experienced colleagues, I mention these programs and say some things about their style. Support of the Congress will be essential in doing the program this way.

APPENDIX #1. EXCERPT FROM DEFENSE SCIENCE BOARD REPORT:

4.0 ASSESSING DEFENSE PERFORMANCE AND THE UTILITY OF POTENTIAL SYSTEMS' IMPROVEMENTS

. . .Defense performance is determined by many factors. The performance of radiation detection systems is only one of them, but it is an important one, and we will use such systems' performance to illustrate broader issues. . . .

As with other elements of the protection/prevention architecture, the performance of radiation-based detection systems can be thought of on three levels. . . .

At the level of detailed technical metrics—detection range, detection time, false alarm rates, etc.—much of what this report recommends is based on our judgment that significant improvement is possible in detection-systems' performance in threat scenarios. Relative effectiveness is not too difficult to assess, but assessing absolute effectiveness is difficult for several significant reasons. One difficulty is that the utility of detectors in real operations depends strongly on natural radiation backgrounds, which vary greatly from place to place and often in time. Such backgrounds, and the nature of radiation detection in general, introduce a probabilistic element in assessment of performance, and the significance of detection and false-alarm probabilities is very scenario-dependent. All of this fuzzes concreteness, which creates difficulties in assessing system performance and in planning defense (and is one basis for our belief that performance can only be determined by field experience with real systems). . .

4.1 Radiation detection performance

Despite these difficulties, rough estimates of radiation detection performance can be made. The referenced IEEE paper lays out some approaches to improving radiation detection and attempts to assess the degree of improvement in terms of both technical metrics and scenario assessment. Key points are excerpted below.

Today's capabilities. Only passive detection is available today. Correlated operation of multiple detectors can be done today only for a small number of sensors that can be integrated by human intelligence, assisted by limited automatic processing. With these and other capabilities:

- Plutonium devices can be detected in vehicles at portals, in cargo containers, and in vehicles at speed, if the device is unshielded or lightly shielded.
- Detection of devices containing highly enriched uranium (HEU) is very difficult and varies widely and is limited today to short range. In some cases lightly shielded devices can be detected at portals. In other cases they can be detected only if they are essentially unshielded.

Some high-value targets are defensible, thanks to geographic features that channel traffic through defensible chokepoints, where capable portal monitors can be stationed. Traffic that attempts to bypass these chokepoints (e.g., on foot) is by definition suspect, and can be detected by non-nuclear techniques.

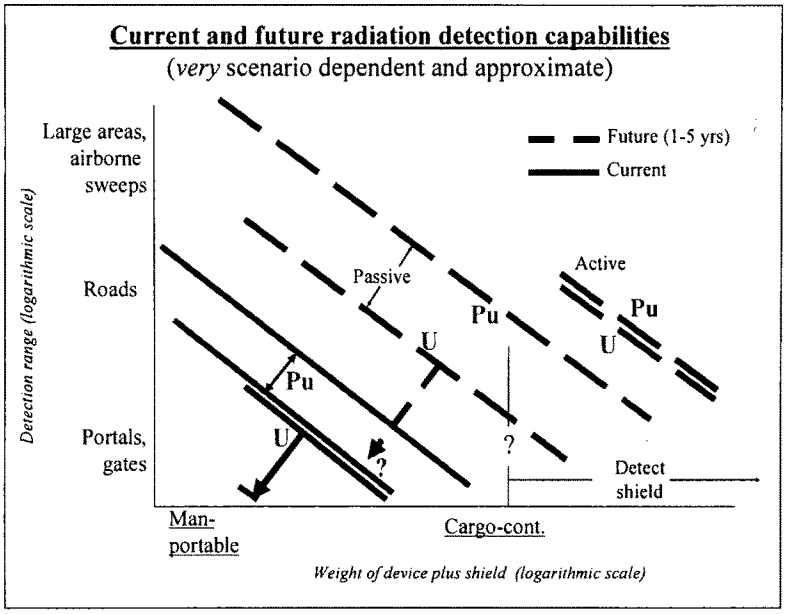
These current capabilities may be impaired by high and/or variable natural radiation backgrounds or innocent man-made radiation sources that yield unmanageable false alarm rates.

In the future. This report recommends greatly expanded R&D on radiation detection. The referenced IEEE paper illustrates some improvements in capabilities that would result from R&D. The following points summarize the potential benefits:

- Detection range can be extended by an order of magnitude, opening new defense operational modes such as rapid, wide-area airborne and vehicle sweeps, and monitoring large remote areas and/or extensive road networks. Shielding around the weapon could reduce performance of the detection systems, but the shielding mass can slow down the attacker and expose him to discovery by other means—e.g., detection of the shielding itself.
- Increased range and improved false alarm rejection will enable intelligent networking of detectors. This could enable coverage of road and rail transport over significant distances—e.g., along the U.S. East Coast, where long-distance transport must pass through a relatively small number of choke points.
- Background and innocent alarm rejection will allow detection of HEU in a wider range of circumstances, for example (in certain cases) in cargo that is naturally radioactive (e.g., bananas).
- Increased sensitivity and background rejection could virtually eliminate the effects of *incidental* shielding in vehicles or cargo containers, except for HEU in certain cases.
- More-portable and longer-lived sources for active interrogation will enable widespread screening of containers and vehicles. Advances in detectors and sources will allow operational restrictions on active interrogation due to health and safety concerns to be reduced.

Beyond such general and qualitative statements, what can be done with radiation detection is complicated to describe. It is a multi-dimensional parameter space, even for a single attack scenario against a single defense layer. There are many possible scenarios, and we have posited a multi-layer defense. The format of the chart below is one greatly simplified way of summarizing some of this complexity. It illustrates a fundamental offense/defense trade between the detection range and time available for detection, and amount of shielding around the device that can reduce the radiation output of the threat object.

The detection metric that the vertical axis represents is a function of range and dwell-time, and it varies by approximately six orders of magnitude along that axis. The diagonal lines on the chart reflect current and future capabilities, some of which are summarized in the paragraphs immediately preceding the chart. The uncertainties and variations in the vertical location of the diagonal lines are about an order of magnitude, as illustrated by the plutonium current technology line. The relative locations of the lines are less uncertain. . . . .



Appendix #2: Excerpt from Defense Science Board Report

4.3 Thinking about the utility of imperfect defenses

When and if the community involved in this work becomes able to assess system performance against threats accurately and comprehensively, it will be found that the defense is not leak-proof, as no defense can be. Because of this, some might argue that devoting the level of resources entailed in the Task Force recommendations would be wasted. We believe this is profoundly wrong. No protection system can be perfect, but over the course of history, defenses that are far from perfect have played vital strategic roles. To deal analytically with the issue of imperfect defense, the third level of performance measures—including the overall goals of the defense—must be addressed. . . .

With the best technology we can develop, how effective can prevention/defense be?

- Much better technology is essential, but not sufficient alone
- Right—not perfection; rather: attenuate threat, dissuade attempts, thwart some attacks, delay successful attack
  —Historically, imperfect defenses often effective
- Reference point: during late '70s, early '80s, the US. . .
- Best technology can raise defenses above "the threshold of dauntingness", dissuade attempts.
  — Deliberately create uncertainties for attacker
- Synergies help. Examples:
  — Better defense→ larger threat operation→ more signatures
  → possible warning→ surge defenses
  — Concentrate nuc mat'ls control on hardest-to-detect mat'ls
- Can't answer with paper studies; can find out only by trying

The stakes are worth the bet

The goal that should be set for a national/global system and its DoD elements is not perfection. Rather, because clandestine nuclear attack attempts will not be frequent, the goal should be to substantially attenuate the frequency of successful attacks (including significantly delaying the first one). Delay and attenuation could provide time to mitigate the threat in other ways, including measures to ameliorate the underlying political and cultural factors that stimulate the terrorist threat, writ large.

Many of us believe that a strong case can be made that prevention/protection can be developed that will substantially attenuate the frequency of successful attacks, by being good enough to (1) dissuade or deter many of those who might consider

attempting attacks and (2) thwart or defeat a good fraction of the (fewer) attacks that might be attempted. The deterrent aspect of the protection equation involves the often-great differences between how a defender and an attacker will view the relative capabilities of the defense. The long history of offense/ defense competitions is strongly characterized by both sides taking own-side-conservative views. More particularly, the annals of terrorism and counterterrorism are replete with instances in which a prospective attacker was deterred by aspects of the defense that may have seemed relatively weak and ineffectual to the defender. The terrorist may not be afraid to die, but he (or his master) does not want to fail.

Dissuasion/deterrence by the adversary's fear of failure might work in a variety of ways. One aspect is that an attacker will want to know enough about the defense to design a robust, successful attack. If the capabilities of the defense can be improved enough that the attacker must know the details of defensive measures in place to understand how to best surmount them, then the attacker may expose himself to discovery during the planning phases of the attack or be altogether dissuaded from the attempt.

Creating uncertainty in the attacker's mind will be critical to maximizing the success of defenses which, realistically, cannot aspire to perfection. To exploit the effects of uncertainty, the defense should be deliberately designed and deployed to create as much ambiguity for the attacker as possible as to where the "boundaries" of defense performance lie. Deliberate deception should be used (carefully) as part of an overall perception management effort.

Data that can be used to be more analytic about these and other deterrence effects should be systematically assembled from the annals of counterterrorism.

Many kinds of synergies contribute to defense effectiveness. An obvious one is the effect of a layered defense, as we propose. With multiple layers, each layer need not be highly effective in order for the overall effectiveness to be high. If the layers require different tactics or technologies to penetrate, the attacker's job is considerably more difficult. This indicates a fundamental synergy between a layered defense and the capability to detect the threat by intelligence indicators, including from law-enforcement activities. A more capable and varied defense means that the attacker must mount a larger operation to penetrate it. A larger operation has more (and more observable) signatures. More people with more skills must be recruited and trained; more money must be obtained and laundered; the operation takes longer; and the attacker must surveil the defense more intensively. By increasing the signature of attack planning, the likelihood of discovery increases commensurately. This, in turn, could allow the defenses to be surged, further increasing effectiveness.

These preliminary thoughts about the effectiveness of a defense have led the Task Force and its predecessors to become convinced that reasonable success in mitigating the threat is sufficiently likely that, in light of the seriousness of the threat and of the consequences of successful attack, a serious development and deployment program is warranted..

Appendix #3: Assuring program effectiveness

The establishment of the Domestic Nuclear Detection Office (DNDO) is an extremely positive step in improving and deploying detection systems, and will provide a group which, adequately funded and properly located organizationally, can do much to accomplish the objectives cited above. But in light of the stakes involved, it is fair to ask whether DNDO will be able to improve deployed detection technology as much and as quickly as possible. DNDO's charter and authorities, as they are expressed in its founding documents, are sound as far as they go, but there are intangibles that are crucially important for success and that are difficult to address in a charter or authority. These intangibles are what I address here.

To deal with such a difficult scientific, technological, and operational issue requires innovation, free thinking, continuity of effort, creativity and simultaneous risk taking (technology investments that may ultimately prove dead-ended). None of these qualities are among those generally attributed to the government's conventional research and development process—which often discourages even prudent risk taking and is at best ponderously slow.

It has generally been found that truly creative research is best pursued by maintaining close coupling between the researchers and those dealing with day-to-day operational challenges. At the same time, it is exactly these latter challenges which often usurp the attention, priority, and budgetary resources which would otherwise be devoted to longer-term research.

When facing such challenges in the past the government has generally been most successful when it removed the attack on a specific high priority problem from the every-day research and development process and established a dedicated, high priority assault on the specific issue at hand. DNDO is intended to catalyze such an

assault, but whether it will be successful will depend on its ability to emulate key features of past successes. Examples include the Manhattan Project, the Apollo Project, the development of the Polaris submarine system, and the development of the U–2, SR–71 and F–117 at the "skunk Works". *What is needed is a mini-Manhattan Project which focuses specifically on the detection of nuclear weapons and materials.* The development of a weapons detection capability is not an easy task, but neither was the development of the nuclear weapon itself.

Key features of many of the past successes mentioned above include:

- high-risk, high-payoff developments are pursued, hedging against possible failure with alternative approaches carried out in parallel;
- R&D reaches from basic research through to fieldable prototypes;
- a streamlined management process with minimal "outside" influence;
- a cooperative and open relationship between government and industrial/academic participants;
- the role of senior, centralized government leadership is to set broad goals, secure funding, and provide freedom of action for the R&D teams; and
- the R&D is conducted mainly outside of government by large, integrated, multi-disciplinary R&D teams with forceful and experienced leaders, and with:
    - wide latitude to achieve broad, ambitious, mission-level goals,
    - direct, frequent, working-level contact between users and R&D people,
    - freedom to change R&D objectives and approaches quickly and flexibly as the R&D proves what is feasible, and
    - the expectation of continued involvement to achieve both near-term milestones and long-term goals.

To accomplish such a feat would entail waiving many of the existing procurement regulations which were designed to conduct the ordinary course of research and development in the government.

The approach sketched here would be exceptional today—a significant departure from the way most government R&D is currently done. Because of this, it will be controversial and difficult to implement and will need high level support, including from the Congress.

Mr. LINDER. Ms. Rooney.

STATEMENT OF BETHANN ROONEY, MANAGER, PORT SECURITY, PORT AUTHORITY OF NEW YORK AND NEW JERSEY

Ms. ROONEY. Mr. Chairman, members of the committee, thank you for the opportunity to testify this afternoon on the important issue of detecting radiation entering the Nation through our U.S. ports.

In early 2003, Customs and Border Protection announced that the radiation portal monitor program would be started in the top 22 ports in the country, including New York and New Jersey. We fully support the deployment of radiation detectors in our port and believe they serve an important function as the absolute last layer of defense in detection strategy. Our experience with the RPM initiative, in particular, the cooperation with the local Customs and Border Protection and Pacific Northwest National Laboratory staff, has been certainly exceptional.

To date, a total of 22 RPMs have been deployed in the port. As has been indicated, we are not fully covered and there are another 10 RPMs expected to be deployed later this year. We are now averaging approximately 150 alarms a day from the radiation portal monitors that are installed, which is about one in 40 containers that moves through our facilities. This high level of innocent or nuisance alarms are from commodities such as kitty litter, ceramics, medical isotopes and the like.

Customs personnel are stationed at the exit gates of the container terminals. In each instance that a container sets off an alarm, they are immediately directed to a secondary inspection

area where the containers are scanned with a radiological isotope identifier and compared to the manifest.

CBP follows strict protocols to determine the source of the alarm. In the vast majority of the cases, these alarms are solved within 10 minutes or less causing no undue delays to the flow of commerce. In the 16 months since these RPMs have been operational in the ports, only twice have they detected what is believed to be a neutron source which would be indicative of either plutonium or uranium. In these instances, the container was isolated and CBP worked with the Port Authority police and other Federal, State and local agencies in order to render the container safe, taking upwards of 24 hours to do so.

Approximately 15 percent of our containerized cargo volume moves by rail or barge out of the port. None of that cargo, or virtually none of that cargo, is currently being scanned by the radiation portal monitor deployment. CBP recognizes this shortcoming in the program and is working with Pacific Northwest Lab and our terminal operators in order to devise options to screen this internodal cargo.

In addition to screening the rail cargo, we also must find a way to screen the cargo that transferred by barge, because in many instances these barge movements are going through highly congested urban areas and we don't want these containers to be delivered to an inland area without being scanned.

Also given its heavy focus on containerized cargo since 9/11, we remain concerned about the ability to use imported vehicles, busses and subway cars to deliver weapons of mass destruction to the United States. We import approximately 620,000 automobiles a year, and absent any other programs to check the integrity of vehicular cargo and inspect it upon arrival in the United States, we believe that steps must also be taken with the auto terminal operators to devise a methodology of screening this cargo with suitable technology.

Under an agreement with the Department of Homeland Security, Science and Technology Directorate, the Port Authority is involved in a very productive program of testing radiation sensor technologies at various transportation facilities, including our river crossings, airports and seaports.

Since most of the commercial off-the-shelf radiation detection devices use gross counters, a large number of alarms from innocent sources are generated when the detection threshold is set too low. Under the leadership of the Department of Homeland Security's Environmental Measurement Lab, we have first bench-tested devices with various radiation sources and operating conditions at the Brookhaven National Lab before deploying them at our facilities. Two devices are now ready for commercialization and could be available for use as early as fiscal year 2006. These devices will be better at detecting things such as highly enriched uranium and plutonium.

The new Domestic Nuclear Detection Office at the Department of Homeland Security provides an opportunity to recommend a comprehensive research agenda that would focus on the marine transportation system. We should take advantage of opportunities to detect, deter and intercept a device well before it passes through a

terminal exit gate. Among the ways to do this is to place radiation detection devices on the container entry cranes or other container handling equipment. The Federal Government should establish a research and development program focusing on identifying a way to scan 100 percent of the containers as they are off-loaded from the ship or when they are sitting idle in the terminal for upwards of 7 days.

We would also encourage the development of an integrated scanning and detection device that would essentially allow for the RPM and the VACIS exam to occur simultaneously. This holistic approach could provide 100 percent screening of international cargo for both radiation and density without causing additional delays.

As screening technology is further developed and tested, we must also take into consideration the potential impact that this technology might have on other container security devices, such as electronic seals and the advanced container security device. We have experienced in Operation Safe Commerce trials that the VACIS exam may have interfered with the radio signals generated by electronic seals, thus rendering them unusable. Therefore, the interference of VACIS and RPM inspection must be considered as these technologies are further developed and deployed.

Of course, detecting a weapon of mass destruction after it arrives in our port or anywhere in the U.S. is too late. Since 9/11, the Federal policy has been to push our American borders out, and DHS from those very first days has implemented that policy through various programs.

In keeping with that policy and with a layered approach to security, RPMs or other suitable radiation detection devices should be installed at foreign ports of export. It would give the U.S. greater confidence that cargo headed our way is not likely to contain a weapon of mass destruction.

I hope my comments today have provided you with some helpful insight on just one aspect of this complex matter of radiation detection. We at the Port Authority of New York and New Jersey are prepared to offer any additional assistance that you may require.

Mr. LINDER. Thank you, Ms. Rooney.

[The statement of Ms. Rooney follows:]

PREPARED STATEMENT OF BETHANN ROONEY

Mr. Chairmen, members of the Committee, thank you for the opportunity to testify on the important issue of radiation detection as it relates to our nation's ports. I am Bethann Rooney and I am the Manager of Port Security at the Port Authority of New York & New Jersey.

I appreciate the invitation to speak on the steps that have been taken since 9/11 to secure our ports and maritime industry from terrorist acts, specifically our ability to detect nuclear weapons and radiological materials that may attempt to enter the country through our Port. The tragic events of September 11th have focused our collective attention on the need to protect our borders at major international gateways like the Port of New York and New Jersey and small ports alike.

This morning I would like to briefly discuss the vital nature of ports and the risk associated with them; the importance of supply chain security, the status of Radiation Portal Monitor deployment in the Port; our experience with the Department of Homeland Security Countermeasure Test Bed and finally some recommended next steps.

THE VITAL ROLE OF PORTS

Ninety-five percent of the international goods that come into the country come in through our nation's 361 ports; twelve percent of that volume is handled in the Port

of New York and New Jersey alone, the third largest port in the country. The Port generates 229,000 jobs and $10 billion in wages throughout the region. Additionally, the Port contributes $2.1 billion to state and local tax revenues and $24.4 billion to the US Gross Domestic Product. Cargo that is handled in the Port serves 80 million people or thirty-five percent of the entire US population. In 2004 the port handled over 5,200 ship calls, 4.478 million twenty-foot equivalent units (TEUs), which is approximately 7,300 containers each day, 728,720 autos and 80.6 million tons of general cargo. Today international trade accounts for 30 percent of the US economy. Considering all this, it is easy to see how a terrorist incident in our nation's ports and along the cargo supply chain would have a devastating effect on our country and its economy.

THE TERRORIST RISK

When describing the potential impact of a terrorist event, the words "risk", "threat" and "vulnerability" have generally been used interchangeably. The fact, however, is that in the standard risk equation, risk is a factor of threat, vulnerability and consequence. Therefore, any discussion of the terrorist risk to ports and other elements of the marine transportation system (MTS) must include each of those three areas.

The most difficult area to understand is the threat, mostly because it is a moving target and we must assume that terrorists are devising new tactics everyday. There are a number of threat scenarios however that are believed to be more likely and therefore are those that most maritime security programs today are built around. These include the use of vessels and ports as a means to smuggle weapons of mass destruction or terrorist operatives into the United States, the use of ships as a weapon, the scuttling of ships in major shipping channels, and attacks on ships such as ferries or oil tankers. Since 9/11, we have seen a number of these tactics used around the globe in events such as suicide bombings using containers in the Port of Ashdod, small boat attacks on an oil platform in Al Basra and the French oil tanker Limberg, and the transportation of suspected terrorist operatives via containers in Italy.

The maritime transportation system's vulnerability or the likelihood that the safeguards will fail is complicated by the general nature and openness of ports, with hundreds of miles of shorelines and facilities that have historically been public access areas. Additionally, the movement of cargo has been built on the tenets of speed, reliability and cost, not security. Therefore, the sheer volume of containers that move through US ports on a daily basis makes them potentially attractive as a potential Trojan horse . . .62,000 of them.

The consequences of a terrorist attack by means of the maritime industry could have an overwhelming and lasting effect. Not only would there potentially be significant death and destruction but the national and global economies could be devastated. It is estimated that for every day that a port is shut down, it takes seven days for full recovery. The West Coast labor strikes last year demonstrated that a ten day shut down can cost an estimated one billion dollars a day.

While our ability to directly influence the threat is limited we can use our understanding of the threat, to make infrastructure improvements, and create policies, programs and procedures that can help reduce our vulnerability and the consequences and thereby mitigate our overall risk.

OUR PROGRESS SINCE 9/11

As a result of significant legislative action, capital investments and operational improvements on the part of the public and private sectors in the nearly three and a half years since 9/11, the Maritime Transportation System (MTS) is more secure today than ever before. While significant progress has been made and much has been accomplished, work still remains to be done.

A Multifaceted Approach

Enhancing maritime security is a complex problem which requires a multi-faceted and layered approach. Maritime security is so much more than just the physical security of our ports and terminals and the vessels that use them. We must also enhance security of the supply chain and the cargo that moves through our ports.

Cargo and Supply Chain Security

America's consumer-driven market now depends upon a very efficient logistics chain, of which the nation's ports are just a single link. US ports provide the platform to transfer imported goods from ships to our national transportation system—primarily trucks and trains—that ultimately deliver those products to local retail outlets or material to manufacturing plants. Historically, that goods movement system has had one overall objective: to move cargo as quickly and cheaply as possible from point to point. Today, a new imperative—national security—has imposed itself

onto that system. As such, we know that ports themselves are not the lone point of vulnerability. Rather, the potential for terrorist activity stretches from where cargo is stuffed into a container overseas to any point along the cargo's route to its ultimate destination.

We believe that through programs like Operation Safe Commerce, a Federally supported study of international supply chain security, of which the Port Authority of New York & New Jersey is a part, efforts must be taken to verify the contents of containers before they are even loaded on a ship destined for a US port. The process must include certification that the container was packed in a secure environment, sealed so that its contents cannot be tampered with, transported under the control of responsible parties, and screened for dangerous substances before it is loaded on a ship. This will be accomplished through the identification and evaluation of new technology, business processes, policies and procedures that could improve supply chain security, and minimize disruption to commerce. The solutions must also be economically and commercially viable.

The many programs that the Departments of Energy and Homeland Security have implemented in the last three years—MegaPorts, the 24-Hour Rule, the Customs-Trade Partnership Against Terrorism (C–TPAT), the Container Security Initiative (CSI), the increase in VACIS exams, and the deployment of Radiation Portal Monitors (RPMs) at terminals are all valuable elements of a layered security system and have gone a long way toward ensuring supply chain security.

RADIATION PORTAL MONITORS

One of the many layers of cargo security is Radiation Portal Monitors (RPMs). In response to a Congressional mandate to preclude nuclear weapons and radiological materials from entering the United States, Customs and Border Protection (CBP) established a strategy in early 2003 to deploy RPMs at twenty-two ports throughout the country, including the Port of New York and New Jersey. RPMs are a passive, non-intrusive means to screen containers for the presence of nuclear and radiological materials, including special nuclear material (SNM), naturally occurring radiation and common medical and industrial isotopes.

We fully support the deployment of radiation detectors in our Port and believe they serve an important function as the absolute last layer of the defense in depth strategy. Of course, detecting a Weapon of Mass Destruction after it arrives in our Port, or anywhere in the US, is too late. The placement of RPMs in US ports must be coupled with the installation of RPMs or other suitable radiation detection technology in foreign ports through programs like MegaPorts and the Container Security Initiative.

