HEARING TO RECEIVE TESTIMONY ON TECHNOLOGIES TO COMBAT WEAPONS OF MASS DESTRUCTION

Wednesday, March 12, 2008

U.S. SENATE
SUBCOMMITTEE ON EMERGING THREATS AND CAPABILITIES
COMMITTEE ON ARMED SERVICES
Washington, DC.

The subcommittee met, pursuant to notice, at 2:41 p.m. in Room SD–106, Dirksen Senate Office Building, Hon. Jack Reed, chairman of the subcommittee, presiding.

Committee Members Present: Senators Reed [presiding], Warner, and Dole.

Committee staff members present: None.

Majority staff members present: Madelyn R. Creedon, Counsel, Richard W. Fieldhouse, Professional Staff Member, and Arun A. Seraphin, Professional Staff Member.

Minority staff members present: Lynn F. Rusten, Professional Staff Member, Robert M. Soofer, Professional Staff Member, Kristine L. Svinicki, Professional Staff Member, and Diana G. Tabler, Professional Staff Member.

Staff assistants present: Kevin A. Cronin, Jessica L. Kingston, and Brian F. Sebold.

Committee members' assistants present: Elizabeth King, assistant to Senator Reed, Andrew R. Vanlandingham, assistant to Senator Ben Nelson, Nadia Naviwala, assistant to Senator Webb, Jennifer Cave, assistant to Senator Warner, Mark J. Winter, assistant to Senator Collins, and Lindsey Neas, assistant to Senator Dole.

OPENING STATEMENT OF HON. JACK REED, U.S. SENATOR FROM RHODE ISLAND

Senator REED. Let me call the hearing to order. Good afternoon. The Subcommittee meets today to hear testimony on technology to combat weapons of mass destruction—WMD. We are fortunate to have started with a demonstration of a number of technologies being developed or fielded for our military and other Government agencies, including some technologies that are used here in the homeland to protect our population.

I want to thank all of the organizations that have brought these technologies to us today, including the Defense Threat Reduction Agency, the Joint Program Executive Office for Chemical and Biological Defense, the Defense Advanced Research Projects Agency,

the Air Force, the Navy, and a number of Department of Energy laboratories.

And I also want to particularly thank Jessica Kingston of our Committee staff for organizing this technology demonstration. Jessica, you did a superb job. Thank you very, very much.

This tech demo is a great opportunity for us to see firsthand what you have developed and put into the hands of those who we ask to protect us and to detect, decontaminate, or defeat threats from chemical, biological, radiological, nuclear, or high-yield explosive weapons and materials.

We are pleased today to have three experts on the technology to combat weapons of mass destruction. Dr. James Tegnelia is the Director of the Defense Threat Reduction Agency, which is the Defense Department's agency with the lead for protection against and reducing threats from weapons of mass destruction.

Dr. Tegnelia also serves as the Director of the U.S. Strategic Command Center for Combating WMD. His agency has expertise and responsibility across the spectrum of all weapons of mass destruction and supports the combatant commands and other governmental agencies and their operational needs relating to these weapons.

Major General Stephen Reeves is the Joint Program Executive Officer for Chemical and Biological Defense at the Department of Defense. His responsibilities include the research, development, and acquisition of all chemical and biological defense equipment and medical countermeasures for all of the United States military.

It is one of the less well-known success stories that the Department of Defense has a single joint program for all chemical and biological defense efforts. His organization cooperates extensively with both the Defense Threat Reduction Agency and with the Defense Advanced Research Projects Agency, both of which conduct critical research and development on chemical and biological defense technologies.

Dr. Jan Cerveny is the assistant Deputy Administrator for Nonproliferation Research and Engineering at the National Nuclear Security Administration at the Department of Energy. The NNSA is our Nation's expert agency on nuclear weapons and related technologies. The labs that this agency works with are among the exhibitors at today's tech demo. They conduct research and development on the technologies for detecting radiation, for detecting, monitoring, and analyzing nuclear weapons activity of other nations.

We hope to learn today about the challenges you all face in trying to develop these technologies, the successes that you have had, and how this technology fits into our numerous efforts to combat weapons of mass destruction. We thank you and all of those who you work with for your dedicated efforts to keep our Nation and our military forces safe from these dangerous threats.

We appreciate that your agencies also had a role in the response to and decontamination of the Senate office buildings after the anthrax attacks of October 2001. We look forward to hearing your testimony.

And now let me turn to Senator Dole for her comments. Senator Dole, please.