Our experience with the RPM initiative has been nothing but positive and the level of coordination and cooperation with local CBP officials and staff from the Pacific Northwest National Laboratory staff exceptional. In July 2003, CBP brokered a meeting with all of our port stakeholders to introduce them to the RPM program, describe the technology and the environment in which it works, and address concerns of different stakeholder groups and layout the timeline for deployment. CBP later met with each of the individual terminal operators, their executive management, traffic engineers and other employees to discuss each terminal operator's specific issues, with the goal of integrating the RPMs into each terminal's operation and not creating disruptions to the normal flow of commerce.

To date, a total of 22 RPMs have been deployed in the Port of New York and New Jersey (Global—5, PNCT–5, APM–12), with the first coming on line in February 2004. Another 8 RPMs (Maher-7. NYCT—1) are expected to be deployed by year-end. We are also expecting to receive 2 mobile RPMs that will be employed during the vessel discharge process at one of our smaller terminals. At this time, we do not have a confirmed schedule for when these mobile RPMs will be available.

CONCERNS WITH THE RPM PROGRAM

High Level of False Alarms

At the outset of this program, we were advised by Pacific Northwest Labs that we could expect the alarm rate to be 1 in every 400 containers. In the Port of New York and New Jersey, we are now averaging about 150 alarms a day from the RPMs, which is approximately 1 in 40 containers, ten times more than was expected. In order to detect nuclear and radiological devices, the RPMs must be calibrated at a low threshold. This results in a high level of innocent or nuisance alarms from commodities with naturally occurring radiation such as bananas, kitty litter, fire detectors and ceramics that move through the port, even truck drivers who not long before had medical tests or treatments with radioactive isotopes.

Customs personnel are stationed at the exit gates of each of the container terminals. In each instance that a container sets off an alarm, they are immediately di-

rected to a secondary inspection point when the container is scanned again, verified with a Radiological Isotope Identifier Device (RIID) and compared to the manifest. CBP follows strict protocols to determine whether the alarm is a potential terrorist threat, a natural source or legitimate medical source of radiation. In the vast majority of the cases, CBP is able to resolve the alarm in approximately ten minutes or less and release the truck without causing any undue delays to the flow of commerce.

In the sixteen months that the RPMs have been operational in New York and New Jersey, there only twice have RPMs detected a neutron source, which would be indicative of either Plutonium or Uranium. In these instances, the container was isolated and CBP worked with the Port Authority Police and various Federal and state agencies, under established response protocols, to render the container safe, which takes up to 24 hours.

Ability to Screen All Intermodal Cargo

In the Port of New York and New Jersey, 13 percent of our cargo volume moves by rail and another 2 percent moves by barge. We expect these percentages to significantly increase in the next 10–15 years. While the current deployment schedule does not include RPMs at our on-dock rail facility (670,000 TEUs), CBP recognizes that this area has not yet been fully addressed and discussions are underway to develop a way to effectively screen these containers. CBP, Pacific Northwest Labs and the terminal operators are collaborating to devise options to screen intermodal cargo in the least disruptive way. This could include the installation of RPMs at choke points where containers enter the rail facility from other container terminals or screening the entire train as it exits the terminal. One concern would be delaying the entire train schedule while an alarm from one or more of the containers on that train is resolved. We expect to conduct a trial of scanning the entire train later this year.

A process to screen containers that will be transferred by barge to another US port must also be developed. In many instances, these barges traverse congested waterways adjacent to densely populated urban areas. We need the same level of assurance that these containers are free of nuclear or radiological devices as we have about the containers that are being delivered to inland destinations by truck.

Ability of CBP to Fully Staff RPM Operations

In some ports around the country, the RPMs are manned not by CBP but by a local law enforcement agency. In theses cases, CBP has committed to responding to an alarm within a specified period of time. As ports and terminals across the country move toward expanding their gate hours, we need to ensure that CBP will have the adequate resources to staff and monitor all of these devices and analyze the high volume of alarms that they will be receiving. Provision must also be made to reimburse the local jurisdiction for assuming responsibilities under a federally mandated program.

Ability to Scan Roll On Roll Off Cargo

Given the heavy focus on containerized cargo since 9/11, we remain concerned about the ability to use Roll On / Roll Off (RoRo) cargo, such as automobiles, buses and subway cars to deliver weapons of mass destruction to the United States. Absent any other programs and initiatives to ensure the integrity of RoRo cargo and inspect it upon arrival in the United States, we believe that steps must be taken to work with the auto terminal operators to devise a method of screening all RoRo cargo with RPM's or other suitable technology upon discharge from the vessel.

COUNTER MEASURE TEST BED

Under an agreement with the Department of Homeland Security, Science and Technology Directorate, the Port Authority is involved with a very productive program of testing radiation sensor technologies at various transportation facilities including our river crossings, airports and the seaport, including the New York Container Terminal on Staten Island and the Customs and Border Protection VACIS facility in Port Elizabeth.

Since most commercial off-the-shelf radiation detection devices use gross counters, a large number of alarms for innocent sources are generated when the detection threshold is set sufficiently low in order to detect nuclear weapons or radiological materials. The Countermeasures Test Bed (CMTB) explores operational methodologies and tests advanced radiation sensor systems that have spectroscopic identifiers that have been developed at various Department of Energy laboratories in a real world environment at fully operational transportation facilities.

Under the leadership of the Department of Homeland Security's Environmental Measurements Laboratory in New York, potential devices are first bench tested with

a variety of radiation sources and under various operating conditions at the Brookhaven National Laboratory before being deployed at our facilities.

As a result of the test bed work in which we participated, the Adaptable Radiation Area Monitor (ARAM) and Sensors for the Measurement and Analysis of Radiation Transient (SMART) devices are now ready for commercialization and could be available for use as early as FY06. These devices will be better at detecting things such as highly enriched uranium and plutonium.

Through our participation in this important initiative, we hope to improve the Nation's ability to prevent the illicit entry and movement of nuclear and radiological devices and materials, increase radiation sensor coverage of the region's critical infrastructure and to advance the capacity of technology to be reliable and of practical use in the field. We remain committed to making our many facilities and operations available to the Department of Homeland Security for this and other important demonstrations and test bed projects.

In the coming year DHS S&T will conduct head-to-head operational testing and evaluation of commercially available spectroscopic units at New York Container Terminal (NYCT) to determine operational viability and performance against real cargo in the port environment. Additionally, DHS will evaluate how integrated radiation monitoring systems at a complex intermodal facility such as NYCT (maritime and rail) could improve operational performances of the facility while meeting DHS goals.

RECOMMENDATIONS

With the advent of the new Domestic Nuclear Detection Office (DNDO) at the Department of Homeland Security there is a unique opportunity to recommend a comprehensive research agenda that would specifically benefit the marine transportation system.

While the port itself is generally not thought of as a likely terrorist target but rather a means of delivering a radiological device to a higher priority target, we believe that we should take advantage of opportunities to detect, deter and intercept a radiological or nuclear device well before it passes through a terminal exit gate. Among the ways to do this is to place radiation detection devices on the container gantry cranes and other container handling equipment.

On average, an import container sits in a US port terminal for five to seven days before it is picked up for delivery to the consignee. Under the current design of the RPM program, the nuclear weapon or radiological material could be sitting on the dock for an extended period of time before it passes through a RPM at the exit gate on its way to the highway system. The Federal government should establish a research and development program focused on identifying a way to scan 100 percent of the containers as they are off loaded from the ship and/or when they are sitting idle in the terminal.

Both we and the Virginia Port Authority have each conducted "proof-of-concept" projects over the last four years to design, fabricate, install and test radiation detectors placed on the spreader bars of gantry cranes. The device would need to be able to be rugged enough to withstand the repeated shock and vibration from handling containers, distinguish between the container that was being lifted and other containers around it, and transmit data to a central monitoring location. The state of the technology was inadequate for this application however, we do believe that the problems can be overcome and should be further evaluated by DNDO.

Another alternative would be to place radiation detection equipment on straddle carriers or rubber tire gantry cranes, which are used to move and stack containers at the marine terminal. That would allow for containers that are stacked three high to be scanned simultaneously and repeatedly during the normal course of business as they dwell on the terminal.

We would also encourage the development of an integrated scanning and detection device that would essentially allow for the RPM and the VACIS exam to occur simultaneously. This approach is a much more holistic solution to provide 100 percent screening of international cargo for both radiation and density, without causing additional delays.

As screening technology is further developed and tested, we must also take into consideration the potential impact that this technology might have on container security devices such as electronic seals and the Advanced Container Security Device.

We experienced in Operation Safe Commerce that the VACIS exam may have interfered with the radio signal generated by electronic seals rendering them unusable. Therefore, the interference of VACIS and RPM inspections must be considered as these technologies are further developed and deployed.

Finally, I'd like to make one last point. Since 9/11 the Federal policy has been to push our borders out and DHS from those very first days has implemented that

policy though their various programs such as the 24 Hour Rule, CSI, and CTPAT. As part of both the layered approach to security that I described earlier and the policy to push our borders out, the deployment of RPM's at ports of export should be increased and strengthened so that we can have even greater confidence that the cargo destined for the US in not likely to contain weapons of mass destruction.

CHALLENGES THAT REMAIN

Addressing the issue of port and maritime security is an enormous challenge given the complexity of the international transportation network. Devising a system that enhances our national security while allowing the continued free flow of legitimate cargo through our ports will not be solved with a single answer, a single piece of legislation, or by a single nation. It will require a comprehensive approach with coordination across state lines and among agencies of all levels of government and the cooperation of the private and public sectors and the international community. Importantly, it will require additional resources for the agencies charged with this awesome responsibility and for the public and private ports and terminals where the nation's international commerce takes place.

I hope my comments today have provided with you some helpful insight on just one aspect of the complex matter of radiation detection. We at the Port Authority of New York & New Jersey are prepared to offer any additional assistance that you may require. Thank you.

Mr. LINDER. Dr. Tannenbaum.

STATEMENT OF DR. BENN TANNENBAUM, AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Mr. TANNENBAUM. Mr. Chairman, Mr. Chairman, Congressman Langevin, Congressman Pascrell, members of the subcommittees, thank you for this opportunity to testify before you today on the detection of nuclear weapons and radiological material.

I am Benn Tannenbaum, Senior Program Associate at the Center for Science, Technology and Security Policy within the American Association for the Advancement of Science. Founded in 1848, AAAS is the world's largest general scientific society, with over 120,000 members and 262 affiliated societies.

The specific center for which I work seeks to connect policy members, such as the members of these subcommittees, with scientific and technical experts in a broad range of science- and security-related topics. In general, we work to identify the experts best suited to meet your needs by providing clear, objective, unbiased research. We do not perform original research ourselves, but instead act as a conduit between the academic research community and the policy arena.

We were approached this spring by Congressmen Markey and Thompson, who sought to better understand the capabilities and limitation of the radiation portal monitors being deployed to detect smuggled radioactive and fissile materials arriving in U.S. ports. We consulted two physicists with long experience in this particular field, Professor Frank von Hippel of Princeton University and Professor Steve Fetter of the University of Maryland. Based on their expert input, we drafted a report that is included within my written testimony and is the basis for my testimony. In addition, I am a physicist with experience in the design and construction of detector technology.

Having made those caveats, I would like to address five main points in my remarks.

First, the isotopes best suited for use in dirty bombs can be detected with passive radiation detectors similar to those being deployed at ports both abroad and in the United States. A passive ra-

diation detector is simply one that monitors the rate at which radioactive decays occur near the detector. The very feature that makes for a good dirty bomb, namely a strong source of radiation, also makes detection easier and shielding more difficult.

In addition, the properties of plutonium, one of two elements used to construct nuclear weapons, are such that it can be detected with passive radiation detectors. An active radiation detector, in contrast, uses some sort of a probe, such as x-rays or neutrons, to determine the contents of a container.

Second, the physical properties of uranium, including the highly enriched uranium that would be used to construct a nuclear weapon, are such that even lightly shielded uranium is very likely to escape detection by passive radiation monitors. While some ports of entry have both active and passive detectors, some observers argue that they are not being used in the most effective manner.

Third, there are several ways to improve the capabilities of the passive detectors currently in use and to improve future generations of detectors. The current detectors can be improved by increasing the sampling time, decreasing the distance between the container and the detector, decreasing the background radiation through additional shielding around the detector, and improving algorithms and adding column meters to the detectors.

In addition, the passive detection of specific energies of radiation, coupled with an active method that identifies the location of very dense objects, greatly reduces false positives by distinguishing harmless radioactive materials, such as kitty litter, from dirty bombs and nuclear weapons.

Fourth, there are several interesting R&D programs exploring new techniques to locate radiological and fissile materials. At Los Alamos, researchers are using cosmic rays to find very dense materials, such as plutonium and uranium, in kilogram quantities within cargo containers. At Lawrence Livermore, researchers use neutrons to ping a container. These neutrons induce a very characteristic gamma ray response in fissile materials.

Another proposal uses inexpensive detectors placed in cargo containers during transoceanic shipment. These detectors take advantage of the 10-day or longer transit time to locate HEU. This has the additional feature of allowing the interception of dangerous materials before they enter a U.S. port.

The Department of Homeland Security and the Department of Energy's National Nuclear Security Administration have recently begun construction of a facility to test portal monitors and expects to select the next deployment of technology this year using a temporary test bed.

Fifth, the best way to protect the United States from smuggled nuclear weapons is to use a layered defense. The currently deployed portal monitors in some domestic and foreign ports are an important first step. Adding in-transit detectors and active scanners would increase our ability to locate radiological and fissile material.

The intrinsic difficulties in detecting uranium make it particularly important to secure, control and protect existing supplies of HEU around the world. It will always be far easier to monitor a lump of uranium at a known location than it will be to detect ura-

nium smuggling, and the infrastructure required to make HEU is much more substantial than that required to construct a gun-type nuclear weapon with existing HEU.

The comprehensive threat reduction threat program has enabled the safeguarding of much of Russia's HEU, and some of the HEU is being converted to fuel for use in nuclear power reactors. This program should be expanded to cover more countries and the rate of fuel conversion should be increased. In addition, research reactors in many countries use HEU as fuel. These reactors should all be converted to use low enriched uranium fuel as soon as possible.

I thank you for the opportunity to testify here and look forward to your questions.

Mr. LINDER. Thank you, Dr. Tannenbaum.

[The statement of Mr. Tannenbaum follows:]

PREPARED STATEMENT OF BENN TANNENBAUM

Mr. Chairman, Congressman Langevin, Congressman Pascrell, members of the Subcommittees, thank you for this opportunity to testify before you today on the detection of nuclear weapons and radiological material. I am Benn Tannenbaum, Senior Program Associate at the Center for Science, Technology and Security Policy within the American Association for the Advancement of Science. Founded in 1848, AAAS is the world's largest general scientific society with over 120,000 members and 262 affiliated societies. The specific Center for which I work seeks to connect policy makers, such as the members of this Committee, with scientific and technical experts in a broad range of science and security-related topics. In general, we work to identify the experts best suited to meet your needs by providing clear, objective, unbiased research; we do not perform original research ourselves but instead act as a conduit between the academic research community and the policy arena.

In this case, we were approached by Congressmen Markey and Thompson, who sought to better understand the capabilities and limitations of the radiation portal monitors being deployed to detect smuggled radioactive and fissile materials arriving in U.S. ports. We consulted two physicists with long experience in this particular field, Professor Frank von Hippel of Princeton University and Professor Steve Fetter of the University of Maryland. Based on their expert input, we drafted a report for Congressmen Markey and Thompson that is included with my written testimony. The testimony I present today is based in large part on their work. In addition, I am a physicist with some experience in the design and construction of detector technology.

Having made those caveats, I would like to address five main points in my remarks.

First, the isotopes best suited for use in dirty bombs, such as cesium-137, cobalt-60, or americium-241, can be detected with passive radiation detectors, similar to those deployed since 9/11 at ports both in the United States and abroad. A passive radiation detector is one that simply monitors the rate at which radioactive decays occur near the detector. The very feature that makes for a good dirty bomb—namely, a strong source of radiation—also makes detection easier and shielding more difficult. In addition, the properties of plutonium, one of two elements most useful in constructing nuclear weapons, are such that it, too, can be detected with passive radiation detectors. An active radiation detector, in contrast, uses some sort of a probe such as x-rays or neutrons to determine the contents of a container.

Second, the physical properties of uranium, including the highly enriched uranium (HEU) that would be used to construct a nuclear weapon, are such that shielded uranium is very likely to escape detection by passive radiation monitors. While some ports of entry have both active and passive detectors, some observers argue that they are not being used in the most effective manner. The passive detection of specific energies of radiation coupled with an active method that identifies the location of very dense objects is a good technique to detect smuggled uranium.

Third, there are several ways to improve the capabilities of the passive detectors currently in use and to improve future generations of detectors. The current detectors can be improved by increasing the sampling time, decreasing the distance between the container and the detector, decreasing the background radiation through additional shielding around the detector, and adding collimators to the detectors. In addition, future detectors must have better energy resolution. This allows one to distinguish harmless radioactive materials, such as kitty litter, from dirty bombs and

nuclear weapons. There are limits, however, to the space available for these detectors and to the time available for scanning.

Fourth, there are several interesting R&D programs exploring new techniques to locate radiological and fissile materials. At Los Alamos National Lab, researchers are using cosmic rays to find very dense materials, such as plutonium and uranium, in very small quantities within cargo containers. At Lawrence Livermore National Lab, researchers use neutrons to "ping" a container. These neutrons induce a very characteristic gamma ray response in fissile materials. An Ohio-based company has proposed inexpensive detectors that would be placed in cargo containers during transoceanic shipment. These detectors take advantage of the 10-day or longer transit time to locate HEU. This has the additional feature of allowing the interception of dangerous materials before they enter a U.S. port. The Department of Homeland Security and the Department of Energy's National Nuclear Security Administration have recently begun construction of a facility to test portal monitors and expects to select the next generation of technology next year using a temporary test bed.

Fifth, the best way to protect the United States from smuggled nuclear weapons is to use a layered defense. The currently deployed portal monitors in many domestic and foreign ports are an important first step. Adding in-transit detectors and active scanners would increase our ability to locate radiological and fissile material. The intrinsic difficulties in detecting uranium make it particularly important to secure, control, and protect existing supplies of HEU and plutonium around the world. It will always be far easier to monitor a lump of uranium at a known location than it will be to detect uranium smuggling. The Comprehensive Threat Reduction program has enabled the safeguarding much of Russia's HEU and plutonium, and some of the HEU and plutonium is being converted to fuel for use in nuclear power reactors. This program should be expanded to cover more countries and the rate of fuel conversion should be increased. In addition, research reactors in many countries use HEU as fuel; these reactors should all be converted to use low enriched uranium fuel as soon as possible.

I thank you for the opportunity to testify, and look forward to your questions.

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

June 17, 2005

The Honorable Bennie G. Thompson
Ranking Member
Committee on Homeland Security
House of Representatives
Washington, DC 20510

The Honorable Edward J. Markey
House of Representatives
Washington, DC 20510

Dear Mr. Thompson and Mr. Markey,

Thank you for your letter of March 9, requesting technical information on the ability of portal monitors to detect the smuggling of high-enriched uranium (HEU). We at CSTSP have consulted with Professor Frank von Hippel of Princeton University and Professor Steve Fetter of the University of Maryland, both of whom are physicists with extensive experience in issues related to national security. Together with Professors von Hippel and Fetter, we have reviewed the report on this topic by Thomas B. Cochran, Matthew McKinzie, and Art Seavey entitled, "An Assessment of U.S. Customs and Border Protection's Ability to Detected HEU in Cargo Containers Using Passive Radiation Portal Monitors" (Natural Resources Defense Council, 14 March 2005).

Before addressing specific questions, it is important to note that to provide fully authoritative answers would require detailed technical (and probably classified) information about the portal monitor systems in use at ports of entry, including operational procedures and methods of data analysis, to which we do not have access. Our assessment is therefore based on general experience with the detection of radiation, together with information in the public domain, such as that contained in the Cochran *et al.* report.

Regarding specific questions:

1) In the panel's opinion, would a mass of HEU similar in shape, packaging and location within a similar shipping container be distinguishable from naturally occurring background radiation (NORM) using radiation portal monitors, physical configurations, algorithms, and alarm settings that are currently deployed by DHS at ports of entry?

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We have reviewed the analysis in the Cochran *et al.* report, which concludes that a several-kilogram cylinder of uranium metal, shielded by a few millimeters of lead and steel and placed in a shipping container, is likely to escape detection by portal monitors using current detectors, algorithms, and operational procedures. Although we have not reproduced these calculations in detail, this conclusion appears to be based on solid analysis.

We also note that the minimally-shielded solid uranium cylinder analyzed in the Cochran *et al.* report represents nearly an optimum case for detection. Relatively simple means exist for avoiding detection that could allow kilogram quantities of HEU to evade detection by even significantly more sensitive and sophisticated passive detection systems than those presently in use.

2) Please list and summarize any limitations of the radiation portal monitors, physical configurations, algorithms, and alarm settings that are currently deployed by DHS at ports of entry in their ability to distinguish between a sample of HEU identical in size and packaging to the DU sample smuggled into the U.S. by ABC News from naturally occurring background radiation and NORM.

The portal detectors in use are limited in several ways. The most important limitation is their very poor energy resolution, which severely limits their ability to identify radioactive sources and thereby distinguish between potentially hazardous sources and NORM. Detector capabilities are also limited by the large width of the portal and the correspondingly large distance between the detectors and potential radioactive sources passing through the portal; the short counting time available for collecting data; and the lack of collimation to reduce the background signal.

3) In the panel's opinion, can additional R&D to develop cost effective improvements to the technology address any of the limitations? If so, please list and summarize the areas of research focus that are required, including the degree to which the limitation would be solved by a particular technology improvement and an estimate for how long it will take to develop and deploy such an improvement and the relative cost of the new technology and procedures.

Additional R&D may improve detection capabilities by making available less-expensive, higher-energy-resolution detectors and automatic data collection and analysis systems that can reliably identify radioisotopes and distinguish between potentially hazardous sources and NORM in order to minimize false alarms. One example is the system recently developed at the Princeton Plasma Physics Laboratory, which is described at http://www.pppl.gov/news/pages/minds_license.html.

We note that any system that depends on detecting HEU at a U.S. port of entry is a source of great danger if that HEU has been fashioned into a nuclear device. Such a device could easily be set to detonate automatically upon arrival at a U.S.. For that reason, we would like to call your attention to a proposal by Dr. Samit Bhattacharyya for an "offshore

detection integrated system" using inexpensive detectors affixed to cargo containers prior to departure from the port of origin. Such a system may potentially be far more sensitive than a portal detector, because of the lengthy time available for data collection during transoceanic transit and the large total number of detectors on each ship. More importantly, it could detect potentially hazardous cargo at sea, far from populated cities. We have attached a brief description of this proposal.

Finally, we wish to emphasize that HEU—particularly HEU that is uncontaminated by reprocessed uranium—is inherently very difficult to detect using passive detection methods. Uncontaminated HEU emits very few neutrons, and most of the photon emissions are of relatively low energy and are easily shielded. More reliable methods for detecting and characterizing HEU use an "active" approach, such as radiography or the stimulation of fission with neutron sources (*i.e.*, the Nuclear Material Identification System developed by Oak Ridge National Laboratory or a similar system specifically being developed for use with cargo by Lawrence Livermore National Laboratory), which should greatly increase the likelihood of detection. Because of concerns about the cost and health and safety of active sources, R&D might focus on active methods that use natural sources of radiation, such as cosmic-ray neutrons or muons or the photons produced by terrestrial radionuclides.

Because of the challenges of reliably detecting HEU, the very highest priority should be assigned to safeguarding all stocks of HEU, at home as well as abroad. Due to its very low rate of neutron emission, HEU can be fashioned into a simple gun-type nuclear weapon—a technology that is well within the reach of virtually all countries and sophisticated subnational groups. Thus, stocks of HEU should be accorded the same level of security as nuclear weapons. Efforts also should be made to reduce and eliminate stocks of HEU whenever possible. The conversion of HEU-fueled research reactors and critical assemblies, which are still widespread, is also very important.

4) In the panel's opinion, can engineering solutions such as additional shielding or placing the detectors closer to the samples being screened address any of these limitations? If so, please summarize each such solution, including the degree to which the limitation would be solved by a particular engineering solution.

Existing portal detection systems could be made somewhat more effective by making the portal as narrow as possible and increasing the counting time (e.g., by reducing vehicle speed) to the maximum practical extent. For example, halving the width of the portal would increase the sensitivity of the detection system by a factor of four; quadrupling the counting time would increase sensitivity by a factor of two. Additional shielding around the detectors would decrease background radiation and thereby increase the effectiveness of the scanners. In practice, there may be limitations to achieving these changes in scanning.

Collimation of the detectors and a corresponding modification of the analysis algorithms may also improve the sensitivity of the detectors. We cannot estimate the possible

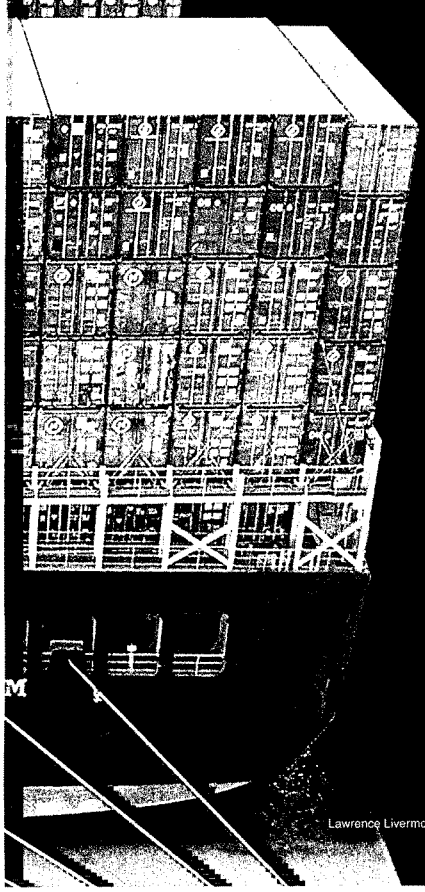
improvement factor, however, without more detailed knowledge of the detection system and algorithms now in use.

We hope that this information, although limited in scope, can be useful. For a deeper look at this complex issue, the committee may want to also consider requesting a detailed technical analysis from an organization such as the National Academy of Sciences, which could include examination of classified information, but would likely take at least one year from when funding is made available.

Sincerely,

Norman Neureiter, Ph.D.
Director

Screening Cargo Containers



Livermore scientists are developing a system to search for weapons and fissile materials that terrorists might hide in cargo shipped to U.S. seaports.

EACH year, some 48 million cargo containers move between the world's ports. More than 6 million of these enter the U.S., but only about 2 percent are opened and inspected when they arrive at U.S. seaports. The West Coast ports of Los Angeles–Long Beach, Oakland, and Seattle alone process 11,000 containers per day, or about 8 containers per minute.

Because of this high traffic volume, U.S. seaports are especially vulnerable to a terrorist attack. Illicit radioactive materials could be hidden in any one of the cargo-filled containers that arrive at U.S. ports. Yet, searching every shipment would bring legitimate commercial activities to a halt. Improving security at U.S. ports is thus one of the nation's most difficult technical and practical challenges because the systems developed for screening cargo must operate in concert with ongoing seaport activities.

Working at this intersection of commerce and national security, Lawrence Livermore researchers are applying their expertise in radiation science and detection to develop improved technologies for detecting hidden radioactive materials. One new technology being designed and tested at the Laboratory is a neutron interrogation system for cargo containers. This system will quickly screen incoming shipments to ensure that nuclear materials such as plutonium and highly enriched uranium (HEU) are not smuggled into the U.S.

Balancing Security and Commerce

The Livermore system would bathe suspicious containers in neutrons to actively search for nuclear materials. A truck carrying a container laden with suspicious cargo would be towed over a generator that would bombard the container with neutrons. It would then be towed through an array of detectors, much like driving through a car wash. If the

to Remove a Terrorist Threat

neutrons encountered any fissile material shielded and hidden among the container's contents—whether produce, clothing, electronics, lumber, automotive parts, or other consumer goods—the interaction would induce tiny fission reactions. These reactions would produce the telltale delayed gamma rays of nuclear materials, which would be picked up by the detectors.

The Livermore system is not intended to screen every container entering a U.S. seaport. Instead, it will be used on the suspect cargo identified by screening procedures, such as radiography or passive radiation inspection, that show some of a container's contents.

The 19-member project team draws on the talents of personnel from Livermore's Engineering Directorate as well as the Physics and Advanced Technologies; Chemistry and Materials Science; Safety and Environmental Protection; Nonproliferation, Arms Control, and International Security (NAI); and Computation directorates. "To some approximation, we work like a soccer team of 8-year-olds," says project leader Dennis Slaughter, technical director of Livermore's 100-megaelectronvolt (MeV) electron linear accelerator (linac). "By that, I mean we all follow the ball. There are no established positions. Everyone 'turns to' the urgent task, and we all help each other without disciplinary distinctions."

Originally funded by Livermore's Laboratory Directed Research and Development effort, the detection project was picked up by the Department of Energy (DOE) in 2003 and is now supported by the Department of Homeland Security (DHS). The Livermore team is focused on developing a system that is not only reliable but also commerce-friendly.

"We want a system that can detect small targets of nuclear material—about 5 kilograms of HEU and 1 kilogram of plutonium—with low error rates of about 1 percent false positive and false negative," Slaughter says. "This system would permit rapid scanning so it wouldn't disrupt commerce. Our goal is to complete the scan and report in about a minute."

An Active Interrogation System

Slaughter and his colleagues consider active interrogation to be the most promising option for detecting HEU in containers. Even moderate amounts of shielding make it difficult to passively detect radiation emanating from hidden sources. The high-energy, gamma-ray signature produced when neutrons interact with nuclear material is unique, so the liquid scintillation detectors can readily distinguish it from the signature for normal background radiation.

The neutron scan would pose few risks to cargo. Most residual radioactivity would dissipate within seconds after the scan. In the team's experiments, radiation dose rates were low.

The team is also working to minimize potential risks to the people who will operate the equipment. The project goal is to limit radiation exposure to the normal allowable doses specified in federal standards for the general public. "Because people might be inside a container during irradiation," says Slaughter, "we want the radiation dose to be too small to cause harm."

Slaughter hopes to see such a system as a regular part of cargo container security at U.S. ports. Eventually, it might also be used at foreign ports to scan containers before they are loaded aboard U.S.-bound ships. Since 2002, the Livermore team has done considerable work related to basic science and engineering of the system, developing the detector and establishing requirements for the neutron generator. Research has been conducted at Livermore and at the 88-inch cyclotron at Lawrence Berkeley National Laboratory (LBNL). The team's timetable is to build a research prototype and evaluate it in a laboratory setting during 2005 and field a vendor prototype at a container port in 2006.

Detecting the Gamma-Ray Signature

Use of a high-energy, gamma-ray signature to detect nuclear materials in containers was proposed by Stanley Prussin, a professor of nuclear engineering at the University of California (UC) at Berkeley, and Eric Norman of LBNL. Prussin, now the chief scientist for the cargo container project, has long consulted with the Laboratory's NAI Directorate. He became involved with the cargo container effort in the summer of 2002 while on sabbatical at Livermore to work on an unrelated project.

Prussin was familiar with Slaughter's work and attended a meeting at which modelers discussed the container effort. He says, "It didn't take too long for me to become convinced that, under their defined worse-case condition, we ought to take another look at the technique they were modeling."

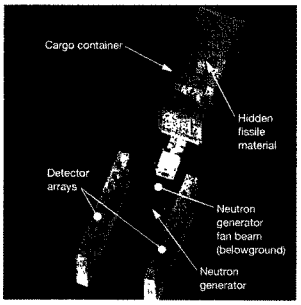
Rather than high-energy gamma rays, the Livermore team originally considered a system that counted delayed neutrons emitted by neutron-induced fission. Delayed neutrons are emitted from a fraction of a second to a few minutes after fission and have lower energies than the fast prompt fission neutrons. Although delayed neutrons can be a reliable indication of nuclear materials, their yield is low.

Prussin noted a difficulty with using delayed neutrons: Hydrogenous cargo—fruits and vegetables, canned meats, wood, plastics—can absorb the short-lived

neutrons and thus might interfere with the delayed neutron count.

"Any system we develop must look for fissionable materials that will be well shielded," says Prussin. "If the material is shielded by hydrogenous material, the probability for the delayed neutrons to actually escape from the container into an external detector is very small. In the U.S., we import almost everything under the sun, and many of those imports are hydrogenous."

Instead of the delayed neutron count, Prussin suggested the team measure the gamma rays emitted. Fission products make numerous gamma rays that have comparable decay characteristics of delayed neutrons. Yet, says Prussin, the probability of the neutron-induced gamma rays escaping from the container through hydrogenous material is about 1,000 times greater than it is for delayed neutrons.



The design for the detector system calls for a belowground neutron generator that would bathe containerized cargo with neutrons. Interaction of the neutrons with fissile material inside the container would produce fission, followed by delayed gamma rays detected by an array of liquid scintillators as the container moves through the system.

In 2003, Prussin and Slaughter worked with Norman to arrange for a series of experiments, funded by DOE's Office of Science, at LBNL's 88-inch cyclotron. The first experiment was conducted using a deuteron beam on a beryllium target. The researchers also bombarded well-shielded sample targets of uranium-235 and plutonium-239, irradiating each sample for 30 seconds, going back and forth to get enough statistics for a relevant evaluation.

"The high-energy gamma rays essentially represent a unique signature that fission has occurred," says Prussin, "both because of their energies, which are above 3 MeV, and because of their temporal behaviors."

Researchers followed up the LBNL measurements with signature verification experiments at a new laboratory commissioned at Livermore for scanning cargo containers. The laboratory houses a 6-meter container provided by APL, one of the world's largest container transportation companies, and gives the researchers a realistic testing environment. In these experiments, they irradiated a 22-kilogram target of natural uranium with a beam from a 14-MeV neutron source. Their results confirmed the intensity of the signature in a realistic cargo-scanning configuration using 150 grams of HEU and a low-intensity source.

Good Results with Simulated Cargo

In studies using simulated cargo stacked around the target, the gamma rays produced were very intense, between 2.5 and 4 MeV. The neutron beam energy must be high enough to penetrate the cargo but low enough to avoid interfering activation. (The research indicates the neutron source should be between 5 and 8 MeV.) Although gamma radiation is 10 times stronger than delayed neutrons, it is weak but detectable, and high-resolution detectors are not required to measure it. Large arrays of low-resolution detectors, such as liquid scintillators, can be cheaply produced and easily deployed.

One question the team must resolve is what accelerator characteristics are required for practical field applications. "Accelerators that can give the appropriate deuteron beam energy intensity on the appropriate target can, in principle, be manufactured commercially and for a reasonable amount of funding," Prussin says. "We don't know that one has been constructed for the exact conditions we'll specify, and we may have some technical issues to address. But our requirement is not for a scientific system. What we will want is a much simpler device."

Meanwhile, the team wants to resolve some problems found when using Monte Carlo codes to mock up experiments and test them on the computer. "We are developing a method that seems likely to serve our purpose," says Prussin. Experiments on irradiation of uranium, which will be conducted at LBNL, are being designed to help the researchers understand how well the computational procedures represent the experimental data.

Simultaneously, efforts are moving forward to develop a large array of liquid scintillators that are sensitive to both neutron and gamma rays. As currently envisioned, the design includes a bank of 20 liquid scintillator–filled tubes spanning each side of the car wash.

Benefits of Liquid Scintillator

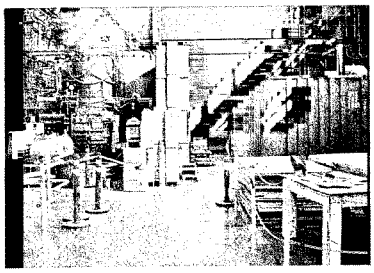
Liquid scintillator is a good candidate material for the cargo interrogation problem. It has a fast response time, and it can be inexpensively instrumented to scan a large volume of material, which helps to ensure that a large fraction of the particle flux emitted by the neutron-irradiated nuclear material will be detected. Livermore physicist Adam Bernstein, who leads the detector design team, says, "Neutrons and gamma rays create a 20-nanosecond pulse of blue light when they scatter in the medium, and this

fluorescent pulse can be detected in photomultiplier tubes." Such detectors can be used in various cargo detection and interrogation scenarios. For example, even with the neutron source off, the detector array may still be sensitive enough to scan cargo for some types of radioactive materials of concern.

The segmented array, which has a response time of about 100 nanoseconds or better, would indicate the location or spatial extent of radioactive material hidden in the cargo. "By establishing the geometric extent of the radioactive material," says Slaughter, "we can better differentiate cargo with small amounts of uranium distributed throughout from normal cargo with a small component of nuclear material hidden in it."

"The liquid scintillator project dovetails nicely with the Laboratory's mission," says Bernstein. "Livermore in general is a center for radiation detection because of nuclear weapons and other nuclear physics research." He adds that the liquid scintillator work is building on a detection technology that has been used for years in high-energy physics. "These types of detectors are often used in fundamental physics research, where we engage in neutrino physics and dark-matter searches, but not for practical applications such as fissile material detection. In this project, we're taking a technology that's a workhorse in high-energy physics and applying it in the real world."

Using liquid scintillators in such applications brings its own challenges for detector designers. "We have a lot of work to do in developing the algorithms for the gamma-ray signal that comes out of cargo containers," says Bernstein. "We want to process the signal in a different way than we do in a physics experiment where we don't have any time constraints and we can wait to obtain data. In this application, we have about a minute to decide whether the cargo container is suspicious or not."



APL, one of the world's largest container transportation companies, provided Livermore researchers with a 6-meter container, which gives them a realistic test environment in the container laboratory.

Keeping the false-positive and false-negative rates low is another technical issue facing the designers. "We want to optimize the signal-to-background ratio as best we can," says Bernstein, "and we'll have to establish the number of false positives that are acceptable. For example, if a few hundred cargo containers go through the car wash each day, a false-positive rate of 1 percent might be unacceptable because that could mean you stop the chain once a day to remove a container for closer inspection."

Another challenge is to develop a robust system, one that can work continually for months or years and that can be operated by people who are not experts in radiation detection. "People frequently underestimate that aspect of the development process," Bernstein says.

Members of the team built a small prototype of a 0.6-meter-tall detector, which they successfully tested. This spring, they are working with an array of four detectors, each 2 meters tall and 20 centimeters in diameter, and according to Bernstein, the team expects this testing to result in some iterations of the design. By the end of 2004, the team hopes to be working on a larger array that would cover one side of the car wash.

"By January or February 2005, we should have the full array," says Bernstein. "We most likely will build it at Livermore. While we're designing the prototype, we'll also try to make the system portable, so we can take it into the field—and possibly test it at a port."

Slaughter is hopeful that by 2005 the Laboratory team will add a commercial partner to develop a system that could eventually be deployed in the fight against global terrorism.

—Dale Sprouse

Key Words: cargo containers, gamma rays, highly enriched uranium (HEU), homeland security, liquid scintillator, nuclear materials, neutron generator, plutonium, terrorism, weapons of mass destruction.

For further information contact Dennis Slaughter (925) 422-6425 (slaughter1@llnl.gov).

Offshore Detection Integrated System (ODIS) – Key Points

The Threat:

- Given the worldwide proliferation of nuclear materials, it is probably only a matter of time before an adversary attempts a nuclear attack on a U.S. city. Experts believe that a very likely means of delivering such an attack will be via one of **the nine million oceangoing shipping containers that enter U.S. seaports every year** – containers often called "Poor Man's ICBMs." One of those containers may one day be the "Trojan Horse" that destroys a major U.S. city.

- Substantial expenditures on missile defense should be complemented by expenditures on the more likely threat presented by the "Poor Man's ICBM." Indeed, few containers entering the U.S. are inspected, and, to the extent that a container is screened for radiation, this is currently done by a portal radiation device upon the container's **exit** from the U.S. seaport – **after** it has sat at the port for days. Given that many U.S. seaports are **within** major metropolitan areas – including New York, Los Angeles, and Seattle – waiting to detect a nuclear weapon until it exits the seaport is too late. A terrorist group could explode the device while it waits at the seaport, and therefore, destroy the neighboring city. **And even if the weapon were to be detected at the seaport, the terrorist group could simply detonate the weapon upon its detection – the "D on D" or "Detonate on Detection" scenario. D on D is a probable terrorist counter-strategy.**

Current U.S. Policy Does Not Meet The Threat And Must Be Revisited:

- Current U.S. policy does not address this threat, for it is still focused on improving our capacity to detect nuclear weapons **after they arrive** at U.S. seaports. This is evidenced by the proposed FY 2006 DHS budget, which requests $125 million for the purchase of **more** portal radiation devices for domestic deployment, focused primarily on detecting nuclear weapons after they arrive in the United States.

- Given the danger presented to seaports and neighboring cities, this "detection after arrival" policy must be revisited. U.S. policy should mandate that all sea container shipments headed to the U.S. undergo effective radiation screening ***before they reach U.S. seaports***. The strategy of "**detection after arrival" could become America's 21st century version of the Maginot Line that the terrorists could easily avoid.**

ODIS Provides A Highly-Effective And Low-Cost Means Of Addressing This Threat:

- ODIS could implement such a shift in U.S. policy. ODIS uses state-of-the-art technology that, if fully deployed, would permit 100% passive radiation screening of **all** sea containers heading for the United States or the Western Hemisphere **before they arrive** at U.S. seaports. ODIS implementation, with full government support, could begin in 24 months, on high-risk routes and be fully implemented within 3 years of first funding.

- Unlike the land based "portal" devices currently being purchased and deployed at U.S. seaports by DHS and at a limited number of foreign seaports by the Department of Energy,

ODIS is a **sea-based** system that is temporarily attached to ocean containers while being loaded for shipment at the port of embarkation . The ODIS sensors collect the necessary data to detect and identify potential threats while the containers are at sea, and then communicate this information by satellite to an ODIS command center – and ultimately to DHS authorities – for further analysis and potential response. They are removed at the port of debarkation for reuse.

- And, ODIS does this without slowing down the flow of trade – indeed; it would expedite the flow of trade. U.S. authorities will have sufficient time to analyze, integrate intelligence, and then decide about any specific container well before it arrives in port without impeding container flow.

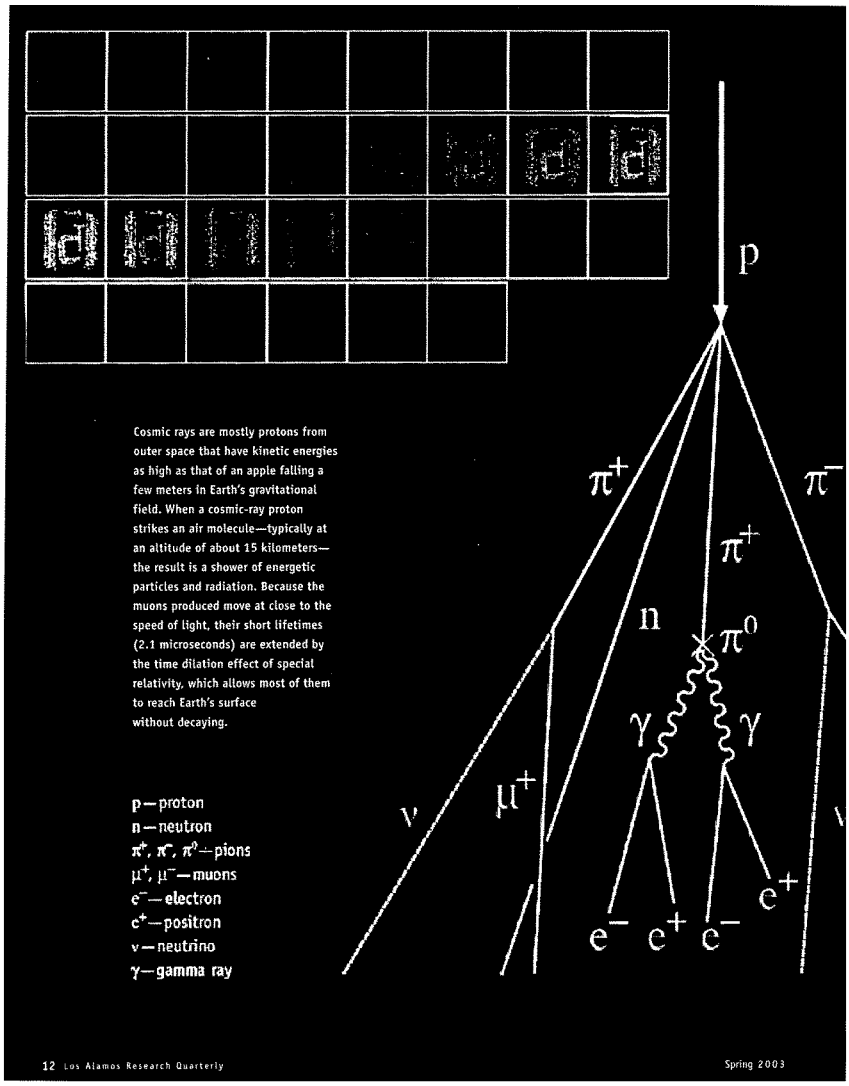
- In addition, implementing ODIS is superior to the deployment of portal radiation detection devices in foreign seaports for several reasons. **First**, ODIS is more effective in detecting shielded weapons-grade materials – for the simple reason that ODIS makes use of the average seven-thirteen days of steaming time for detection- time becomes our ally. ODIS detectors are given the length of a container's ocean voyage to detect and then analyze the telltale gamma and neutron radiation emitted from even well-shielded weapons. By contrast, portal detectors stationed at seaports are given only seconds to do this job – and, for a well-shielded device emitting minimal radiation, this short exposure is simply not enough time for effective detection. **Second**, ODIS sidesteps serious implementation, command and sovereignty issues that have plagued the deployment of inspection in foreign countries. **A U.S. policy based upon the willingness of a foreign government to assume the risk of a Detonate on Detection event at their seaports is unrealistic.** While cooperative relationships with foreign governments (such as through CSI) are vital to securing the global trading system, **foreign governments should not be relied upon to become the primary shield for U.S. Homeland Security.**

- Active inspection technologies have significant performance issues and raise safety concerns. Also, at full implementation, they have a negative impact on the flow of commerce. In addition, port systems, active or passive, ignore the Detonate on Detection problem.

- Because ODIS is a sea based system, it can be implemented on an international basis to also protect US trading partners and world commerce. The reciprocal nature of ODIS makes it an ideal system for supporting the president's anti-nuclear proliferation policy.

- The costs of implementing ODIS are also modest, especially in relation to the tremendous risk associated with **not** implementing a 100% offshore nuclear detection strategy. For the ODIS pilot to be launched now, only $7.5 million in FY05 dollars would need to be reprogrammed. In FY06, $30 million would be needed as an appropriation.

- The ODIS technology platform currently exists, is proven, is adaptable, and was designed by a highly experienced world-class team. With adequate funding, it could be deployed and fully operational in three years – providing the American people with confidence that one of the nine million sea containers heading for our seaports will not become a nuclear "Trojan Horse," devastating a major seaport or coastal city. Given the ever-increasing risk of nuclear terrorism, the small expenditures needed to get ODIS off the ground are well worth it.



Cosmic rays are mostly protons from outer space that have kinetic energies as high as that of an apple falling a few meters in Earth's gravitational field. When a cosmic-ray proton strikes an air molecule—typically at an altitude of about 15 kilometers—the result is a shower of energetic particles and radiation. Because the muons produced move at close to the speed of light, their short lifetimes (2.1 microseconds) are extended by the time dilation effect of special relativity, which allows most of them to reach Earth's surface without decaying.

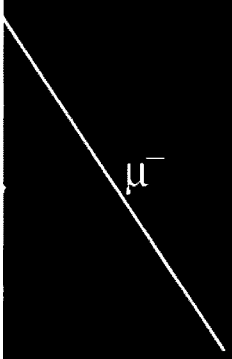
p—proton
n—neutron
π^+, π^-, π^0—pions
μ^+, μ^-—muons
e^-—electron
e^+—positron
ν—neutrino
γ—gamma ray

Muon Radiography

Detecting Nuclear Contraband

by Brian Fishbine

Muons, elementary particles that shower down on Earth, hold promise as a sensitive means of detecting nuclear materials being smuggled into the country.



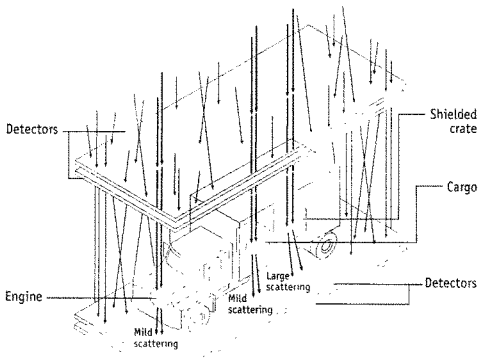
Each minute, about 10,000 muons rain down on every square meter of Earth. These charged subatomic particles are produced when cosmic rays strike air molecules in the upper atmosphere. The cosmic rays themselves are mostly energetic protons produced by the sun, our galaxy, and probably supernova explosions throughout the universe. Thousands of muons pass through us every minute, but they deposit little energy in our bodies and thus make up only a few percent of our natural radiation exposure.

A team of Los Alamos scientists—Konstantin Borozdin, Gary Hogan, Chris Morris, Bill Priedhorsky, Andy Saunders, Larry Schultz, Margaret Teasdale, John Gomez, and Val Armijo—has found a promising way to use this natural source of radiation to detect terrorist attempts to smuggle uranium or plutonium into the country. Either nuclear material could be used to make an atomic bomb (see sidebar on page 16). The technique also detects lead and tungsten, which could be used to shield the gamma rays emitted by nuclear materials—or other radioactive materials—in order to elude detection.

The new technique uses the fact that muons are more strongly deflected, or scattered, by nuclear or gamma-ray-shielding materials than they are by materials such as plastic, glass, and aluminum. This enhanced deflection occurs mainly because the atomic nuclei of nuclear and gamma-ray-shielding materials contain large numbers of protons, which exert large electrostatic forces on muons passing nearby. Since the number of protons is given by the atomic number Z, such materials are called "high-Z" materials.

Center for Homeland Security

The Laboratory recently established a Center for Homeland Security to coordinate interactions with the new Department of Homeland Security. The Center has four major focus areas: chemical/biological threat reduction, radiological/nuclear threat reduction, critical infrastructure protection, and national infrastructure simulation and analysis. Los Alamos efforts to enhance homeland security have already made significant impacts—from helping identify the strain of anthrax used in the attacks just after September 11 to developing computer simulations that help policymakers assess the vulnerabilities our nation's infrastructures, including public health. This and the following article showcase current Lab work focused on promoting homeland security.



Nuclear (high-Z) materials more strongly deflect muons than do the low-Z materials found in typical shipping cargoes. In muon scans, detectors above and below a truck would record each muon's path before and after it passes through the cargo. Using this information and muon scattering theory, a computer program would then calculate and display three-dimensional images of objects with high atomic numbers and number densities—signature properties of nuclear materials.

The deflection is also determined by how many nuclei a muon encounters while passing through the material, which is proportional to the number of nuclei per unit volume—the number density. The number density equals the material's density divided by the mass of its nuclei. The materials that most strongly deflect muons have high atomic numbers *and* high number densities. Several low- and high-Z materials along with their deflections of cosmic-ray muons are listed in the table.

In muon detection, particle detectors above and below a vehicle or container record each muon's path before and after the muon passes through the cargo. A change in a muon's trajectory means the muon has been scattered by the cargo. Using the path information and muon scattering theory, a computer program then constructs a three-dimensional image of the cargo's dense, high-Z objects.

Los Alamos simulations, validated with small-scale experiments (see cover photo), show that cosmic-ray muons can penetrate the 3-millimeter-thick steel walls of a freight truck to detect a block of nuclear or gamma-ray-shielding material 10 centimeters (4 inches) on a side hidden among other cargo, such as livestock or auto parts. The muon scan takes about a minute. People who stay in a vehicle during a scan will receive no more radiation than if they had stayed home in bed. Thus, muon radiography poses no health hazard.

The Los Alamos team can discriminate between different materials even more precisely by measuring muon energies as well as deflections. In computer simulations, this improved technique easily distinguishes between

tungsten and steel, for example. Experiments to confirm this discrimination capability are planned for the near future.

Next Step, Border Inspection?

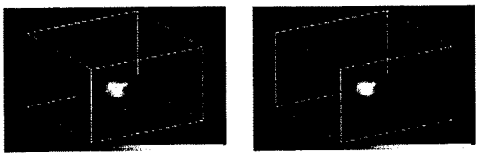
Border inspectors now use gamma-ray radiography to detect nuclear materials. Because of their high atomic numbers and number densities, nuclear materials strongly absorb gamma rays as well as strongly deflect muons. Thus, nuclear materials are fairly opaque to gamma rays and cast dark shadows in radiographs of vehicles and freight containers.

A gamma-ray scanner uses a radioactive pellet a few millimeters in diameter to produce gamma rays that are energetic and intense enough to scan a large vehicle or container in as little as a few minutes. Although a gamma-ray scan would expose a vehicle's occupants to a negligible dose of radiation—less than a hundredth that of a dental x-ray—occupants are usually removed before scanning, or only the volume of the trailer rig is scanned.

Muon scans will have several advantages over gamma-ray scans. First, the gamma-ray scanner's radioactive pellet must be properly handled and its emissions properly controlled. The pellet must also be replaced after a time about equal to its half-life—the time required for the pellet's radioactivity to decrease to one-half its initial value. Cobalt-60, the most penetrating and hence preferred gamma-ray source, has a half-life of five years. By contrast, cosmic-ray muons do not require radioactive sources that must be replaced. The muons are already there, continuously, wherever the inspection site.

Second, because gamma-ray radiography produces two-dimensional images of the cargo, it can be hard to find a block of nuclear material surrounded by, say, a load of steel auto parts. The superimposed gamma-ray shadows of many objects can prove confusing and create a problem called "clutter." Muon radiography's three-dimensional views overcome this problem.

Third, cosmic-ray muons are also far more penetrating than the gamma rays emitted by even cobalt-60. With



Using muon energies, as well as their deflections, produces radiographs that discriminate more precisely between materials. (Left) A muon radiograph based only on deflection data shows an 11-centimeter-diameter tungsten cylinder on a plastic plate with two steel support rails. (Right) A simulated radiograph that includes data on muon energies shows only the tungsten cylinder. This simulation was validated against the experimental image. Combining muon deflection and energy data should enhance the technique's ability to detect both nuclear and shielding materials. (Note: Because of its high number density and atomic number, tungsten is a good nonradioactive surrogate for plutonium and uranium in assessing the capabilities of muon radiography.)

Comparison of Muon Deflections

Material	Atomic Number	Number Density*	Muon Deflection (milliradians)†
Plastic			~2
Aluminum	13	6.0	5
Borosilicate glass	-	-	~4
Iron (steel)	26	8.4	11
Tungsten	74	6.3	27
Lead	82	3.3	20
Uranium	92	4.9	29
Plutonium	94	5.0	30

*Units are 10^{22} nuclei per cubic centimeter.

†The deflection of a 3-billion-electronvolt muon passing through 10 centimeters of various materials with different atomic numbers. For reference, 30 milliradians is about 1.7 degrees.

an energy of 1 million electronvolts, the gamma rays penetrate about 1 centimeter of lead. With an average energy of 3 billion electronvolts (at sea level), muons penetrate nearly 2 meters of lead. Greater penetration depth means the muons can detect nuclear materials surrounded by greater amounts of high-*Z* shielding material or clutter.

Nuclear Threats

Two materials that can be used to make an atomic bomb are plutonium-239 and highly enriched uranium, which contains at least 20 percent of uranium-235. Since both materials have high atomic numbers and number densities, both can be detected by muon or gamma-ray radiography.

Although plutonium-239 can be detected with either neutron detectors or gamma-ray radiography—both techniques are now used for border inspection—uranium-235 presents greater detection problems. It has no significant neutron emission, and its natural gamma-ray emissions can be shielded—usually with a layer of high-*Z* material such as lead or tungsten. In addition, there is much more highly enriched uranium in the world than there is plutonium-239; thus uranium-235 is more available to terrorists (see sidebar).

Although both muon and gamma-ray radiography can detect highly enriched uranium and its gamma-ray-shielding materials, muon radiography's greater penetration depth and more precise materials discrimination promise enhanced detection capabilities. For this reason, work is now underway to utilize the ubiquitous and benign cosmic-ray muons for detecting nuclear contraband. ■

A Terrorist Nuclear Attack

One of the most devastating attacks a terrorist group could mount would be to explode an atomic bomb in a city. If exploded in Manhattan during working hours, for example, a bomb with a yield of only 1 kiloton could kill 200,000 people outright and flatten eleven city blocks.

It is believed unlikely—but not impossible—that terrorists could buy a stolen nuclear weapon on the black market. More likely, they will try to obtain fissile materials to make their own bomb. Al Qaeda operatives have repeatedly tried to buy stolen nuclear materials and recruit nuclear-weapon scientists. The extensive materials on nuclear weapons (including crude bomb designs) found in Al Qaeda camps in Afghanistan underscore the group's interest in such weapons.

Regarding the difficulty of making an atomic bomb, former Los Alamos director Harold Agnew said, "If somebody tells you that making a plutonium implosion weapon is easy, he is wrong. And if somebody tells you that making an improvised nuclear device with highly enriched uranium is difficult, he is even more wrong." Contrary to popular belief, terrorists could make either type of bomb without being killed by radiation exposure as they assembled it.

In theory, as little as 4 kilograms (9 pounds) of plutonium would be needed to make a bomb. As little as 16 to 20 kilograms of highly enriched uranium would be needed to make an efficient bomb; a crude bomb could be made with 50 to 100 kilograms of the uranium. By contrast, the world's supply of highly enriched uranium is estimated to be 1,600,000 kilograms; the supply of plutonium, 450,000 kilograms.

The Researchers

Larry Schultz has a B.S. in agricultural engineering from Oklahoma State University and an M.S. in electrical engineering from Portland State University. He is pursuing a Ph.D. in electrical engineering at Portland State and has been performing research for his Ph.D. at Los Alamos since 2001.

Konstantin Borozdin has an M.S. in nuclear physics from the Moscow Engineering Physics Institute and a Ph.D. in astrophysics from the Moscow Space Research Institute. He came to the Lab as a postdoctoral researcher in 1998 and joined the technical staff in 2001.

John Flower

Mr. LINDER. Mr. Aloise, you talked about the troubling problem of lack of cooperation and coordination between the various agencies. I presume you studied the proposed DNDO that the department is attempting to stand up. Can this center help?

Mr. ALOISE. Actually, Mr. Chairman, we have not yet studied that proposal. We are doing that as we speak. We have ongoing work doing that. But if the agency can get better coordination and get the agencies talking to each other on a continuous basis, that would help.

Mr. LINDER. Dr. Wagner, if you were advising the terrorists on how to get radioactive material into this country, would you advise them to avoid the points of entry that are guarded?

Dr. WAGNER. Mr. Chairman, that would depend on what we had done elsewhere. Certainly today, I think, coming through the guarded points of entry might be as good a way of getting in as some other way. We can close off those relatively easily because we control those. If we have done that and if we have made it easy for them to get it to our shores, which we ought to not let it be easy for them, then either you or Mr. King, I believe, talked about bringing it in a pickup truck. That might be a pretty easy way to do it.

I think, however, that with an aggressive R&D program it would be possible to develop sensor technologies that might be able to be deployed, even where pickup trucks could come across, to close off that route too.

Mr. LINDER. Mr. Aloise, you talked about two important things that are going to have to be improved—training and intelligence. I assume you are aware that the Department's intelligence portion of the budget is about 1 percent, maybe as much as 2, and we are sending billions of dollars to local communities to buy things with no training and experience tied to it.

Do you think it would be a good idea for us to find a way to tie any of these grants to local States and localities for training issues?

Mr. ALOISE. Training is vitally important. It doesn't matter how good the equipment is if they don't know how to use it. It lessens the effectiveness of it greatly. I would say that training would be a very good thing to invest in.

Mr. LINDER. How about intelligence?

Mr. ALOISE. As well as intelligence, of course, yes.

Mr. LINDER. Should it be more than 1 or 2 percent of the budget?

Mr. ALOISE. I really couldn't comment on that at this point.

Mr. LINDER. Dr. Tannenbaum, how many locations do you think there are in this country where you could find cesium-137?

Mr. TANNENBAUM. Dozens.

Mr. LINDER. Unprotected?

Mr. TANNENBAUM. Yes.

Mr. LINDER. Do you think it is fair to say that hospitals spend more energy and money disposing of hypodermic needles than they do taking care of their cesium?

Mr. TANNENBAUM. I believe so.

Mr. LINDER. How much would a terrorist have to have to make a problem?

Mr. TANNENBAUM. A dirty bomb is a weapon of mass terror; it is a weapon of not mass destruction, but of mass disruption. So as

long as they were sufficient to trip radiation detectors, that would be enough.

Mr. LINDER. Thank you. I yield to my partner, Mr. Langevin.

Mr. LANGEVIN. Thank you, Mr. Chairman.

Mr. Aloise, you have done a great deal of work on nuclear detection, and one thing that stands out in your testimony is that the Federal Government does not have a nuclear detection and interdiction strategy. Such a strategy would define agency responsibilities, ensure that all screening operations are integrated and set the framework for our government's research and development efforts.

In your work, have you come across such a nuclear detection strategy, and if not, do you feel one is needed?

I would also, of course, be interested in hearing the opinions of our other witnesses.

Mr. ALOISE. When we started our work, none of the agencies we looked at actually had plans or strategies, strategic plans. Since the issuance of our report, some plans have been developed, but we still are hearing of and are aware of problems with coordination. That suggests there is still a need for a broader strategy.

Mr. LANGEVIN. Do any other witnesses care to comment?

Dr. WAGNER. Well, since I already waded into this a minute ago, I will wade a little farther, sir.

Somebody said that plans are nothing, but planning is everything, and I think that is really important. I once read a quotation from Winston Churchill where at the beginning of World War II, one of his aides said, "Prime Minister, are we going to plan to win this war, or are we just going to muddle through?" And Churchill's answer was, "We are going to plan to muddle through."

I think the flavor of the way the government approaches this problem has to be to "plan to muddle through." I think it is possible to overplan, to spend so much effort on planning and detail that the people doing the work in the field will never get things to actually figure out how they work and feed that back into the R&D process.

So, again, it is a question of balance between how much you plan, how elaborately you lay out the architecture in advance and actually get something in the field that helps a little bit and gets some experience to plan the next cycle.

Ms. ROONEY. As I mentioned in my statement, the coordination at the local level is absolutely exceptional. As we have said in other testimony on other subjects, there appears to be a greater need for a strategy at the Department or at the agency levels.

The delivery of the product on the local level is very good, but we notice a number of gaps and overlaps in the strategy, or lack thereof, from department to department.

Mr. TANNENBAUM. There should also be better coordination between domestic and foreign ports. I think the training levels that the foreign operators receive are not always sufficient. That would be a definite place to start.

Mr. LANGEVIN. And in your testimony, Mr. Tannenbaum, you had suggested that we need as quickly as possible to protect research and medical reactors.

Mr. TANNENBAUM. There are a set of research reactors used at universities all over the world. There are also a set of reactors used to produce medical isotopes. By and large, these use highly enriched uranium as fuel, typically in several-kilogram quantities. These are on university campuses, often with low security, so these are prime targets.

Many of them, since they are being used for research purposes, can be converted to low enriched uranium. Those that are being used for medical purposes can also be converted to low enriched uranium. There is no reason economically or by the laws of physics not to convert those.

Mr. LANGEVIN. Is that the standard right now, that those research reactors use high enriched uranium, or is that the exception?

Mr. TANNENBAUM. When research reactors were first deployed I believe they all used HEU, and as time has gone on, we have converted more and more to low enriched uranium.

Mr. LANGEVIN. Can you clarify that in terms of percentages?

Mr. TANNENBAUM. I am afraid I cannot.

Mr. LANGEVIN. I would be curious to know if you have the committee follow up with getting an answer to that question. I would like to know how much research reactors right now are still using highly enriched uranium. I see my time is just about to expire, so I just want to thank you very much. I have other questions I will submit for the record.

Mr. LINDER. Thank you, Mr. Langevin. Chairman King.

Mr. KING. Thank you, Mr. Chairman.

Ms. Rooney, in your testimony, you said that New York has approximately, has 22 of the 30 RPMs that are required. You also said that the intermodal cargo is not screened. So obviously, not all cargo is being screened. But even assuming that you had 30 out of 30 and the intermodal cargo was screened, it would seem to me that if the terrorists had managed to get these type of devices into New York harbor, it would be much more worthwhile for them to detonate it right in the harbor rather than go to the trouble of offloading it. Do you have any idea how many of the ships coming in have been screened before they get into the harbor, into the port?

Ms. ROONEY. If there is credible intelligence that CBP or other agencies get of a particular device or substance that may be on a ship, they do some screening and some preliminary testing out at sea. We have a number of ships in the last four years, the Mayview Maersk, the Palermo Senator, that have all had suspect cargo on board that were screened out at sea. Other than credible intelligence, all of the screening is done after the cargo is discharged, after it has sat on the pier for 5 to 7 days, and only on its outbound entry, outbound exit of the terminal into the hinterland.

We maintain that the screening should be done at the port of export so that we have every reasonable assurance when the cargo arrives in the United States, that it is in fact clean, and that if we are doing screening here in the U.S., it is as an absolute last resort, just to double-check, not as our primary inspection point.

Mr. KING. There is a practical matter, for instance, with the megaport program and the container initiative, do you have any

way of knowing what percentage of ships that would affect right now?

Ms. ROONEY. I am not familiar with the container, as familiar with the container security initiative in terms of what equipment is deployed in which particular ports. I know other container security issues that are not required to have radiation portal monitors, as opposed to having an extra type machine, which perform extremely different functions. So I can't quantify that at this point.

Mr. KING. Obviously, I am more familiar with New York and New Jersey, but I would just think that Los Angeles, Baltimore, Houston would all have the same dilemma that once it arrives, the catastrophic damage that could be caused, you know would be incalculable.

Okay. Let me go to another point. We are talking about containers, but how about the thousands of boats and yachts and other non cargo ships that travel in and out of our ports on a daily basis? I can open it up to anyone on the panel. They are not subject to RPM inspection. How significant a problem is that? Let me just add that I agree with Dr. Wagner. We shouldn't be afraid to fail in certain respects here. If we have to overspend, if we have to make some mistakes, fine. It is important to go ahead. So when I am asking these questions, I am not trying to be overly negative. I really like your opinions. What are we doing about non cargo ships that are coming into our ports?

Ms. ROONEY. In terms of passenger vessels or personal, you know, vehicles, again, there is little that is being done certainly by Customs on those vessels, unless they are arriving from foreign, they are reported to Coast Guard. They do need to indicate their arrival, their intended arrival to the Coast Guard but there is very generally little focus on personal vessels as compared to commercial vessels. And that remains an area of concern, even so much as the physical security of marinas, you know, remains a concern of ours.

Mr. KING. Anybody else wish to comment?

Dr. Wagner.

Dr. WAGNER. Yes, sir. You keep posing tough problems and that is a really tough one. To beat that particular avenue of attack, I think the main tool we have is intelligence and law enforcement overseas. Now, portal monitors and other means that we have at our disposal are not unconnected to intelligence. They are connected to the question of discovering an attack on us and interdicting it by intelligence and police work in the following way. They are connected. If we can raise the bar by deploying effective systems where we do control the environment, that means the attacker has to mount a larger operation, he has to recruit more people, he has to surveil the routes that he will take in. Every one of those steps makes him more subject to being discovered by police work and intelligence.

Mr. KING. Thank you for your testimony.

Mr. LINDER. The time of the gentleman has expired. The gentleman from New Jersey, Mr. Pascrell.

Mr. PASCRELL. Thank you, Mr. Chairman. My first question is this to the panel, and I have asked you to be brief and I will try to be brief with my question. There are very few containers that

are going through radiological inspection now before they hit our ports. We have a relationship with about 35 countries that are examining cargo before it goes on foreign ships when they come here.

It would seem to me we want to cut down the amount—we are never going to be able to examine every container, we know that, for explosives, for nuclear weapons. But it would seem to me, with such a small percentage of those ships, those containers that will be inspected for radiological situations, how can we increase appreciably the amount of inspections? Are we trying to guess at this?

I know we don't have a seamless, and we will never have a seamless process. I understand that. I heard the Secretary talk about that as well. All right. We can accept that. We know this is not a perfect world. We are finite beings. But it would seem to me, that we—either we haven't—not only we haven't created the technology, we don't have enough money to increase the state of the art. What am I missing here? Suppose you start us off, Dr. Wagner.

Dr. WAGNER. Having, being a scientist and having been a technologist my whole career, I believe that research can lead to reductions in costs of even high tech stuff. It will take a while. It will take years, although not decades to do that. The Defense Science Board task force that I chaired posited procurement and deployment of hundreds of thousands of detectors. We said that such a defense might cost a few 10s of billions of dollars. To me that is kind of the right—I mean, we are spending many tens of billions of dollars on missile defense, so I think the combination of thinking big in terms of procuring large numbers of the detectors and driving the cost for those detectors down through R&D is the path to success.

Mr. PASCRELL. Ms. Rooney.

Ms. ROONEY. I believe that the scientific community needs to partner more with the private sector and with the maritime industry in that, you know, making the technology work is only one aspect of the problem. Fitting the technology into the business process is a much more complex issue. And by partnering with the private sector, the—we can inform the scientists on how the technology needs to work within our industry. Just by way of example, both the port of Virginia, Norfolk and the port of Newark, New Jersey experimented with radiation detector devices on our cranes.

The technology works, but the technology was beat up by being, you know, the impact of hitting the container. The technology needs to be ruggedized in order to withstand our industry, and it is something as easy as understanding how we operate that could help the science and their research and development community to make better devices.

Mr. PASCRELL. Thank you. Anyone else wish to respond to that?

Mr. TANNENBAUM. I would focus on ports where security is the least right now rather than those that have the highest volume.

Mr. PASCRELL. Well, we are doing an assessment of that. So you are saying we should provide resources for those ports that are most vulnerable, obviously.

Mr. TANNENBAUM. Correct.

Mr. PASCRELL. Okay.

Mr. ALOISE. Well the DOE's megaports program is in two ports. And one of the problems they are facing is convincing other ports

to cooperate. So it is not only technology, it is getting the cooperation of other ports overseas to join in on us in this effort.

Mr. PASCRELL. Yeah. I am not too hopeful about the situation from what I am hearing from you. I know that you are telling me what you really think. But, I mean, you know, we are going to hear from the panel, Department of Energy, Department of Defense, Homeland Security, we hope that they are talking to each other. We hope the intelligence community, all of these agencies are talking with each other, since we do not have the state of the art to find out where this radiation is. If it is out there, hopefully these 15 agencies are talking with each other, you know. I don't believe they are talking to each other. But let me ask one more question.

Ms. Rooney, so far only the port of Oakland had fully deployed radiation portal monitoring equipment. How far along is the New York-New Jersey Port Authority in deploying this equipment, and when do you expect to complete the work?

Ms. ROONEY. Well, we have 22 out of the 30 devices that we are going to get. They are not currently installed in our largest volume terminal operator. So approximately 45 percent of our cargo volume is currently being scanned. We expect that they will be fully implemented by the end of the year, except for the rail and barge cargo.

Mr. PASCRELL. Thank you. Thank you, Mr. Chairman.

Mr. LINDER. I thank the gentleman. Mr. Simmons, do you wish to inquire?

Mr. SIMMONS. I thank you, Mr. Chairman, I thank both of our Chairs and both rankings for a very interesting subject. As I reflect on Mr. Tannenbaum's testimony, point five had to do with a layered defense, and I think there is a lot to be said for a layered defense. I spent some time in Israel a few months ago, and they have a very excellent system of layering their defenses against terrorist activities, not so much nuclear but terrorist. But it occurs to me that a layered system is essentially passive in nature; that portals, especially fixed portals, the portals that don't move around but are set in certain locations are essentially passive; that even inspections in ports, unless they are informed by intelligence or tip offs are essentially passive.

And I recall a comment that was made some months ago that if you want to find a needle in a haystack, it helps to have a magnet. If you want to find a needle in a haystack, it helps to find a magnet. Using a magnet to find a needle is more active, less passive, in my opinion. And taking that analogy to the next step, if indeed we are going to be successful and if indeed we are going to be able to afford what we are doing, it seems to me that we have to be more active. We have to rely more on intelligence and law enforcement, both at home and abroad, and that we may even have to rely on active measures to draw the terrorists out, perhaps sting operations, things of that nature, where you place a piece of bait out into the domain and see who nibbles, and roll them up. Is there any value in that? Has anybody in the panel given consideration to those types of active measures?

Dr. WAGNER. I think, sir, that you are just right. The limit threat, in some sense, is highly enriched uranium that has as much shielding around it as will fit in whatever the container is that car-

ries it, whether it is a pickup truck or a cargo container. I don't think you are going to find that without active interrogation.

Now, I was talking with Ms. Rooney before the hearings began, and she tells me that the longshoremen in New York are getting comfortable with x-ray radiation and the health and safety concerns that might come along with that. I think that is a fruitful avenue to pursue and it ought to be pursued strongly.

Mr. TANNENBAUM. If it reaches the United States it is too late. If it leaves a foreign port it is too late. If it arrives at a foreign port it is too late. I think that the best thing to do is to maintain control of as much material as possible where it is right now and rather than letting it be stolen and converted into a weapon.

Mr. SIMMONS. So that would be essentially a "nail it down and keep an eye on it" strategy, which works except in the case of loss or theft.

Mr. TANNENBAUM. Yes.

Mr. SIMMONS. Another alternative, and you made a very interesting remark about whether a nuclear, a dirty bomb would be designed to destroy or designed to disrupt. I believe cesium is available in the United States in hospitals and universities and other medical facilities. So in fact, it is resident here in the United States. It could be stolen here and could be used for a dirty bomb attack on an urban area. How would we address that issue?

Mr. TANNENBAUM. Even worse than being stolen or lost is on a regular basis we have thousands of sources that are lost in this country that are utterly unaccounted for. It depends on how much money we want to spend. Do we want to put a radiation detector on the underside of every bridge in New York City? Do we want to put one on the corner of every building? I think that is the extreme you have to go to if you are absolutely sure that you want to get rid of absolutely every possible dirty bomb.

Mr. SIMMONS. Anybody else?

Mr. ALOISE. Yes. The question of dirty bomb material is a significant question, and we have reported on this in the past. DOE has developed a program to collect some of the worst types of those materials. But again, it is a matter of resources. If they had more money they could collect more. But it is an important program that they have, and one that we support.

Ms. ROONEY. Well, I can't comment on the amount of sources, you know, that are available. We are heavily focused on supply chain security and needing to know exactly what it is in a container, what is going in a container from its point of origin all the way through its final destination. And we believe that development of supply chain security standards, so that we know what is going in the container, we know the individuals that are stuffing it.

We can ensure the integrity of the container. We can have sensors in the container that will regularly scan for chemical, biological, radiological devices and send an alert if something happens all the way to the final point of delivery is what needs to be developed as yet another layer in that overall security system.

Mr. LINDER. The time of the gentleman has expired. Mr. Thompson wish to inquire?

Mr. THOMPSON. Yes, Mr. Chairman. This is a good topic. One of the questions, Ms. Rooney, that I hear quite often from the busi-

ness community is if we do the inspections, how will this impact the movement of goods? Have you all done an analysis of these technologies and whether or not they would impair the movement of goods?

Ms. ROONEY. Well, one of the reasons why it is important to get the private sector involved in the development phase, is so that we don't impact the movement of goods, we highly encourage the R&D community to get the private sector involved at the ground level. We have not done a study, per se, but I can tell you that we have not had any complaints from the likes of the trucking community or the shippers saying that their cargo has been delayed because of the radiation portal monitors. Again most of the alarms have been resolved within 10, 15 minutes and the truck is sent on its way, so it is not a tangible delay that the community is faced with right now.

Mr. THOMPSON. Thank you. Dr. Wagner, in your view, has the deployment of the portal monitors, resulted in improved coordination between agencies, such as DHS or DOE? Is there enough communication for us not to be repetitious, for us to make sure that there is a standard that is employed across the board so that we deploy the best possible technology?

Dr. WAGNER. Mr. Thompson, I have not watched that particular program closely enough to know whether the agencies are coordinating well enough or not. My guess is probably not because that is often the case. I am more concerned about close coordination between Ms. Rooney's people and the scientists and engineers in the private sector and at the laboratories than I am about coordination between the government agencies. That is the short circuit that I want to build in, between the people really doing the work in the field to develop better technologies and her people who are using the current ones so that we can learn and they can learn.

Mr. THOMPSON. Mr. Aloise, do you want to address that?

Mr. ALOISE. Yes. Coordination was a problem in the beginning. It got better, but it is still of concern. And it is not just coordination for coordination's sake. As we reported and it is in my statement, one agency, State Department was deploying equipment that wasn't as good as other agencies were deploying, so the countries that the State Department were in deploying, their borders were more vulnerable because the equipment they were deploying was not as good.

So, you know, coordination was a problem. It got better but it is still a concern. We are still concerned that labs are not talking to each other as they should. The agencies are not talking to each other as they should. And we are looking at that problem again right now.

Mr. THOMPSON. The other question I have speaks to whether or not the communication between government and the private sector is sufficient enough that we can get the latest technology into the ports within a reasonable period of time, or do you feel that DHS, for instance, does not move fast enough in its implementation of this new technology? Have you had an opportunity to look at any of that?

Mr. ALOISE. Yes, we looked at deployment and it was slow in the beginning. It is better now. The question is, a question everyone

faces, I guess at this point, do you wait until the better technology comes along or do you deploy what you have now? Originally this program was thought of as just another tool for the Customs agent or border inspector. It wasn't an end all or be all. So what we are facing now, what is the incremental value we are going to get from this new technology against what we have now, because the question is whether you wait or not to deploy more equipment is a vital one.

Mr. THOMPSON. I guess the other issue is, protected regardless of the technology, is there a uniform standard so that we are not vulnerable at one point of entry, and not vulnerable at another? Or is it that the technology is such a state that it would render us more vulnerable? I guess that is my point.

Mr. ALOISE. The present set of equipment has limitations. But the bottom line is that with the equipment you have some chance of catching this material. Without it you probably have very little chance of catching it.

Mr. THOMPSON. Thank you.

Mr. LINDER. Thank you, Mr. Thompson. Mr. Pearce, do you seek to be recognized?

Mr. PEARCE. Thank you Mr. Chairman. Mr. Tannenbaum the portal that you mentioned, is that the DTRA attempt to put monitors in all of the Soviet Union sites?

Mr. TANNENBAUM. That is part of it, yes.

Mr. PEARCE. Are you familiar with the requirement to have that completely done by 2007? In other words we have had about 15 years and it was supposed to be 100 percent finished by 2007.

Mr. TANNENBAUM. That is correct.

Mr. PEARCE. The reports I have are that it is about 30 percent done.

Mr. TANNENBAUM. Again, correct.

Mr. PEARCE. And the reports that I have is the 30 percent that is done is very poorly done. In your report you are pretty, you have—you have been very supportive of the portals, and yet it sounds like the program is not functioning so well.

Mr. TANNENBAUM. It has been, shall we say, a bad few years for the installation of portal monitors where a lot of negotiations on liability have been happening. And I am hopeful that we will see things change now.

Mr. PEARCE. Mr. Wagner, you indicate that we need not be too concerned about waste. Does this waste that we see here rise to the level that you get concerned, or is it part of what you said, we just need to, if we try to eliminate all the mistakes, we are not going end up with any progress. Are we rising to the level where you are concerned?

Dr. WAGNER. If you are asking, sir, about the DTRA CTR program—

Mr. PEARCE. Yes, that is what I am asking about.

Dr. WAGNER. I think that no, sir, that particular one, I don't think waste is the right way to characterize it. I agree that the deployments have not been as effective. But I think that the difficulties in doing contract work in Russia and those places are so great that—

Mr. PEARCE. Well, I mean we have spent the money.

Dr. WAGNER. I am pleased that we have made the progress we have. But I think it ought—I mean, I wish it were a lot faster and a lot more—

Mr. PEARCE. I understand. But if we have spent the money and we didn't get—I just can't envision that it would be as expensive to do that here as it is there. And if there are problems getting it in, I can understand. But if we go ahead and spend the money and we don't succeed, I don't understand that.

Recently the vice president of Los Alamos labs was quoted as saying that the future of Los Alamos labs is not nuclear detection and security, but instead nanotechnology. Do you agree or disagree with his statements?

Dr. WAGNER. I am not sure I know—I wasn't aware of that statement. But I would disagree. I think it is both radiation detection, nanotechnology and a lot of other technologies that are important for national security.

Mr. PEARCE. Why do you think that he made those comments? It makes it very difficult for us to—

Dr. WAGNER. I know it does. The national labs, if I may volunteer, the national labs, which are of crucial, although not—they are not sufficient, but are a crucial part of working this problem, have institutional issues that they need to deal with. And what I mean by that is the following: That the labs for decades have provided technology for problems like this one, coming out of the technology base, the science understanding that came with the nuclear weapons program, since the Manhattan Project. The labs are concerned that programs like the radiation detector program, will suck effort out, but not renew that technology base. And I think that is an important question for the labs.

Mr. PEARCE. Okay. I have got one more question. Mr. Aloise, also we have reports that the Department of Commerce is permitting technology to be shipped out to accomplish these oversight capabilities. But DOE is requiring certain permits and slowing the process down by 6 months. Are you familiar with that?

Mr. ALOISE. I am not familiar with that, no, sir.

Mr. PEARCE. Thank you, Mr. Chairman. That is my last question.

Mr. LINDER. Thank you. Mr. Etheridge, do you wish to inquire?

Mr. ETHERIDGE. Thank you, Mr. Chairman. I do. Mr. Simmons touched on the issue a while ago and several others have. I tend to agree that if we could get our hands on this stuff, especially through the Nunn-Lugar, we would be a lot better off, and the dollars we spend there probably are the best dollars we can spend.

But Mr. Aloise, let me ask you a question, if I may, sir. Several have raised the issue of movement of goods, the commerce that is so critical. People obviously want to get the stuff here and we want to ship it out. And one of the issues that has popped its head up as we move stuff in and out is this whole issue of a false positive pops up with some of the technology as important as technology is. As an example, if it pops up in a port, you may just stop one truck. But it happened to be at an airport, you know, you have got a much bigger problem. Has the GAO done any kind of cost-benefit analysis on these issues as the result of an unknown or even if it were an unknown issue, or a medical piece, the cost of such issue?

Mr. ALOISE. We have not done a cost benefit analysis, but in our work every place we have gone we have asked that question and we have observed operations overseas. The nuisance alarms are a problem. And we have been at border sites at Russia and around the world watching trucks pulled over and gone through secondary inspections. No one has really told us that it has impeded commerce to the point that they thought it might at this point, even with the nuisance alarms they are getting.

Mr. ETHERIDGE. All right. Let me follow that up. Have you done any examination of the cost-benefit or some of the higher performing radiation technologies that may be out, or do you do that?

Mr. ALOISE. We have not.

Mr. ETHERIDGE. Who does?

Mr. ALOISE. We have not done that. And I am not aware of any studies we have had along those lines. However, a lot of the newer technologies are not to the point yet where, you know, we would have even been there to do that yet. That is what some of these new test beds that are developed around the country are designed to do in Nevada starting in August.

Mr. ETHERIDGE. Okay. Thank you. Ms. Rooney, let me ask you a question along the same lines, if I may, because as someone said, you are right where the rubber meets the road, where the containers come in and out. As it relates to the containers coming in, you mentioned earlier that you have had some, but it was a matter of minutes, or certainly less than an hour they would move. Do you consider such indirect cost when acquiring the detection equipment that you buy?

You did allude to the fact that some of this was really not designed for the heavy impacting it will take when you unload containers, et cetera.

Ms. ROONEY. We are not the purchaser or the users of technology. It is the—

Mr. LINDER. Is your mike on?

Mr. ETHERIDGE. Turn your mike on, please.

Ms. ROONEY. The Port Authority is not either the procurer or the user of the technology. It is procured by CBP and it is operated by CBP. So we have not done any cost-benefit analysis as well. And as I mentioned before, we have had no complaints of commerce being impeded as a result of these technologies. There was grave concern when the program was first announced that commerce would be impeded and would be slowed down, but that has not come to be.

Mr. ETHERIDGE. Let me just read a piece. A recent New York Times article reported that at the port of Newark, the ports follow system for radiation alarms are handling devices that are supported to or supposed to determine what sets off an alarm as a flawed device. The weakness of the devices were apparent in Newark. One recent morning a truck whose records indicated it was carrying brakes from Germany triggered the portal alarm, but the back-up device could not identify the radiation source. Without being inspected, the truck went on its way to Ohio.

Ms. ROONEY. I can't speak to the details of that particular incident because I am not familiar with it. My understanding of the way that CBP operates the program is if an alarm goes off through

the portal monitor, it then goes to a second inspection where a handheld isotope identifier is used in order to identify the actual isotope. That is then compared to the manifest and a determination is made whether or not it could go on. I would find it hard to believe that until the source was identified and satisfactorily identified that that truck would have been allowed to go on.

Mr. ETHERIDGE. Mr. Chairman, I only read what I read in the paper and I assume that is, but I—I know my time is expired. Is there a record kept of those kind of things, someone keeping the documented records, because I think that is important?

Ms. ROONEY. CBP does keep the documented records of all of the radiation alarms and their resolution.

Mr. ETHERIDGE. And their disposition?

Ms. ROONEY. Yes, sir.

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

Mr. LINDER. Mr. Gibbons.

Mr. GIBBONS. Thank you very much, Mr. Chairman. To our witnesses, thank you today for being here and helping us understand this issue greatly. I have just one question because throughout the period of the Cold War, we have spent so much time developing a strategy that was based on assured mass destruction as a deterrent. What kind of deterrence do you envision to be able to enact that would threaten somehow those that are willing to perpetrate a disastrous event with one of these radiological or nuclear devices in our community? How do you create a deterrence image with—how would you do such a thing? Dr. Wagner.

Dr. WAGNER. Having lived through that Cold War, the deterrence developed into almost a theology, as you know. Deterrence meant in that context, deterrence by fear of punishment. I don't think that is going to work very well against these enemies. But there is another meaning, which is deterrence by fear of failure.

Chairman Linder, I believe it was in his comment, said that the terrorist would go to great lengths to be sure that he can penetrate the defense. Deterrence by making him unsure that can he penetrate the defense is the kind of deterrence that I think is available and crucial for this job.

Mr. GIBBONS. It seems a bit uncertain to me that those people who are so committed to this type of a heinous act, who have gone to such great lengths, would be so vulnerable or so casual as to not select an avenue or a route that would allow them to achieve their goal. They are not stupid people. They are not people that would not, or would just take a rather casual approach to this whole thing, but one which I believe are very well studied. So I am not sure that that is any kind of a deterrence at all.

Dr. WAGNER. May I respond sir?

Dr. GIBBONS. Yes, sir.

Dr. WAGNER. I am not sure either. But no defense is going to be absolutely sure. Do I think it is worth the money? If the stakes weren't so high I would say it is not worth the money to try. But the stakes are incredibly high, and so I think it is worth the money.

Mr. GIBBONS. One other issue that came to mind was the issue about reporting for health issues. In other words, whenever there is some kind of a radiation disease that is noticed or recognized by

a hospital or health care facility in an individual, is there a mandatory report that has to be filed with that so that we know somebody has been exposed? When you are dealing with this type of material, it is a very expensive process to avoid being exposed to this type of thing. I would think that one of our first signs of intelligence would be some type of a health report on somebody who is exposed, received care for some type of radiation treatment. Is there a mandatory report at all in any of the areas that you know about?

Dr. WAGNER. I don't know whether there is or not sir, and others may want to comment. But some of the, what are called innocent alarms in portal monitors and other kind of radiation monitors come from, you are quite right, people who have received radiation treatment. It is possible to develop, in fact, one can buy them today, isotope identification systems that can distinguish the signature of that kind of radiation from the signature of a bomb.

Mr. GIBBONS. Well, that would be something like a nanolever, wouldn't it, where it is coded to receive a certain molecular or isotope?

Dr. WAGNER. Some of the biological warfare programs are intending to be molecular identifiers. In the case of radiological treatment, health treatments, it is more detecting the gamma rays, which is what we have been talking about here this morning.

Mr. GIBBONS. Thank you, Mr. Chairman.

Mr. LINDER. Gentleman from Massachusetts, Mr. Markey.

Mr. MARKEY. Thank you, Mr. Chairman. Dr. Tannenbaum, first of all, excellent study by you and Dr. Neureiter and Dr. Fetter and Dr. Von Hippel. As you know, we sent our request to you because there was a discrepancy between the views of many experts who determined that the radiation portal monitors deployed by the Department of Homeland Security were unable to detect highly enriched uranium and assertions by Department officials who repeatedly claimed that the portal monitor is capable of detecting HEU. You, like so many others, came to the conclusion that the laws of physics simply do not lend themselves to detecting the very material that represents the easiest pathway for a terrorist to build and detonate a homemade nuclear weapon capable of killing tens of thousands Americans.

Your analysis also discusses some cost effective engineering fixes the Department could utilize in the short term to approve the sensitivity of its equipment. Could you please elaborate.

Mr. TANNENBAUM. Certainly. We described several ways that you could physically modify the terminals, the portal scanners. I have since spoken with the current deployment of those monitors and they question whether or not our recommendations make sense. But we suggested that you decrease the distance between the actual detector and the sample. That increases the likelihood of measuring it. We suggest that you increase the sampling time, meaning, you drive the truck through the portal slower. This gives you more data to work with.

We suggest that you increase the amount of shielding around the detector to decrease the amount of background so you can find a real signal and get rid of all the background noise. And finally, the algorithms that are being used right now are sort of second genera-

tion algorithms, and I believe that there are many ways that those can be improved.

Mr. MARKEY. How long do you think it would take for these short-term fixes to be completed before entirely new detection technology is ready?

Mr. TANNENBAUM. I can't answer that question.

Mr. MARKEY. Let me ask this. ABC News smuggled kilogram quantities of depleted uranium, not once but twice into the United States. The Department of Homeland Security says the detection problem is fixed. Do you agree with that?

Mr. TANNENBAUM. I am not convinced that it is, no.

Mr. MARKEY. No. Dr. Wagner, you, like so many others, came to the conclusion that detection of devices containing highly enriched uranium is very difficult and varies widely and is limited today to short range. Dr. Tannenbaum has said that taking some simple short-term engineering measures such as shielding the detector or decreasing the distance between the container and the detector would help. Do you think the Department of Homeland Security should take some of these or all of these measures in the short-term while recognizing that continued R&D might result in even better solutions long term?

Dr. WAGNER. Yes, I do.

Mr. MARKEY. Could you elaborate.

Dr. WAGNER. There is a continuum and the process is to close off a larger and larger fraction of that continuum in the threat space. My own view is that some of these near-term measures of the sort that Dr. Tannenbaum mentioned ought to be deployed, but in a relatively limited way at the highest priority locations. And in parallel with that, R&D for even better capability, ought to be done and deployed more widely later.

Mr. MARKEY. All right. So let us just take that and parse it a little bit. Where would those high—where would you deploy these short-term fixes waiting for a longer term solution?

Dr. WAGNER. The DOE has an analysis model that prioritizes the risks at various locations. To first order, I think I would follow the recommendations of that model. It is not a perfect model. It will miss some things.

Mr. MARKEY. Okay. For the committees purposes could you elaborate on where the specifics of those locations are.

Dr. WAGNER. I don't know where those locations are. I like New York City.

Mr. MARKEY. New York City would be on the list to have a short-term solution.

Dr. WAGNER. If I were calling the shots, yes.

Mr. MARKEY. Anything else that you would, off the top of your head, put on that list?

Dr. WAGNER. I would rather not give you specifics because I haven't thought through those specifics.

Mr. MARKEY. Okay. Well, I thank both of you. It is very helpful. And I think we do Mr. Chairman have to look from some short-term solution especially for high priority targets, I think.

Mr. LINDER. I thank the gentleman. Does Mr. Lungren seek to inquire?

Mr. LUNGREN. Thank you very much Mr. Chairman. Mr. Tannenbaum you mentioned in your testimony about an Ohio-based company that has proposed inexpensive detectors that would be placed in cargo containers during transoceanic shipment. Obviously, detectors would take advantage of the 10-day or longer time to locate it. Can you tell us any more about that?

Mr. TANNENBAUM. Certainly. The notion is that you have a set of detectors that are placed in each container right before it is shipped off across the ocean. They measure radiation. They communicate with each other and before the ship arrives in the port of the United States it communicates its data back to some central location where it is interpreted and decided is this a ship we need to intercept or is it one that can go ahead and dock.

Mr. LUNGREN. Do you have any idea how far along this is in terms of development?

Mr. TANNENBAUM. This particular company claims to have a prototype that is working and is ready to start doing some serious scale testing.

Mr. LUNGREN. Thank you. Mr. Aloise, your earlier work—

Mr. LINDER. Will the gentleman yield for 1 minute?

Mr. LUNGREN. Yes.

Mr. LINDER. I would just like to ask, do you have any estimate on cost on that?

Mr. TANNENBAUM. No, I don't, sir.

Mr. LINDER. Thank you. Thank the gentleman.

Mr. LUNGREN. Anybody else on the panel aware of that? Okay. Mr. Aloise your earlier work has identified certain weaknesses in the effectiveness of the personal radiation detectors called pagers.

Mr. ALOISE. Right.

Mr. LUNGREN. It is my understanding, are Customs agents still using these pagers in an attempt to search containers for radiologic materials? Is this an effective use of these pagers?

Mr. ALOISE. As search instruments, no. As we understand it the Customs inspectors wear them on their belts as safety devices. It is best used in a combination suite of equipment, with the portals, with the grids, the isotope identifiers and the pager. Used by itself it has limited effectiveness.

Mr. LUNGREN. Is it being used in concert with these others?

Mr. ALOISE. Yes, as far as we know it is. But in some cases we have seen them misused.

Mr. LUNGREN. What do you mean?

Mr. ALOISE. Well, they were used as search instruments. Instead of searching a truck with isotope identifier, we have seen them search the truck with the pager, and it just does not have the same effectiveness and is not designed to do that.

Mr. LUNGREN. So you are not suggesting that it is a strategy that is proved by the Department, are you? You are suggesting it may just be a lapse in good work product by the people using them?

Mr. ALOISE. It is a need for better training of the equipment.

Mr. LUNGREN. Okay. The Department of Energy has the Megaports Program. DHS has the Container Security Initiative. Both place radiation monitors at foreign seaports. What is the difference between these programs and why do we need both?

Mr. ALOISE. Well, the Megaports Program is placing the radiation detection equipment at the seaports and they have done two so far. They have got five more underway. The CSI program, which I am less familiar with, has got agreements with many more ports and does a number of other things to target containers for review.

Mr. LUNGREN. Dr. Wagner, you have been involved in detection for many, many years. We have a limited budget. We have admittedly incomplete technology right now. We have to make some decisions. Where would you put the emphasis right now?

Dr. WAGNER. I would put it on developing detectors that can both increase the sensitivity to the wanted—the signal radiation from the weapon if it is there, by being larger so that more radiation can intercept it, but can also sort out the signal from the noise by doing very highly resolved identification of the energies of the gamma rays. That is—there are many, many instantiations of that general idea, and exactly which one of those instantiations I would choose, I can't say.

Mr. LUNGREN. Ms. Rooney, if you had one thing that you needed from us, what would it be?

Ms. ROONEY. Well, that is a loaded question. We do, as I mentioned before, need to move to supply chain security standards. And as an overall approach to cargo security, the radiation portal monitors and the isotope identifiers and Megaports and CSI are all parts of that.

Mr. LUNGREN. Well, let me ask you a question on that. And that is with all due respect, you speak as if that is something that can be done. Are you telling me we lose no containers at sea, we don't lose track of them, that they are totally secure once they are on an ocean-going vessel?

Ms. ROONEY. We need to have greater assurances that we know what is going into the container, that the container's integrity is maintained, that we have indication of its location of the radiation signal that is being emitted from the container, all the way along in the supply chain, yes.

Mr. LUNGREN. Thank you, Mr. Chairman.

Mr. LINDER. Mr. Reichert.

Mr. REICHERT. Thank you, Mr. Chairman. Ms. Rooney, you spoke of high level of false alarms, and if there is a hit, the container is then scanned again and has a second inspection. And I am just wondering if you are able to attach a cost for that second inspection and who bears that cost?

Ms. ROONEY. The entire program is funded and operated and maintained by Customs and Border Protection. There is no cost of the radiation inspection to the cargo owner or to the trucking company, so we don't have any quantifiable numbers on that.

Mr. REICHERT. Additional personnel?

Ms. ROONEY. It is all borne by Customs. We don't have any visibility into that cost.

Mr. REICHERT. So the cost is borne by Customs?

Ms. ROONEY. Yes, sir.

Mr. REICHERT. Can you describe to me what port security looked like before September 11 in your world then?

Ms. ROONEY. Port security prior to 9/11 was predominantly based on theft and pilferage as opposed to national security. We were

more concerned about keeping cargo in a container and on a facility until it was legally picked up than we were about keeping bad stuff out of a container. So there has been a complete change in our focus of container security.

Mr. REICHERT. What kind of tools did you use then?

Ms. ROONEY. There were little tools in terms of cargo security or facility security. I mean, all of the port facilities were secured. They had a perimeter fence. But the threat was different. The threat profile, again, was completely different pre-9/11 than it is today.

Mr. REICHERT. Had you ever heard of RPMs?

Ms. ROONEY. I personally had not, no.

Mr. REICHERT. Before September 11?

Ms. ROONEY. No, sir.

Mr. REICHERT. I am just asking this question. The point is that I am new to Congress and I am sitting in this hearing and I am listening to this discussion and I think we would be remiss to point out that this world has really changed. Your world has really changed, and I appreciate the work that each and every one of you are doing. We are in a transition period. And I do agree with Dr. Wagner that there will be mistakes made and we will spend some money that we wish we didn't have to spend, but I think we are going to be in that process for a while.

And with research and development that you have spoken about, I now just want to ask this one last question, if you can describe for me what port security will look like in 5 years or 10 years. Do you have a vision of what port security might look like? We know where we came from and we know where we are right now. We are trying to figure this out and here we are talking about the things that we need to do. We might have to place these monitors on corners of buildings as the doctor had indicated earlier, if we really carried this thing out further and further and further. What will port security look like in this 5 to 10 years from now?

Ms. ROONEY. Port security, from my perspective, has two components, the physical security of the facility and the vessels, and then the security of the cargo. The physical security of the facilities and the vessel has been well addressed by the Maritime Transportation Security Act. I believe that there are more things that we can do in terms of other threats, such as a small boat attack on a vessel, you know, a USS Cole-type event. The Coast Guard has the—the Coast Guard is trying to address that threat, but it is something that is very difficult to get anyone's arms around, you know, those types of threats.

In terms of cargo security, again, we talk about supply chain security from origin to destination that we know a lot more about the cargo. We don't know a lot more about the people that are doing it. There is tremendous value in things like the monitors and C–TPAT where there is voluntary compliance to new standards. We believe that a container will have a lot more security devices on board on the container, that it will have electronic seals, that it will have tracking and trace devices, that it will have sensors inside the container that will be able to tell us whether there is a chemical, biological radiological device, or whether or not a hole has been cut inside the container.

We are fairly far along through a program, Operation Safe Commerce, which is federally funded in developing those technologies and coming up with the cost-benefit of those, with the ultimate goal of not impacting the flow of commerce and providing a cost-benefit to the shipper that there is encouragement for the shipper to purchase this technology or apply this technology on to their container, because there will be some business benefit for doing that.

Mr. REICHERT. Thank you very much. We now know you know where you are going and we just have to figure out a way to help you. And if anyone else has a comment, that would be appreciated.

Dr. WAGNER. I just want to comment. I think that was an absolutely wonderful vision. I think radiation detection technology can complement that vision, but it is only a complementing function. All those things you mentioned are really important to do. I see the radiation detection technology part of this as doing triage while the container is coming to the port, so that at the port the authorities at the port can be fairly sure that certain ships and certain segments on the ships don't have weapons. The radiation detection at the port can then focus on those areas where there might still be a problem, where identification, not just sensing, not just getting a hit, as you say, but identifying what the hit is, is highly sure and can be done very, very quickly. And I think the radiation detection technology can be made available with R&D to complement that vision.

Mr. LINDER. The time of the gentleman has expired. Mr. McCaul.

Mr. MCCAUL. Thank you, Mr. Chairman. A bit of a follow-up on the technology. I am interested in the technology of today and what we are capable of doing. And I see we have votes coming up right now. Timing is everything in this game. But I have one of the largest ports in the Nation in my district, in Houston. Representative King led a delegation to the New York Port Authority, you may recall that, very insightful. What I have been told is that in 6 months, we will have radiological sensors in place at the ports. Is that still an accurate estimate of time? And this is probably to you, Ms. Rooney.

Ms. ROONEY. My understanding in talking to my colleagues in the port of Houston is that that is the current schedule yes, but I am only getting that from my colleagues.

Mr. MCCAUL. Okay. How accurate is the technology of today in detecting, and obviously we can't go through every cargo container, which seems to me to be a very pragmatic way of screening cargo. How effective is it in screening the containers coming through?

Ms. ROONEY. It does have the capability of screening 100 percent of the cargo when fully deployed. The capabilities of the detection technology is something, you know, that Dr. Tannenbaum and Dr. Wagner can speak of much better than I can.

Mr. MCCAUL. Do you care to comment, Dr. Wagner?

Dr. WAGNER. I think the near-term technologies are going to be pretty limited. But they are worth deploying for two reasons. One is to give an attacker something more to worry about and be some protection, but also to get experience with actual use of even the limited technologies and actual operations, which is really impor-

tant for guiding the R&D that will give you the better things later on.

Mr. MCCAUL. There is a concept, talking about R&D and the energy windowing process. Are you familiar with that? Will that enhance our ability to detect radiation?

Dr. WAGNER. It won't help too much with the actual detection of radiation, but it will help to you say, help a lot with saying what is the radiation from. Is it a threat object, an innocent alarm or natural background? That is really the key to doing this.

Mr. MCCAUL. The University of Texas is in my district as well. They are teaming with Lockheed Martin to bid on the Los Alamos research project. What is your assessment in terms of the sharing between the research laboratories out there and the United States on this very issue? Is it working?

Dr. WAGNER. I think sharing among the labs is not perfect, but it is working pretty well. The government can help to enhance the sharing by creating larger programs where the labs aren't, in a sense, acting as contractors seeking small contracts but are challenged with large problems. When they are challenged with large problems they can work together.

Mr. MCCAUL. My final question, because I know we have to go vote, and that is, I have the Mexican border in my home state. What I have found in my experience at Justice was that you have the major ports and we seem to be protecting those pretty well. But the cartels can move contraband. They don't typically move it through the ports. They move between the ports. And this is really no exception. The movement of a nuclear device the size of, say, a bale of marijuana, could be easily transported across the border. And I know we can't be 100 percent safe in everything. Where are we with the technology with these sensors to detect between the ports of entry where we are most vulnerable to a terrorist threat? Where is the technology today with that?

Dr. WAGNER. I think that within 5 or 6 years it might be possible to build a sensor that could be put into a rather large helicopter, like a Chinook, which I once flew around in with radiation detectors in northern Canada trying to find pieces of Cosmos 954, but much, much better, so that grid patterns could be flown over low air grade at low altitude. But certainly man-portable devices that would have to be made of plutonium which would be light enough to smuggle in easily in that way.

Mr. MCCAUL. We are moving towards that?

Dr. WAGNER. Not as fast as we should.

Mr. MCCAUL. I thank you for your time here today. Thank you, Mr. Chairman.

Mr. LINDER. I want to thank the panel. Your testimony has not only been interesting, but it has been helpful. We appreciate it. You are excused. Thank you very much.

We have a 15-minute vote and four 5-minute votes. We will ask the next panel to join us at about 4:45. Thank you all.

[Recess.]

Mr. LINDER. We will reconvene this hearing. If you could keep your statements to 5 minutes, thank you for being here.

Mr. LINDER. Mr. Oxford, Acting Director, Domestic Nuclear Detection Office, Department of Homeland Security.

STATEMENT OF VAYL OXFORD

Mr. OXFORD. Good afternoon, Chairman Linder, Chairman King and ranking members and members of the subcommittees. Thank you for the opportunity to come before you today to show the progress we have made in developing and deploying new technology to protect the Nation from a terrorist nuclear or radiological threat.

Today I will discuss several topics related to the use of technology in the detection of nuclear and radiological materials that could be used in a terrorist attack. Specifically, I will discuss the Department's formation of the Domestic Nuclear Detection Office, or DNDO, as you have heard referred to it previously, and its near-term nuclear detection, development and deployment strategy, as well as some of the current DHS deployments. I will also address the various detection technologies that we are currently developing and the technology development and deployment model that we hope to use in the future.

Before describing the Department's efforts, I would first like to point out that protecting the United States from nuclear threats is a job that extends beyond DHS. I would like to thank my partners who are here today from the Department of Defense and the Department of Energy for their contributions in developing and deploying technologies to protect the Nation.

First, let me address the creation of DNDO. Combating the threat of catastrophic destruction and loss of life posed by terrorists possessing and using nuclear or radiological weapons is one of the most critical priorities of the Nation. In order to integrate the Department's efforts against this threat under a singular direction, as well as to coordinate these efforts with the partners with me today and others across the government, the President established the DNDO.

This new office is chartered with developing a global nuclear detection architecture and strategy and acquiring and supporting the deployment of the domestic detection system to detect or report attempts to import or transport a nuclear device or fissile or radiological material intended for illicit use.

Let me say a few words about the detection deployment strategy that we have in mind. No single detection layer can prevent a terrorist from importing nuclear or radiological material with intent to harm the Nation. Therefore, partnering with other government agencies and the private sector, we must create coordinated, robust layers of defense.

While technology is a critical tool to combat nuclear terrorism, we recognize that this threat is not one that can effectively be done by technology alone. Accordingly, while the DNDO is allocating considerable funding to research, development and acquisition, we are also dedicating resources to the people and infrastructure required to develop a fully integrated operating environment.

We will ultimately have the ability to fuse detection data and intelligence assessments in a near real-time environment to maintain an overall system and situational awareness. This integrated approach to detection and information analysis will ultimately provide substantial improvement in alarm resolution, threat assess-

ments, data trend analysis, and, most importantly, overall probability of mission success.

Regarding current DHS deployments, even as we develop next-generation technologies, we are in the process of deploying several commercially available technologies to the field. For example, U.S. Customs and Border Protection has made rapid progress with the radiation portal monitoring program, which deploys commercially available radiation detectors to the Nation's official ports-of-entry. The Coast-Guard also has begun deployments of personal radiation detectors and more advanced handheld detectors for use in detection and characterization of radiological materials.

Technology itself is being pursued in several venues. Recent reports have been published in the media questioning the overall capability of currently deployed detection equipment. Contrary to public perception that, that detection equipment is not sensitive enough, the actual primary limitation of today's systems is one of discrimination and shielding. Specifically, today's equipment lacks a refined capability to rapidly determine the type of radioactive material it detects. Operationally, this leads to higher nuisance alarm rates, or those alarms that must be resolved by further inspection. Because false alarm rates are a direct function of probability of detection, the operators must make operationally driven decisions when deploying and operating currently available systems.

To overcome these limitations, we are investing substantial resources in the Advanced Spectroscopic Portal program that is focused on developing detectors that will be able to discriminate between naturally occurring radioactive materials and threat materials. This level of discrimination will allow systems to operate at a substantially lower detection threshold, while simultaneously offsetting the subsequent operational constraints associated with the current systems.

However, passive detection systems are ultimately limited by physical properties of the radiation they are designed to detect, specifically with regard to range of detection. The problem is confounded by the sufficient amounts of high-density shielding materials, such as lead or steel, that can act as effective measures to prevent the emissions of detectable amounts of radiation.

Radiography systems can, however, overcome this limitation by providing images of the contents of the container to identify areas of high density that are potentially indicative of shielding materials. An integrated passive detection and radiography system would, then, be capable of detecting either the unshielded materials that are emitting radiation, or detecting the materials that are used to shield the material itself.

Active interrogation systems can further alleviate detection limitations by probing or interrogating containers to induce additional measurable detection signatures. A number of methods are currently under investigation and are currently in a prototype development and demonstration phase, including systems which "interrogate" containers with either neutron or gamma rays.

Let me talk next about the RDT&E process and model that we hope to use. I would like to discuss a little bit more in that context

the ASP Program, the Advanced Spectroscopic Portal program, that I mentioned previously.

The model that DNDO will use was, first of all, initiated based on an operational requirement from Customs for a more capable portable monitoring system to be deployed at the borders. There are currently 10 R&D efforts under way that will culminate late this summer with a high-fidelity test and evaluation campaign to take place at our new Radiological and Nuclear Countermeasures Test and Evaluation Complex at the Nevada Test Site where each of these developed systems will be fully evaluated against one another as well as against currently deployed systems. Based on the results of these tests, a limited number of vendors will be selected to begin initial low-rate production of detection systems to be deployed at the border. Meanwhile, operational testing of these systems will begin taking place at the Countermeasures Test Bed in New York and New Jersey.

This comprehensive technology development program will guarantee that capable radiological portal monitors, with known performance characteristics, are being deployed to implement the baseline domestic detection architecture. The bottom line is, only after extensive testing is complete and performance is characterized will acquisition and deployment decisions be made.

In conclusion, the DNDO has taken a comprehensive approach to addressing the threats posed by a nuclear attack. This approach, which begins with focused research and development and culminates in high-fidelity test and evaluation campaigns, provides the basis for the Department to make informed, justifiable acquisition decisions. Equally important, the DNDO recognizes that the deployment of these technologies must be done as part of an overall larger strategy, one that extends to overseas deployments executed by the other agencies. Ultimately, all of these systems must be connected and work within an environment that is responsive to information gained from the intelligence, counterterrorism and law enforcement communities.

Mr. Chairman, this concludes my statement. I will be glad to answer any further questions.

Mr. LINDER. Thank you, Mr. Oxford.

[The statement of Mr. Oxford follows:]

PREPARED OPENING STATEMENT OF VAYL OXFORD

Introduction

Good afternoon, Chairmen Linder and King, Ranking Members Langevin and Pascrell, and distinguished members of the subcommittees. I thank you for the opportunity to come before you today to share the progress we have made in developing and deploying new technology to protect the Nation from a terrorist nuclear or radiological attack.

My name is Vayl Oxford. I am the Acting Director of the Department of Homeland Security's newly created Domestic Nuclear Detection Office (DNDO). Additionally, I am currently serving as the Acting Director of the Homeland Security Advanced Research Projects Agency within the DHS Science and Technology Directorate. Prior to this, I have also held positions at the National Security Council and with the DoD's Defense Threat Reduction Agency.

Today, I will discuss several topics related to the use of technology in the detection of nuclear and radiological materials that could be used in a terrorist attack. Specifically, I will discuss the Department's formation of the DNDO and its nuclear detection deployment strategy, as well as current DHS deployments. I will also address the various detection technologies that we are currently working to develop

and deploy and the program model that we are following, using the Advanced Spectroscopic Portal monitor program as an example.

Before describing the Department's efforts, I would first like to point out that protecting the United States from nuclear threats is a job that extends beyond the work of DHS, and I would like to thank my partners who are here today from the Departments of Defense and Energy for the contributions that their organizations are also making to develop and deploy technologies to protect the Nation.

Creating the DNDO

Combating the threat of catastrophic destruction and loss of life posed by terrorists possessing nuclear or radiological weapons is one of the most critical priorities of DHS. In order to integrate the Department's efforts against this threat under a singular direction, as well as coordinate these efforts with the partners with me here today and others across the government, Secretary Chertoff provided notification to the Committee on April 13 of this year, of his intent to establish the DNDO.

On April 15, 2005, the President signed a joint presidential directive establishing the office, NSPD–43/HSPD–14, "Domestic Nuclear Detection". This new office is chartered with developing a global nuclear detection architecture and acquiring and supporting a deployment of the domestic detection system to detect and report attempts to import or transport a nuclear device or fissile or radiological material intended for illicit use.

DNDO Detection Deployment Strategy

No single detection layer alone can prevent a terrorist from importing nuclear or radiological material with the intent to harm the Nation. Therefore, partnering with other government agencies and the private sector, we must create a well coordinated, robust layered defense with built-in redundancies.

While technology is a critical tool to combat terrorism, we recognize that this threat is not one that can be effectively overcome by technology alone. That is why we must work hand-in-hand with well trained Federal, State, Tribal, and local law enforcement agencies, as well as the larger intelligence and counterterrorism communities. Accordingly, while the DNDO is allocating considerable funding to technology research, development, and acquisition, we are also dedicating significant resources to the people and infrastructure required to develop a fully integrated operating environment. We will ultimately have the ability to fuse detection data and intelligence assessments in a near real-time environment to maintain an overall system and situational awareness. While this plan will require the DNDO to interact closely with the Intelligence Community as a developer of intelligence requirements and consumer of intelligence products, the DNDO will not act as an intelligence collection agency. This integrated approach to detection and information analysis will ultimately provide substantial improvement in alarm resolution, threat assessments, data trend analysis, and, most importantly, overall probability of mission success.

Current DHS Deployments

As next-generation technologies are being developed, the Department is already in the process of deploying several commercially available technologies to the field For example, U.S. Customs and Border Protection has made rapid progress with their Radiation Portal Monitor Program, which deploys commercially-available radiation detectors to the Nation's official Ports-of-Entry (POE). CBP has already deployed detectors to international mail facilities and major POEs along the Northern Border. Additionally, CBP officers are equipped with personal radiation detectors, pager-like devices that indicate the presence of radioactive materials. The U.S. Coast Guard has also begun deployments of these same personal radiation detectors and more-advanced handheld detectors for use in the detection and characterization of radiological materials.

Technical Approaches to Detecting Nuclear Materials

Recent reports have been published in the media questioning the overall capability of currently deployed detection equipment. Contrary to public perception that detection equipment is not sensitive enough, the actual primary limitation of today's systems is one of discrimination. Specifically, today's equipment lacks a refined capability to rapidly determine the type of radioactive materials it detects. Operationally, this leads to higher "nuisance alarm" rates—the number of alarms that must be resolved by further inspection. Because false alarm rates are a direct function of the probability of detection, the operators are being forced to make operationally-driven decisions when deploying and operating the currently available technologies.

To overcome these limitations, the DNDO is currently investing substantial resources to the Advanced Spectroscopic Portal (ASP) program, which is focused on developing detectors which will be able to discriminate between naturally occurring

radioactive materials and true threat materials. So, rather than alarming when any radiation is detected, whether it is emitting from granite tiles or a nuclear weapon, these new systems will be able to determine, "yes, there is radiation present, but the radiation signature matches that of naturally occurring radioactive materials and not special nuclear materials or radiological threat materials, and, therefore, is not a threat." This level of discrimination will allow the systems to operate at a substantially lower detection threshold, while simultaneously offsetting the subsequent operational constraints associated with the current-generation systems.

However, "passive" detection systems are ultimately limited by the physical properties of the radiation that they are designed to detect, specifically with regard to range of detection. The problem is exacerbated by the fact that sufficient amounts of high-density "shielding" materials, such as lead or steel, can act as an effective measure to prevent the emission of detectable amounts of radiation.

Radiography systems, similar to x-ray machines, can, however, overcome this limitation by providing density images of the contents of a container to identify areas of high density that are potentially indicative of shielding materials. An integrated passive detection and radiography system would, then, be capable of either directly detecting unshielded materials that are emitting radiation, or detecting the materials used to shield materials and prevent radiation emission.

"Active interrogation systems" can further alleviate detection limitations by probing, or "interrogating," containers to induce additional measurable detection signatures. A number of methods are currently under investigation, including systems which "interrogate" containers with either neutrons or gamma rays. However, current systems are still in a prototype development and demonstration phase, and design and performance obstacles must be overcome to substantially reduce the size and cost of systems if they are to be widely deployed.

Research, Development, Test, and Evaluation to Advance the State-of-the Art

I would like to discuss in a little more depth the Advanced Spectroscopic Portal (ASP) program, which I mentioned previously, in order to explain the model that the DNDO will use for all technology development and acquisition programs. The ASP program was initiated in direct response to a CBP requirement for more capable radiation portal monitors to be deployed at the borders. The Homeland Security Advanced Research Projects Agency, or HSARPA, then issued two Broad Agency Announcements and awarded contracts to ten private industry participants for the development of these portals; these contracts have subsequently been transferred to the DNDO. These efforts will culminate late this summer with an extensive high-fidelity test and evaluation campaign to take place at the Radiological and Nuclear Countermeasures Test and Evaluation Complex (Rad/NucCTEC) at the Nevada Test Site (NTS), where the developed systems will be evaluated against one another, as well as currently-deployed systems. Based on the results of these tests, a limited number of vendors will be selected to begin initial low-rate production of detection systems to be deployed at the border. These first deployments will provide an opportunity for operational test and evaluation of the systems, the results of which will be provided to the design and production team for incorporation into subsequent spiral developments. This comprehensive technology development program will guarantee that capable radiation portal monitors with known performance characteristics are being deployed to implement the baseline domestic detection architecture.

This program highlights a unique DHS asset that I believe is critical to the overall success of the DNDO research and development efforts. The Rad/NucCTEC, currently under construction at NTS, has been developed to ensure a high-fidelity test and evaluation cycle for all technologies developed and transitioned to operational end-users. The facility is being built in close proximity to the Department of Energy's Device Assembly Facility, or DAF, to leverage its ability to handle significant quantities of special nuclear materials (SNM). The RadNucCTEC will be authorized to handle SNM for the purpose of testing developed technologies against actual samples of these materials which provide the greatest threat to the Nation for use in a nuclear attack. Until the construction of this facility, no location existed which allowed access to these quantities of materials while maintaining the flexibility to place these materials into relevant threat scenarios and cargo configurations. Once completed, the complex will provide the Nation with a unique capability that will bridge the gap between "bench-top testing" preformed by developers and operational field testing conducted during pilot deployments.

Conclusion

The DNDO has taken an end-to-end approach to systems development and technology improvement. By integrating research and development efforts with a comprehensive test and evaluation program that ultimately leads to an informed systems acquisition and deployment process, the DNDO is working to provide the Na-

tion with a continuously improving capability to protect against a terrorist nuclear attack.

The DNDO has taken a comprehensive approach to addressing the threat posed by a terrorist nuclear attack. This approach, which begins with focused research and development programs that culminate in high fidelity test and evaluation campaigns, provide the basis for the Department to make informed and justifiable acquisition decisions. Equally important, the DNDO recognizes that the deployment of these technologies must be done as part of a larger strategy, one that extends to overseas deployments executed by other agencies. Ultimately, all of these systems must be connected and work within an environment that responds to information obtained from intelligence, counterterrorism, and law enforcement communities.

I am proud to have shared with you today how the Department and its interagency partners will work within the DNDO to continue to make progress against this very real threat. I look forward to working with you on these subcommittees in a continuing effort to confront this threat to the Nation.

This concludes my prepared statement. With the committee's permission, I request my formal statement be submitted for the record. [Chairmen, Congressmen Langevin and Pascrell, and Members of the Subcommittees, I thank you for your attention and will be happy to answer any questions you may have.

Mr. LINDER. Mr. Huizenga.

STATEMENT OF DAVID HUIZENGA, ASSISTANT DEPUTY ADMINISTRATOR, INTERNATIONAL MATERIAL PROTECTION AND COOPERATION, NATIONAL NUCLEAR SECURITY ADMINISTRATION, DEPARTMENT OF ENERGY

Mr. HUIZENGA. Thank you, Mr. Chairman and other members of the committee, for inviting me to testify today.

I will be discussing the Department of Energy's role in the interagency effort to prevent a nuclear terrorist attack against this country. I will focus on the role of my office, the Office of International Material Protection and Cooperation, as part of this larger, coordinated effort.

Our mission is to enhance U.S. national security by reducing the threat of nuclear proliferation and nuclear terrorism. We pursue this mission in two broad areas.

The first line of defense, our first goal is to secure nuclear weapons and weapons-usable material by upgrading security at vulnerable sites at international locations. We focus on the Russian Federation and other countries of greatest concern to U.S. national security. By working to secure these materials and weapons at the point of origin, we are making significant progress toward denying terrorists the essential element of a nuclear weapon, the fissile material. Securing the material is a top priority of the Bush administration, and we have now completed security upgrades at over 75 percent of the sites in Russia and the former Soviet Union. We are building a momentum from the recent Bush-Putin Summit and are poised to accelerate these critical activities in the upcoming months.

The second line of defense, the second mission, basically, is to prevent smuggling of nuclear and radiological material at international seaports, airports and land border crossings. The Second Line of Defense, or SLD, program, is dedicated to this program. At the committee's request, the Second Line of Defense program is the focus of my testimony today.

The SLD program has two parts. The Core Program focuses on securing material primarily in Russia and other former Soviet States, Eastern Europe and the Mediterranean region; and the sec-

ond part, the Megaports Initiative, which we had some discussion of earlier today. It is a 2-year-old effort to equip major international seaports with radiation detection equipment to screen cargo containers bound for the U.S.

The implementation of the SLD program involves deploying a suite of equipment, including fixed radiation portal monitors and associated communications system, as well as handheld equipment for secondary searches. This equipment is part of an overall system that includes initial site surveys, installation of the equipment followed by acceptance, testing and calibration of these radiological detection monitors. We provide extensive training on the use of the equipment to assure the long-term reliability. This training is essential since the very best equipment is ineffective if it is ignored, incorrectly calibrated, improperly maintained or easily bypassed by corrupt or incompetent operators.

The centerpiece and workhorse of the SLD effort is the radiation portal monitor, RPM. Currently, we deploy monitors that use plastic scintillators to detect gamma signatures and helium 3 tubes to detect neutrons. The purpose of the technology is to detect special nuclear material, in particular plutonium and uranium. These monitors will also detect radiological materials suitable for use in a radiological dispersal device or a dirty bomb.

I am aware of and somewhat disappointed in the recent criticism of the U.S. efforts to deploy radiation portal monitors both here at home and abroad. I want to be clear at the outset, over the last several years these portals have proven their value on many locations, and I expect they will continue to do so well into the future.

The gravity of the potential consequences of elicit trafficking in nuclear material requires that we deploy and employ all of the tools available to us now, while, of course, seeking to update and improve our efforts as new technologies emerge.

Certainly, as you have heard, there are issues, both domestic and international. We face these challenges in deploying this equipment. I have discussed these challenges in some detail in my written statement, and I will briefly summarize here.

First, certain configurations of shielded HEU are difficult or impossible to detect. Intense R&D work is going on, as Vayl Oxford has pointed out. Currently, the best solution is the overlapping use of existing RPMs in conjunction with the imaging technology to reveal anomalies within the container's contents.

The second challenge is to quickly and effectively distinguish the NORM alarms from special nuclear material. Currently, the best solution is various types of energy windowing used by both Customs and the Second Line of Defense program to eliminate a significant number of NORM alarms and then do secondary inspections to eliminate the rest. Spectroscopic portal monitors may help with this problem. However, the data on the portal monitors is being collected, and we await the results.

The third challenge is transshipment, finding ways to scan the container traffic at a port that moves from ship to ship or ship to shore and then to ship and doesn't pass through a checkpoint. As the program gains experience, we are finding innovative ways to solve this problem.

In the port of Freeport, for example, we are using a straddle carrier, which is a device that is pointed out on the left-hand side of the picture over here that is used to carry containers around in the port. We put monitors, both spectroscopic and plastic monitors, on this straddle carrier; and we are driving this around the port to make sure we are screening the cargo that doesn't actually go through an entry and exit gate.

SLD, the program is working closely with the Department of Homeland Security to develop solutions to these issues. We are engaged in cooperative efforts with several offices, including the DNDO office and the Customs and Border Protection Office of Field Operations and the Office of International Affairs. We routinely exchange information, data and lessons learned with our counterparts at CBP. We are also providing training courses at the Pacific Northwest Laboratory facility, the HAMMER facility, for CBP officers and foreign customs officers as well. Finally, we work closely with the SNT office to share implementation challenges and seek promising solutions.

I have addressed the effectiveness of the technology but for context need to point out something that our trainers always tell both the U.S. and foreign customs officers. Equipment supplements the skill of the officers but does not replace it. These officers must use all that they have learned about human behavior, suspicious activities and smuggling techniques in order to make the technology most effective. Alert and effectively trained officials using the best equipment available will always be our strongest protection against illicit trafficking.

I would like to close by reiterating what I stated earlier. While we are focused on technological challenges in our hearing today, there are a lot these monitors can and are doing. They can detect radiological materials. They can detect shielded plutonium and certain configurations of shielded HEU. They have proven to work reliably in a variety of extreme field conditions.

An example pointed out recently by our Russian Customs Ministry informed us that the second line of defense in Russian monitors deployed along the Russian border recorded 14,000 hits last year. Two hundred of these cases involved potential attempts to smuggle nuclear or radiological materials. That is 200 cases that would not have been discovered and investigated but for the presence of the radiation portal monitors.

Thank you. I would be happy to answer any questions you have.

Mr. LINDER. Thank you, Mr. Huizenga.

[The statement of Mr. Huizenga follows:]

PREPARED STATEMENT OF DAVID HUIZENGA

Mr. Chairman and Members of the Committee, thank you for inviting me to testify before you today. I would also like to express my appreciation for the efforts of my colleagues from the Departments of State, Defense and Homeland Security. I will be discussing the role of the Department of Energy's National Nuclear Security Administration (NNSA) in the interagency effort to prevent a nuclear terrorist attack against this country. More specifically, I will focus on the role of my office, the Office of International Material Protection and Cooperation, as a part of this larger, coordinated effort.

The mission of the NNSA's Office of International Material Protection and Cooperation is to enhance U.S. national security by reducing the threat of nuclear proliferation and nuclear terrorism. We pursue this mission by improving the security

measures protecting weapons-usable material and by enhancing radiation detection and proliferation interdiction capabilities at key transit points including international border crossings and large ports of call. My group implements these critical programs in Russia and other states of the former Soviet Union (FSU) and in other countries around the world.

The first goal of my office is to secure nuclear weapons and weapons-usable nuclear materials by upgrading security at vulnerable nuclear sites. We focus on efforts in the Russian Federation and other countries of greatest concern to U.S. national security. By working to secure nuclear material and weapons at the point of origin, we continue to make important strides toward denying terrorists and states of concern the essential element of a nuclear weapon: the fissile material. As you know, securing nuclear material is a top priority of the Bush Administration, and we have now completed security upgrades at over 75% of the sites containing nuclear materials and nuclear weapons in Russia and the FSU.

The second goal of my office is to prevent smuggling of nuclear and radiological material at international seaports, airports and land border crossings. The Second Line of Defense program or SLD is dedicated to this important effort. At the Committee's request, the SLD program will be the focus of my testimony today.

The SLD program has two parts. The Core Program focuses on securing border crossings in Russia and other former Soviet States, Eastern Europe, the Mediterranean region and other key countries. The second part of our SLD program, the Megaports Initiative, equips major international seaports with radiation detection equipment to screen cargo containers for dangerous materials.

Implementation of the SLD program involves deploying a suite of equipment including fixed radiation portal monitors and an associated communications system, as well as hand held equipment for secondary searches of shipping containers.

I would like to emphasize that the nuclear detection technology deployed by the SLD program is part of an overall system. This overall system includes site surveys to determine the best placement of the monitors at major transit points, and vulnerability assessments to determine the potential efficiency of this technology at the particular site. Once the technology has been installed, we perform extensive acceptance testing and calibration of the radiation detection monitors. We also work with the host country government to provide extensive training on the most effective use of the installed equipment. This training program includes specifics on incident response procedures, requirements for maintenance and technical support, and long-term sustainability planning. This systematic approach recognizes that the effectiveness of the installed equipment is fundamentally determined by how it is used on the ground by host country personnel. The very best equipment available is ineffective if it is ignored, incorrectly calibrated, improperly maintained or easily bypassed by corrupt or incompetent operators. Therefore, the fundamental objectives of the SLD program include ensuring that our equipment is operated properly and effectively by the host country. We seek to ensure that the host country understands how to maintain the equipment after U.S. assistance has ended. We also work to ensure that the equipment, particularly the communication system, is minimally susceptible to corruption at these foreign locations.

The centerpiece of every Core and Megaport installation is the radiation portal monitor or RPM. Currently, we deploy monitors that use plastic scintillators to detect gamma signatures and Helium 3 tubes to detect neutrons. The purpose of this technology is to detect special nuclear material (SNM), in particular plutonium and uranium enriched to levels of 20% or higher in the isotope U–235. Equipment targeting this SNM will also detect other radioactive materials suitable for use in radiological dispersal devices.

To understand how the RPMs work, it is important to understand the interface between the detector and communication system. Our communications systems will graph the gamma or neutron signal detected by the RPM and help the operators identify what type of alarm has occurred and where it seems to be located. If the RPM signals an alarm, hand held equipment is then used to further localize the alarm and to identify the specific radioisotopes that caused the alarm. Determination of the specific isotopes involved and their specific location is important because a number of common materials such as ceramic tile and kitty litter, in large quantities, may signal an alarm due to their relatively high concentration of radioisotopes. We call these 'NORM' alarms, for 'naturally occurring radioactive material' alarms. In addition, individuals who have recently had certain medical treatments involving radiation may trigger an alarm. In these cases, secondary inspections allow us to identify the actual nature of the alarm.

Distinguishing "NORM" and medical alarms from actual instances of illicit trafficking is one of a number of technological challenges facing the operators of this equipment, in any location. For this reason, there are a number of critics of U.S.

efforts to deploy radiation portal monitoring both here at home and abroad. I want to be clear, however, at the outset that these portals have proven their value on many occasions and I expect that they will continue to do so well into the future. The gravity of the potential consequences of illicit trafficking in nuclear material requires that we employ all of the tools available to us now, updating and improving them as new technologies emerge.

Now to the challenges we all face in deploying this equipment. Serious concerns have been raised about the efficacy of RPMs in three key areas.

First, certain configurations of shielded highly-enriched uranium (HEU) can be very difficult to detect. This issue is of great concern. Intense work is ongoing in laboratories and commercial arenas to develop solutions to this challenge. The Bush Administration is making substantial investments in an interagency research and development (R&D) program in nuclear detection technology coordinated by the recently created Domestic Nuclear Detection Office (DNDO) at the Department of Homeland Security. I am sure my colleague from DHS will discuss these R&D efforts in greater detail.

Until these R&D efforts improve the detection of well-shielded HEU, the best solution is overlapping the use of existing RPMs in conjunction with imaging technology that reveal anomalies within a container's contents. A trained operator can pinpoint areas of concern within a suspicious shipping container or vehicle using imaging technology and reveal a potential effort to shield HEU. Such imaging equipment is present or will be soon in many U.S. and foreign ports.

Once imaging technology reveals a potential anomaly within a container, the container can be searched, or an active interrogation device can bombard the specific area of concern with a neutron signal revealing more information as to the nature of the potential threat. These active interrogation devices currently exist as prototypes, and we believe they will become commercially available within the next few years. I would like to note that the combination of imaging equipment and RPMs is what DHS's Container Security Initiative (CSI) and SLD provide cooperatively to foreign ports. Put another way, our joint efforts maximize the possibility of the detection of trafficking in nuclear materials.

The second technological challenge faced by users of portal monitors is finding ways to quickly and correctly distinguish 'NORM' alarms from actual illicit trafficking in nuclear materials in order to minimize the need for time and resource-consuming secondary inspections. International port operators and foreign governments as well as our own domestic ports are sensitive to the fact that these nuisance alarms can and do slow down the flow of traffic and commerce. We have developed number of ways to address this particular challenge. Energy windowing (EW) is a method that U.S. Customs is using to reduce the number of 'NORM' alarms so as to allow more effective deployment of RPMs. This approach entails specific algorithms that sort out alarms on the basis of the fact that norm alarms generally have higher gamma signals than special nuclear material. SLD currently uses a version of EW that works well on our monitors by which the monitors are configured for increased sensitivity to the low gamma energies of HEU. This approach also reduces the number of NORM alarms. We are currently working with Customs to compare these two approaches and to ensure the highest possible standards for effectiveness.

Another promising approach for resolving 'NORM' alarms is the development and use of spectroscopic portals. These portals essentially provide a means to identify the presence of nuclear material and to identify the type of radioisotope present by means of a fixed monitor. Although these portals will not, unfortunately, have increased "intrinsic" SNM sensitivity, they may be useful for quickly distinguishing alarms caused when approved or naturally occurring radioactive materials are found in cargo or vehicles. This potential increased operational effectiveness may allow the monitors to be set at a lower threshold, thus allowing for greater sensitivity. The potential improvement in sensitivity may or may not be significant. Until these monitors are completed and tested, it is impossible to know for sure. We are currently studying their use for secondary inspections in cases where a large spectroscopic portal will be more effective than the currently available hand-held identifiers.

Such spectroscopic portals are currently under development and will be tested by DHS later this summer. If these tests are successful, SLD hopes to work through DHS to procure a number of these spectroscopic portals and then put them in secondary inspection locations in selected ports around the world. Operational testing under real deployment conditions will help us determine the true effectiveness of the monitors in the field. We hope that providing more extensive field-testing for this DHS-led effort will be another exemplary example of US interagency cooperation in the area of nuclear detection. It is important to note that these spectroscopic

portals are estimated to be approximately eight times more expensive than the RPMs currently deployed by SLD. Unfortunately, scintillation crystals with sufficient sensitivity and sufficient resolution to be effective in these spectroscopic portals are very costly and currently unavailable in large quantities.

SLD is deploying a specialized version of the spectroscopic detector as part of a pilot project in a selected port. In this effort, a straddle carrier stripped of its lifting equipment has been outfitted with plastic scintillators, neutron detectors, NaI detector systems (spectroscopic detectors), and other equipment to allow the modified straddle carrier to travel through rows of containers for successive screenings. We expect to learn more about spectroscopic detector capability from this specialized effort to solve the problem of transshipment, which is containers that don't come into a port through a gate, but rather are moved from ship to ship or ship to shore to ship.

This issue of transshipment leads into the third challenge that impacts the effectiveness of portal monitors—monitor placement. For these monitors to work, they must be appropriately spaced, and vehicles of all types must move through them within certain specified speeds. This is not generally a problem for gate traffic, but large ports may not be configured with choke points where portals can be effectively deployed to screen the transshipped cargo, which is moving through the port from one ship to another.

Such difficulties present serious deployment challenges. However, as we gain valuable implementation experience in a variety of environments and as new technology develops, we fully expect that our ability to screen cargo effectively will improve. R&D efforts may contribute to solving the current challenges we face. For example, in addition to the straddle carrier which is being implemented, a crane-mounted monitor may eventually be developed to facilitate the screening of transshipped cargo. We are also taking new and creative approaches to strategic deployment of RPMs and the technology that we do have at our disposal right now. For example, in addition to the large transshipment hubs, SLD is working to install equipment at feeder ports in designated high threat locations, where most of the traffic comes through the gate and can be screened entirely before it moves into the maritime system.

In confronting these challenges and developing solutions to them, SLD works closely with DHS. We are engaged in active cooperative efforts with several offices including DNDO and various components of Customs and Border Protection (CBP) including the Office of Field Operations and the Container Security Initiative. We routinely exchange information, data, and lessons learned with our counterparts in CBP. Additionally, we provide joint training courses at the HAMMER training facility at the Pacific Northwest National Laboratory for CBP officers and foreign customs officials. Commissioner Bonner and NNSA Deputy Administrator Paul Longsworth signed a Memorandum of Understanding on 12 April to formalize this relationship.

Let me address a final concern that has been raised about the portals—the variability in the detection capabilities of the portal monitors that are being deployed in domestic and international settings. Although DHS/CBP and SLD are deploying different portal monitor models, they target essentially the same amounts of material. Recent comparison tests conducted by DOE and DHS indicate that when SLD and CBP radiation detection monitors are set to operate at thresholds that would produce acceptable nuisance alarm rates in an operational cargo setting, they demonstrate similar detection capabilities. In other words, in operational settings, the two types of monitors are operating at similar levels of effectiveness.

I have attempted to address the issue of efficiency of technology while still keeping the place of the technology in perspective within the larger system of inspection, detection and identification. On that point, I would remind you of something that our trainers always remind both the U.S. and foreign customs, border protection, and port authority officers during training at DOE facilities. Equipment supplements the skill of the officers but does not replace it. These officers must use all that they have learned about human behavior, suspicious activities and smuggling techniques and patterns in order to make technology most effective. Alert and effectively-trained officials in foreign and domestic facilities using the best equipment available will always be our strongest protection against illicit trafficking in nuclear materials.

I'd like to close by saying that, while we focused on technological challenges today, there is a lot these monitors *can do:* they can detect radiological materials, they can detect plutonium, and they can detect HEU. They can also detect shielded plutonium and many configurations of shielded HEU. They are proven to work in a variety of field conditions.

As an example, Nikolai Kravchenko, our counterpart in the Russian Customs Ministry, recently informed us that these monitors deployed along the Russian border recorded 14,000 "hits" last year. Some 200 of these cases involve potential attempts to smuggle nuclear or radiological materials. That's 200 cases they would not have discovered nor be investigating without these monitors that the Second Line of Defense program has installed.

Finally, I would like to reiterate the strong and deepening relationship with State, DHS, DoD and other agencies participating in this effort to improve our nuclear and radiological detection capabilities. We share the common objective of preventing terrorists and states of concern from obtaining and smuggling nuclear materials and work closely with other USG agencies in the implementation of the program. The unique capabilities of each Department and agency are being leveraged to accomplish this objective.

Thank you. I would be happy to answer any questions you may have.

Mr. LINDER. Mr. Evenson.

STATEMENT OF MICHAEL K. EVENSON, ACTING DIRECTOR, COMBAT SUPPORT DIRECTORATE, DTRA, DEPARTMENT OF DEFENSE

Mr. EVENSON. Thank you, Mr. Chairman.

Chairman Linder, Congressman Langevin, distinguished members, it is an honor for me to be here this afternoon to discuss the effectiveness of radiation portal monitors and other technologies to detect smuggled nuclear and radiological materials. I will summarize my statement and ask that it be included in its entirety in the record.

DTRA conducted the Unconventional Nuclear Warfare Defense program, UNWD as we refer to it, as directed by Congress in the 2002 defense appropriations bill, and installed four test beds to demonstrate nuclear protection systems at four different U.S. military bases. We used existing technology, as directed.

For almost any "bright" materials, i.e., medical and industrial, those probably used in a radiological dispersal device, the existing portal monitors that were installed will detect unshielded material, both at fixed and at highway speeds. The detectors were somewhat effective against these types of materials even if moderately shielded. However, for special nuclear materials, the detectors are not as effective.

We have also conducted numerous tests at the Technical Evaluation and Assessment Monitoring Site, the TEAMS facility, at Kirtland Air Force Base, New Mexico, and conducted red team exercises against all four bases.

Our observations are that when the concept of operation, or CONOPS, is followed rigorously by the personnel at the portals, the protection scheme is 100 percent effective against all unshielded materials.

We also developed detectors that detected at highway speeds over 55 miles an hour. We developed detectors that detected over water on small craft, 35- to 40-foot-size boats.

Our most successful installation is at Camp Lejeune, North Carolina, where at the initiative of the base commander and the local city and State governments the detectors are located off base. The warning and notification network is integrated into the base, city and county emergency operations centers, and the local officials developed a plan to respond to detections and prevent the device's approach to the base.

Our experience with this project and other detector work DTRA performs leads us to the conclusion that the concept of protection from nuclear devices must be thought about as gaining warning time for a proper response and not solely that of radiation detection. That is, we must have an integrated systems approach and a well-developed concept of operations.

Currently, we must depend on an extensive number of sensors to gain this warning time. For that reason, we encourage the investigation and research into means to make the detectors themselves cheaper.

We also encourage the committee to look into developing alternative technologies, that is, other than radiation detection, for technologies that detect other physical phenomena, such as weight, density, heat and the presence of high explosives. Despite the success of the UNWD program, our conclusion is that much research needs to remains to be done. Much of this work is detailed in the independent report on UNWD, copies of which I provided the committee.

I would emphasize my earlier comments that the concept of protection from nuclear devices must be thought about as gaining warning time for a proper response and not solely that of radiation protection, and we must look for alternative technologies in the integrated system solution.

I thank the committee for their time and welcome your questions.

Mr. LINDER. Thank you very much.

[The statement of Mr. Evenson follows:]

PREPARED STATEMENT OF MR. MICHAEL K. EVENSON

Mr. Chairman and members of the Subcommittees, it is an honor for me to be here today to discuss the Defense Threat Reduction Agency's (DTRA's) radiation detection and portal monitoring programs. I will summarize my statement and ask that it be included in its entirety in the record.

The mission of DTRA is to reduce the threat of weapons of mass destruction (WMD). Countering chemical, biological, radiological and nuclear weapons is the reason for the agency's existence. We focus full-time on countering these threats. Our mission is guided by the National Strategy to Combat Weapons of Mass Destruction, and direction provided by the Secretary of Defense and the Chairman of the Joint Chiefs of Staff. While our primary customers are the Combatant Commanders, DTRA also makes unique contributions to homeland security with its dual-use tools, knowledge, expertise, and services. We provide these through the US Northern Command, the Assistant Secretary of Defense for Homeland Defense, and others to address, counter, and mitigate WMD threats.

DTRA programs and activities support the three components of the national strategy: counterproliferation, consequence management, and nonproliferation. These components are synergistic by nature. Our counterproliferation programs provide offensive and defensive means for combating WMD. DTRA nonproliferation programs support diplomatic and cooperative international efforts to halt the spread of WMD. Our consequence management efforts provide capabilities for responding to actual use of WMD.

We also provide an interface between science and technology and the warfighters by integrating current and emerging technologies from many sources—US Government agencies, the DOE National Laboratories, academia, the private sector, and from our friends and allies—into products and tools that permit warfighters to counter and defend against the threat of WMD, including the nuclear/radiological threat. Within the realm of DTRA's detection technology program, our goals are to provide and enhance current detection, identification, and characterization capabilities for nuclear/radiological items, improve equipment survivability during military operations, and improve ease of use by the military forces. We also seek to standardize Concepts of Operations, improve data dissemination and networks, and pro-

vide reachback. These efforts yielded several tools that have been operationally employed in several missions to include OPERATIONs ENDURING FREEDOM and IRAQI FREEDOM.

One of our recent success stories is the Unconventional Nuclear Warfare Defense (UNWD) Program wherein we collaborated with DOE, the National Labs and the Services to establish four permanent test beds to develop technologies and concepts of operation to counter the threat from stolen nuclear weapons, improvised nuclear devices (INDs), or radiological dispersal devices (RDD) delivered by unconventional means other than missile or aircraft. Original funding for UNWD was provided by Congress under Public Law Number 107–117. The four sites, one for each branch of the armed forces, are located at: Kirtland Air Force Base, NM; Submarine Base Kings Bay, GA; Camp Lejeune, NC; and Fort Leonard Wood, MO. Successful demonstrations at these sites have also provided a unique venue for critical infrastructure facility protection systems, as well as integrating the system into state/local emergency response assets that will augment the facility response and recovery capabilities that could be used for homeland security.

As an off-shoot of this program, DTRA manages the Technical Evaluation and Assessment Monitor Site (TEAMS) at Kirtland AFB. TEAMS is a flexible, multi-use facility that serves as an important test-bed to evaluate DTRA and inter-agency programs and emerging technologies to detect, combat, and defeat the nuclear/radiological threat.

Under the Cooperative Threat Reduction or CTR program, DTRA is also fielding nuclear/radiological portal monitors in Uzbekistan at 11 of that nation's international ports of entry. We are also planning for a second increment that will add six more ports of entry. Additionally, the CTR program will help the Government of Uzbekistan develop and implement a comprehensive "Train the Trainer" program to support the CTR-provided equipment. Our goal is to provide Uzbekistan with self-sustaining WMD detection and interdiction capabilities. The Department of Defense coordinates CTR WMD border security activities closely with the Departments of Energy (DOE) and State. In Uzbekistan, the CTR program also will install nuclear/radiological portal monitors similar to those that DOE is installing in Russia in its Second Line of Defense (SLD) program. The Department of Energy will provide follow-on maintenance and sustainment.

DTRA also executes the DoD International Counterproliferation Program. Congress mandated that the Department of Defense work in cooperation with the Federal Bureau of Investigation and the U.S. Customs Service (now, the Department of Homeland Security's (DHS) Bureau of Customs and Border Protection and Bureau of Immigration and Customs Enforcement) to develop and deliver training programs to counter the WMD proliferation threat. The resulting DoD International Counterproliferation (ICP) Program provides training, equipment, and technical assistance designed to enhance the detection, identification, interdiction, and investigation capabilities of border, customs and law enforcement officials in vulnerable regions. Using a country-specific implementation approach, the ICP Program directly supports the National Strategy to Combat Weapons of Mass Destruction as the United States continues "to work with other states to improve their capability to prevent unauthorized transfers of WMD." A significant component of the DoD ICP Program is delivering equipment necessary to allow officials tasked with interdicting WMD materials, or responding to crimes involving WMD-related materials, to perform their duties. The equipment includes radiation pagers, hand-held and bench-top isotope identifiers.

Two promising radiation detection research and development projects are sensitive scintillating glass fibers technology and mechanically cooled high-purity germanium spectrometry. These are particularly applicable to our operational requirements in that the glass fiber supports multi-mode application (land, sea, or air) and the mechanically cooled spectrometer provides unequaled resolution and identification capability in a hand-held device. In keeping with the defense in depth concept, these technologies allow interrogation of materials at any given point rather than in a single material handling area, such as a port or staging area. Both technologies are at, or slightly beyond, prototype stage and expect maturation with the year. Our technology development process optimizes these and other technologies by integrating their capabilities for a more robust effect including integration with information connectivity, ruggedness, and operator ease-of-use engineering.

Under the UNWD and other programs, DTRA has performed numerous tests to evaluate the performance of current detection technologies. For almost any "bright" materials, i.e., medical, and industrial, those probably used in an RDD, the existing portal monitors will detect unshielded material, whether fixed or at moderate highway speeds. The detectors were somewhat effective against these types of materials even if moderately shielded. However, for Special Nuclear Materials (SNM) the de-

tectors are not as effective. However, while shielding reduces the potential for radiation detection, it opens other venues for interdiction such as X-ray for dense materials (or alternative signatures). Additionally, the evaluations demonstrated that if portal monitors are placed in tandem, they are more effective and harder to defeat; problems with false and nuisance alarms and system interface need further development; and, that Concepts of Operations are key to the system success.

DTRA's knowledge, experience, and expertise are available to address the nuclear/radiological threat and we stand ready to assist other US government agencies in addressing their mission requirements. The most recent example of this long-standing commitment is our assignment of two detailees in coordination with OSD to the newly-formed Domestic Nuclear Detection Office (DNDO), one of whom was a key player in the Unconventional Nuclear Warfare Defense Program. DTRA stands ready to assist DNDO as it performs its critical mission.

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

Mr. LINDER. Mr. Oxford, Mr. Huizenga and Mr. Evenson, do you all talk to each other regularly?

Mr. OXFORD. Mr. Chairman, at least Mike and I have known each other for at least 10 to 15 years, so we have known each other well. Dave and I have gotten to know each as part of the transition team to stand up DNDO. So we have worked very closely in putting this together.

Mr. LINDER. Do you think that the DNDO should have statutory authority?

Mr. OXFORD. Mr. Chairman, I guess it would depend on statutory authority to do what? I think, right now, the way it is established, with the agreements that we have across the participating departments, that we are sufficiently authorized to do what we need to do. We have agreed, as I testified before, to jointly develop the strategy, because we do think the strategy is critical, with each of us then understanding our various implementation paths to make sure we are working cooperatively across that and then sharing that information with that deployed strategy.

Mr. LINDER. You heard the previous panel, or one of the members, talk about the lack of coordination in getting these detectors out. Some countries have different types of detectors than other countries. Some are better. Some are worse. Would DNDO be the agency to try to pull those various disparate groups together?

Mr. OXFORD. Mr. Chairman, I believe it will. The goal, again, was to do the joint planning. As the previous panel said, planning together is very, very important. We do have overseas hurdles, I think Congressman Markey was getting to the point, we will have to deal with, and that is some of the technology export control issues of advanced technology. There are software and some other things we may have to deal with from an export control perspective.

But understanding systems performance together so that as we take these systems to our common test bed I think is our goal, collectively, and the other members can respond to this. I think you will ultimately see a narrowing down of the number of test beds that are out there, so the one at the Nevada test site will become a common test bed for all of us so we fully understand systems performance. Therefore, we will be deploying systems that we all understand how they work. The implementation then becomes a lot more simple if we understand that performance.

Mr. LINDER. Mr. Huizenga, you note in your testimony that 14,000 hits—is that radiological hits in Russia?

Mr. HUIZENGA. Yes, it is, Mr. Chairman.

Mr. LINDER. What were most of them from? Is it Norm?

Mr. HUIZENGA. Some of it is Norm, some of it is contamination, and some of it is the actual illicit movement of material.

Mr. LINDER. That was 200.

Mr. HUIZENGA. That is correct.

Mr. LINDER. Did anyone ever determine, was it weapons grade material?

Mr. HUIZENGA. Those are things probably that we would be better off talking about in a separate session.

Mr. LINDER. Did anybody track down where it came from?

Mr. HUIZENGA. We worked closely with the intelligence community in that regard.

Mr. LINDER. Okay. All of you have mentioned Megaports, I think. Are we a little bit behind in getting those Megaports stood up?

Mr. HUIZENGA. Well, it is a matter of perspective, I guess. Gene Aloise and I talked at length about the report. It did take us a while to get going. He is accurate. We have two done, and we are working on—he said five—are actually working on six, and we are negotiating with another 20 countries, and by the end of 2006 we are projecting to have 10 done. So we are, actually, I think ramping up and making steady progress right now.

Mr. LINDER. The radiography you talked about, it pictures through the container, but it can't go through lead, is that correct, to get a picture of what you are looking at?

Mr. OXFORD. Mr. Chairman, that is exactly right. Although we do expect with some of the advanced radiography systems to have the possibility—again, we have to test this—to actually be able to discriminate the HEU as well. We will definitely get the high-density material so we know there is an anomaly in the image. We are also hoping to be able to get some of the threat materials. But that is what the advanced techniques will give us over what is currently fielded.

Mr. LINDER. How far away are we from that?

Mr. OXFORD. Again, the design methodology and model that I talked about in my opening statement, we are pushing hard for that technology that is within hand to be able to fielded within 3-1/2 years. So we are not proposing a protracted development cycle. We are looking at doing an RFP, request for proposal, for advanced radiography within the next 4 months.

Mr. LINDER. Mr. Evenson, is anybody looking for cesium-137?

Mr. EVENSON. Well, I think I understand your meaning, but all our detectors will detect it. Do you mean are we actively out searching for it?

Mr. LINDER. We have got cesium-137 in virtually every hospital in America, unprotected.

Mr. EVENSON. Absolutely, Mr. Chairman. Yes, sir.

Mr. LINDER. Is that a problem for us?

Mr. EVENSON. Yes, sir. Actually, I am part of a Defense Science Board that is meeting now, and one of our conclusions is that we in this country, at least if you share that board's view, it is more likely a radiological dispersal device. The materials will be gathered inside the United States and not transhipped. We need to get control of the materials, yes, sir.

Mr. LINDER. Thank you.

Mr. Langevin.

Mr. LANGEVIN. Thank you, Mr. Chairman.

Gentleman, thank you for being here today.

Mr. Oxford, I want to welcome you back and begin with you. I would like to discuss a couple of things with you, the first being the deployment plan for the current version of radiation portal monitors.

You stated in your testimony in April that $71 million of the fiscal year 2006 budget request will go to research and evaluation of advanced portal monitors. Now, this will be $54 million for the deployment of current systems.

The concern that I have is that the deployment plan of the current portal monitors is really funding dependent, and the CBP has never received a full allocation to cover seaports, landports and other ports of entry. So taking $71 million and putting it towards research, while needed, clearly hurts current detection operations.

So my question is, does the Department intend to reprogram funds to cover the balance of the program costs, which are about $163 million? And, if not, what is the target completion date for the deployment of the current system if your funding level remains unchanged?

Mr. OXFORD. Out of the $125 million that was requested in fiscal year 2006, what we agreed to do was not research with the remaining amount. It really is all going towards deployment activities. What we wanted to do was gradually phase in the deployment of new systems, the advanced spectroscopic systems.

Based on a limited available amount of the sodium iodide crystals and the actual source selection process, we felt it was prudent to go ahead and continue with the deployment of existing radiation portal monitors with Customs. The rationale for that is our design methodology for the advanced systems is what I will call a retrofit or plug-and-play. So for every location that we have a current radiation portal monitor, we will be able to go back in and replace directly those panels with the new advanced spectroscopic systems.

About 80 to 90 percent of the cost of the existing installation is in the physical installation, as opposed to the current detector hardware. So we will be able to benefit by their continuing deployment. But we will be following directly behind them with deployment of the new systems. Roughly $131 million I think is our estimate in fiscal year 2006 of the new advanced spectrographic systems. So we are not diverting R&D money from that $125 million. It is all for deployments of different kinds of systems.

Mr. LANGEVIN. The cost that we are talking about here, does that also include the training for those individuals that are going to be operating? That is one of the Chairman's concerns, we are spending money on equipment, that we may not be paying as much attention to adequate training so that the people that are operating this equipment are proficient.

Mr. OXFORD. The total amount of money going into the radiation portal monitoring in fiscal year 2006 is roughly $178 million, $53 million of which goes into training in the operational support of fielded systems. So the $125 million you saw as a direct acquisition request in the 2006 budget was for deployment of either the cur-

rent systems or the follow-on systems. But there is a separate $53 million for training and support in the field.

Mr. LANGEVIN. Right now, it is my understanding that the portal monitors, they can't distinguish between special nuclear materials and naturally occurring radioactive material. This has resulted in I guess numerous nuisance alarms at border crossings and seaports, causing CBP inspectors to reduce the sensitivity of the machines. Obviously, reducing the sensitivity of this equipment diminishes the machine's effectiveness. Can you comment on that?

Mr. OXFORD. Again, the sensitivity is not the issue. It is the discrimination, as I mentioned earlier. So one benefit of the new systems is that we will be able to discriminate between the normally occurring material and the threat material.

Again, without going into a lot of vulnerabilities, we still have the issue of shielding that I mentioned in my opening statement. The new systems—and, again, this is all subject to the tests that we will do in August and September—will give us the results. It will give us the discrimination capabilities that replaces the currently fielded systems.

Mr. LANGEVIN. On another topic, both the House and Senate appropriations committees cut about $100 million out of the President's request for the DNDO. The appropriators, along with the members of the committee and Senator Lieberman, have also voiced concerns with your office. Congress' primary concern deals with role of DNDO as it relates to other Federal agencies, especially the Departments of Energy and Defense. How do you envision the role of the DNDO? Can you elaborate on that? Can you tell us what steps you are taking to address appropriators concerns?

If I could, I would also like to request Mr. Oxford brief the members on DNDO as soon as possible.

Mr. LINDER. We will be happy to invite him back.

Mr. OXFORD. I would welcome that opportunity.

Let me address your first question. The extent of the $100 million cut causes great concern, obviously, and we have gone through and briefed the Senate in an extensive fashion and will do so with the House before the Conference Committee. I believe in some cases it is a matter of a new office being stood up and not having the ability to execute the resources in 2006. But I will tell you that we have active programs in all the areas that I mentioned before, the strategy development, the architecture work, the active interrogation, the passive detectors, as well as the radiography systems.

On top of that, we have an aggressive new start proposed in the transformational research. It is in that category that you will find us working things like this, what we call the long-dwell transit problem, what the previous panel referred to as the time between point-of-debarkation to point-of-entry, where we have days to weeks to deal with the radiation detection problem versus minutes at either the-point-of-departure or point-of-entry.

We really want to be able to work that, and we think there are technologies out there, even though some have mentioned that there are industry representatives selling it as a near-term solution. We have to drive the costs and the false alarm rate significantly lower than what we currently expect. So, from that vantage

point, we would really like to start the transformational program in 2006, and the $100 million cut would seriously jeopardize that.

The coordination issue you raised, again, the first priority we put within DNDO was to get a team together from DOD, DOE, the FBI and DHS to work the strategy and the architecture. That is our first priority. We have set a baseline of March of 2006 to have that strategy in place so as we go forward collectively we know what we want to implement.

So, again, we are very happy to work with the Congress on resolving those issues as we go forward.

Mr. LINDER. The time of the gentleman has expired.

The gentleman from California.

Mr. LUNGREN. Thank you, Mr. Chairman.

Mr. Evenson, in response to the last question asked of you, you suggested that a group that you are working with is either coming to or has come to the conclusion that it is more likely that we would see an attack based on material from within rather than transported here.

Mr. EVENSON. That is correct, Congressman.

Mr. LUNGREN. Can you tell me a little more about that?

Mr. EVENSON. We actually think it is much easier to gather the material inside this country and make a radiological dispersal device than it is to go through DHS or anybody else's detectors.

Mr. LUNGREN. Is that because of our lack of security with hospitals and so forth?

Mr. EVENSON. The conclusion of the group is we don't track the materials well. It is not unguarded. Certainly you are more aware of the problem possibly than I am. It is guarded, but it is not tracked. It is not something you regard as a serious weapon in this country, so our conclusion was it would be fairly easy for a determined terrorist to gather that material.

Mr. LUNGREN. Mr. Oxford, you mentioned in your testimony that the U.S. Coast Guard has deployed some handheld radiation detectors. Are these different than the ones we were talking about with the first panel that are used by Customs and Border Patrol now? And for what purpose are they used? The suggestion was that they are actually used for the protection of the agents, as opposed to actually being able to identify things in a significant way.

Mr. OXFORD. The current technology that they are using is very similar to what Customs has used, at least in the handheld and the pagers, but they are used in a much more strict environment, they are doing it on a controlled boarding and an interdiction where they actually know what they are going after.

In the R&D program we have some handheld devices, some advanced systems, that we are ruggedizing for maritime application, specifically for the Coast Guard, to replace those that should be available in the next couple of years. But they are reliant on the currently existing systems as well.

Mr. LUNGREN. I like the word "ruggedizing" because normally the word around here is robustness. So ruggedizing is a nice word.

You were talking about the radiation portal monitor program and about the $125 million for fiscal year 2006. As I understand it, for you to continue onto that program in the various modes you

wish it to have, you are going to need something like $880 million in fiscal year 2007.

Is it the thinking of your Department that, that is what you are going to be asking for, and if you don't get it, can you really suggest that you are going to complete the installation of the portal monitors in 2009 as planned?

Mr. OXFORD. I was actually scheduled to brief the Deputy Secretary on our 2007 to 2011 program tomorrow, but it got delayed for a week or so.

We will come in with a bigger request than that in 2007. I can't tell you what that means. The $800 million that you heard was a Customs number predicated on the existing plastic portal systems versus some of the advanced systems. So we are going back and looking at a combination of the retrofit and the deployment of the new systems. We will be trying to seek an 2007 through 2008 completion at the legitimate ports-of-entry.

Mr. LUNGREN. Suffice to say, it is going to be a good chunk of change?

Mr. OXFORD. Absolutely.

Mr. LUNGREN. Mr. Huizenga, you have testified about the usefulness of the energy windowing to improve the performance of the RPMs and lower the number of NORM alarms. At least I have been informed there is some debate within the scientific community regarding the effectiveness of energy windowing. Can you comment on that debate and the reasoning behind DOE's decision to go forward with the deployment?

Mr. HUIZENGA. Yes. It depends on the cargo, and what you are hearing is the noise in the system. Some locations, the energy windowing works better than others. So we have adjusted our monitors in general to be focused more on the HEU, because it is harder to detect, and we found this will allow a proper balance between the NORM alarm rate and the actual target quantities. So we have found it to be successful. It is kind of a crude energy windowing we are actually using. It is a little different than the one the CBP people are pursuing right now. But if the cargo is right, it actually has a benefit.

Mr. LUNGREN. Do you have anything to say about that?

Mr. OXFORD. We were asked by the Senate as well as the IG to look at energy windowing. They wanted us to convene an expert panel to look at the merits of that. What we finally collectively agreed to do is we are bringing those systems to the test bed in Nevada, so we will fully test those along with a new developmental system. So instead of doing this based on theory, we are going to actually test them against the various threats and find out how well that works.

Mr. LUNGREN. Thank you very much.

Thank you, Mr. Chairman.

Mr. LINDER. Mr. Oxford, are you familiar with the GAO recent study that said that some of these other nations are reluctant to use radioactive detectors in there simply because it will slow down commerce?

Mr. OXFORD. Yes, sir.

Mr. LINDER. What is your response to that?

Mr. OXFORD. I think that I would understand their concerns, but, at the same time, I think we have an obligation to work more collectively with them in a variety of ways. That is one of the reasons why we brought the State Department into DNDO, where they will be working with us, with our other partners, to look at future agreements that we would seek.

In addition to that, for example, we are seeking to expand our border protection by working more closely with the governments of Mexico and Canada. It extended just beyond the U.S. borders themselves, and the agreements look like they will fall into place. So we will start to extend that to ports-of-entry in North America, as opposed to just within the domestic realm.

I understand their concerns, but, at the same time, I think it is a matter of working with them collectively in the future.

Mr. LINDER. At the previous panel we had testimony that there are very small radiological detectors that can go inside the container and can actually communicate with each other. Would anybody care to tell us a little bit about that?

Mr. OXFORD. I have looked at three or four different concepts in that regard. We think there is a real opportunity there.

Again, as I mentioned, I want to make sure that we understand the cost and false alarm rate. The last thing we want to do is start offloading ships based on false alarms. So the same kind of problems we currently face at the borders. We need to work within that transit system, and then to have the real-time communications, that if we build up a threat basis of radiation during the transit, that we have communications and an interdiction, as Mr. Evenson said, a response model to get to that ship, knowing that there is an actual threat there. We think that is a great opportunity as part of layered defense that is fertile ground.

Mr. LINDER. Mr. Langevin?

Mr. LANGEVIN. I would actually like to follow up and build on the question the chairman just raised with respect to the portal monitors.

The GAO report on the Megaports program reports that they installed radiation portal monitors in two foreign ports. One of the challenges that the Department of Energy faces is getting a foreign government to agree to have the portal monitors installed at their seaports, yet the Department of Homeland Security has agreements with 35 countries to allow our Customs inspectors to be deployed to foreign ports. Many of these ports are the same ones that the Department of Energy wants to install portal monitors. Why doesn't DOE leverage existing DHS agreements to accelerate the installation of portal monitors at foreign ports?

Mr. HUIZENGA. We actually are very closely partnering now with the Department of Homeland Security CSI program. As a matter of fact, we have gone to the last several countries with the CSI as a package deal, making sure that when we are pursuing the CSI initiatives we are pursuing Megaports at the same time.

We started about 2 years after the CSI program ramped up, and I think that we are now catching up with them. But we have to install equipment. There was a concern that initially countries had that if you were going to put these radiation portal monitors in

their ports that that was going to slow down commerce. There really wasn't the same sense associated with the CSI program.

Now that we have demonstrated in Rotterdam and Greece that the program works and it really doesn't slow down commerce, we are having a lot more acceptance of the program.

Mr. LANGEVIN. With the use of Customs inspectors, wouldn't that same argument apply? They could fear they were going to slow down commerce when you have Customs inspectors on site?

Mr. HUIZENGA. If you think about it, the Customs inspectors are selecting a certain percentage of containers for secondary inspection. Our goal is to screen all the containers that go in and out of these inbound and outbound gates. So the overall sense was you are going to potentially impact our commerce in a way that the CSI people may not. So we are overcoming this operational concern at this point.

Mr. LANGEVIN. I would like just to point out in that case we have in these 35 countries—we already have an agreement that is existing. So it would seem to make sense we would want to leverage that and build off that.

Mr. HUIZENGA. We absolutely are. Like I say, we are going with the CSI people to the new ports, and we are going back to the ones they are already involved, and we are using that leverage and their relationships they have already built in-country in order to further the Megaports Initiative.

Mr. LANGEVIN. I think that is important.

Just one other question for Mr. Oxford. When I asked about training for and use of the equipment that will be installed, just if you could describe for me where the $53 million for training is coming from. Is that S&T or CBP or some other source? That is the first time I have heard of that.

Mr. OXFORD. It is in the CBP budget request, $53 million for the training and the support of fielded systems. The agreement of DNDO was we would do the development and acquisition but not the deployment nor the support of the deployment. So that is retained within the Customs' budget.

Mr. LANGEVIN. The only last comment, Mr. Chairman, if we could follow up with Mr. Huizenga, the number of elements of potential nuclear material that had been—

Mr. LINDER. We will follow up on that in closed session.

Mr. LANGEVIN. That was a striking figure. I would like to have more information.

Thank you. I yield back.

Mr. LINDER. Mr. Markey.

Mr. MARKEY. Yes. Mr. Oxford, you were named acting director in February.

Mr. OXFORD. Actually it was March 16.

Mr. MARKEY. March 16. When is that going to be a permanent director?

Mr. OXFORD. Actually, sir, that is in Presidential personnel for final decision.

Mr. MARKEY. Is it going to be soon?

Mr. OXFORD. I hope so.

Mr. MARKEY. For America's sake, I hope we have a permanent nuclear detection head, and I hope you get it, if you want it. But I just hope it is permanent. It gives you a lot more authority.

As you know, ABC News smuggled depleted uranium into the U.S. in September, 2003. I sent a letter to DHS to express my concern about the potential for a terrorist to smuggle HEU into the country. I also questioned the Department's technical capabilities to detect the importation of these dangerous weapons, usable materials.

The Department's response to my letter claimed it is likely that the radiation portal monitors could locate and identify highly enriched uranium in cargo.

On June 3, 2005, DHS issued a press release whose headline read "Nation's busiest seaports to have complete radiation detection coverage by the end of 2005."

Today, Mr. Thompson and I released an analysis conducted by experts consulted by the American Association for the Advancement of Science who confirm several other experts' conclusions that this is not true. The technology used by DHS is not capable of detecting kilogram quantities of HEU; and, in fact, no usable technology really exists to do that job. Other witnesses made similar references to this problem.

In your testimony today, you state that the problem with the detectors is not that they are not sensitive enough to detect HEU, but they are unable to discriminate between naturally occurring radioactive materials and dangerous ones.

The Department appears not yet willing to concede the limitations of the portal monitors currently being deployed when it comes to detecting highly enriched uranium. Why are you the only ones not willing to confront this reality? The science seems to be uniformly on the other side.

Mr. OXFORD. First of all, Congressman Markey, I would agree with the technical merits of the argument. I think in some cases, especially in open session, we don't want to talk about vulnerabilities, and I think we are somewhat limited by that.

Again, if you go back to my testimony, the discrimination and shielding does pose a problem, and we are working on active systems and radiography systems to supplement existing passive systems, as well as fielding advanced passive systems to get to the discrimination of lightly shielded or unshielded materials.

So it is going to take a family of systems to do the job. So I am not disagreeing with the technical basis of what AAAS did.

Mr. MARKEY. In September, 2004, the DHS Inspector General conducted a review of DHS's procedures to detect highly enriched uranium in light of its failures to do so in the ABC News case. The unclassified version of the report stated that the IG made specific recommendations to DHS to enhance the sensitivity of its detection capabilities. Has the Department implemented all of these recommendations that were in the unclassified version of the report?

Mr. OXFORD. I don't think we have implemented those. What we are doing is we are replacing the systems starting in fiscal year 2006 with the advanced systems that give us more discrimination capabilities and rapidly producing the advanced systems for active

interrogation radiography to give us the ability to detect a shielded material.

Mr. MARKEY. But you are not adopting the recommendations?

Mr. OXFORD. I would have to go back to Customs, because they would be modifying operations in the field to do that. I would have to ask CBP if they are acting upon that at this point.

Mr. MARKEY. Please report to the committee.

The AAAS analysis released today indicates that by taking some relatively straightforward and short-term engineering measures, such as better shielding of the detector, it would help improve the ability of the monitors to detect highly enriched uranium. Do you plan to examine and implement those recommendations?

Mr. OXFORD. We will look at that, along with the practicality of doing that versus deploying the new systems. We may not want to pay for two different approaches. So as we come out of the test bed this August and September we will make some determinations as to whether that is more prudent or fielding the new systems would be more practical.

Mr. MARKEY. In your testimony, you discuss the use of radiography machines that would be able to show an X-ray image of what was inside the containers at the same time as detecting whether anything in the container was radioactive. In this way, you could determine whether there was a shielded sample of highly enriched uranium in the container by looking at the X-ray image, and you could also use an X-ray image of what was inside to eliminate concern associated with a shipment of bananas that caused the radiation detectors to go off.

But this is nothing new. In fact, the company, AS&E, which has headquarters in Billerica, Massachusetts, has installed exactly this sort of system at the Port of Boston; and it is being used to simultaneously X-ray and detect radiation in every container leaving the port.

If you think that is the way to proceed, why haven't you explored the commercially available options to do so?

Mr. OXFORD. First of all, Congressman, that is the first I have heard of that particular application. We went out with a competitive solicitation on the advanced radiography program. I am not sure if they proposed against that or not with our work. I will have to go back and look at that.

Mr. MARKEY. It is already installed in the Port of Boston—installed.

Finally, in your testimony you also discuss active interrogation systems, which would certainly improve the ability to detect radiological materials. But don't these systems involve the use of neutrons that could harm the people located near the sample?

Mr. OXFORD. There are a variety of approaches being investigated. One is a neutron source and the other is a photon source. We are looking at that. There would have to be some operational protocols put into place that would limit the exposure of humans. But, again, we have to get through the technology development. That is a consideration, obviously.

Mr. MARKEY. Thank you, Mr. Chairman.

Mr. LINDER. Thank you all. We are sorry you had to be delayed, but from time to time we actually have to vote up here. You are excused. Thank you.

The hearing is adjourned.

[Whereupon, at 6:10 p.m., the joint meeting of the subcommittees was adjourned.]

FOR THE RECORD

QUESTIONS FROM THE HONORABLE NORM DICKS, FOR ACTING DIRECTOR VAYL OXFORD RESPONSES

You testified that "the DNDO is currently investing substantial resources to the Advanced Spectroscopic Portal (ASP) program, which is focused on developing detectors which will be able to discriminate between naturally occurring radioactive materials and true threat materials," and that the new systems can distinguish among different radioactive materials. You also told the committee the ASP systems will be tested in August and September of this year, and that based on the results of these tests, a limited number of vendors will be selected to begin initial low-rate production of detection systems.

- **What is DNDO's assessment of the near-term availability of ASP systems and components (for example sodium iodide crystals)?**

Response: The relative simplicity of portal hardware design requires the need for only a small number of (mostly) readily available components. However, as your question highlights, there is a potentially significant production capacity issue for the thallium doped sodium iodide crystals proposed for use by seven of the ten vendors. Initial market surveys indicate that the currently available production capacity will support the production of 125–150 portals annually. The low-rate initial production (LRIP) that will begin in June 2006 will fall within the current capacity thresholds.

- **What are DNDO's plans for encouraging industry to increase the availability of such systems and components?**

Response: The DNDO has proposed investing $20M over two years (FY 2006 and FY 2007) to increase the industrial production capacity of sodium iodide crystals. The DNDO released a Request for Information (RFI) on May 12, 2005 "to assess current manufacturing capacity and to solicit industrial mobilization recommendations and options from industry". The DNDO intends to competitively award contracts in early FY 2006 to address the known sodium iodide crystal deficiency.

- **What role will risk and cost play in DNDO decisions to move to low-rate production of new detection technology?**

Response: As with all large acquisition programs, risk and cost will be large factors in any decision to proceed through the ASP acquisition cycle, even prior to and beyond LRIP. The ASP program has undergone Departmental review to ensure that the program addresses Department requirements and to validate the projected investments. In his Decision Memorandum approving ASP through LRIP, pending successful testing, Deputy Secretary Jackson stressed the need for a concise plan to mitigate cost, schedule, and performance risks. With regards to performance risk, in particular, the DNDO is engaging in a robust test and evaluation program, as was discussed in the testimony of June 21. The thorough understanding of systems performance determined through this testing will significantly decrease the performance risks associated with the program. Additionally, the LRIP process will allow for a comprehensive operational test and evaluation opportunity to further characterize system performance prior to a full-rate production award.

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