STATEMENT OF HON. ELIZABETH DOLE, U.S. SENATOR FROM NORTH CAROLINA

Senator DOLE. Thank you very much, Mr. Chairman. I certainly join Senator Reed in welcoming our witnesses, and I want to thank each of you for your efforts in working to secure our Nation and our deployed forces against the threats posed by chemical, biological, and nuclear weapons.

I would also like to thank the participants and presenters who have gone to considerable effort to bring us the technology demonstrations we have reviewed this afternoon.

Throughout our history, when this Nation is faced with threats to our security and to our homeland, we have called upon our scientists and engineers to rise to the challenge of developing the technologies and innovations needed to help defeat those threats and to keep us safe.

The technologies demonstrated here today are impressive, indeed, examples of American innovation and the progress we are making. The threat of weapons of mass destruction getting into the hands of terrorists remains the preeminent threat to our country and our allies. Today's hearing will focus on the research and development efforts of the DOD and DOE to develop technologies to identify, eliminate, interdict, defeat, or destroy WMD and to mitigate the consequences of a WMD incident.

I look forward to the testimony of our witnesses regarding research and development programs under their purview to include the Nation's and their respective departments' requirements in these areas. How well their departments are doing to identify, prioritize, and meet those requirements. How they are coordinating their R&D efforts with those of other Federal agencies, as well as other public and private organizations.

I am also interested to know whether the fiscal year 09 and Future Years Defense Budget reflects sufficient priority, resources, and authorities for these important technology research and development programs.

Dr. Tegnelia, wearing two hats and the responsibilities that he has in both of these positions, is responsible for developing, integrating, and providing capabilities to reduce and counter the threat to the United States and its allies posed by WMD. We welcome your testimony of how DTRA integrates and coordinates these disparate efforts to meet the requirements identified by the department for combating weapons of mass destruction.

General Reeves is responsible for the research, development, and acquisition of all chemical and biological defense equipment and medical countermeasures for the armed services and for integrating and coordinating all DOD efforts to develop and field chemical, biological, radiological, and nuclear defense equipment as well as medical countermeasures for the warfighter.

We welcome your testimony on how DOD establishes requirements in this area, how you apportion resources to meet those requirements, how efficiently DOD transitions technology into fielded capabilities, and to what extent these protective capabilities are provided to the active, Reserve, and National Guard components of the armed services.

Dr. Cerveny is responsible for research and development to support nonproliferation requirements, using the unique facilities and scientific skills of the DOE national laboratories in partnership with industry and academia. The core mission of her organization is to develop the next generation of nuclear nonproliferation sensors and detection capabilities.

We welcome your testimony on how you prioritize technology investment and how you coordinate and integrate these research and development programs within DOE and with other Federal agencies, including the Department of Defense and the Department of Homeland Security.

Let me again join our Chairman in thanking all of our witnesses for their service and certainly for appearing here today and giving us your testimony.

Senator REED. Thank you very much, Senator Dole, not only for your statement, but also for your great collaborative efforts on the Subcommittee. We enjoy very much—I do—your support and your participation.

Senator DOLE. Thank you.

Senator REED. The witnesses, your written statements will be made part of the record. So feel free to summarize, to cut to the point of most importance, and we will recognize Dr. Tegnelia first. Dr. Tegnelia?

STATEMENT OF DR. JAMES A. TEGNELIA, DIRECTOR, DEFENSE THREAT REDUCTION AGENCY; AND DIRECTOR, U.S. STRATEGIC COMMAND CENTER FOR COMBATING WEAPONS OF MASS DESTRUCTION

Dr. Tegnelia: Thank you, Mr. Chairman. Senator Reed and Senator Dole, thank you very much for taking this opportunity to give all of our engineers and scientists the opportunity to display to you some of the important work that they are doing. We appreciate this opportunity.

We also—I also would like to tell you that I appreciate the opportunity to appear before you on this panel with two associates, General Steve Reeves, who our agency works with on a continuing basis with regard to the chem and biological weapons program, and also Dr. Jan Cerveny of the Department of Energy.

DTRA and the Department of Energy, DTRA has the responsibility for being the executor of the Nunn-Lugar program, and we work with the Department of Energy on nuclear matters associated with the Nunn-Lugar program. So it is a pleasure to be on the same panel with them this morning.

Sir, as you indicated, we have submitted our statement for the record. That statement outlines six challenges that the Defense Threat Reduction Agency is responsible for addressing. In order to be brief, I would like to summarize, if I could, just two of those challenges.

The first one is the subject of loose nuclear weapons and what we would do about that, and the second one, if I don't take too much time on that subject, is to just summarize advancing biological sciences and their impact on weapons of mass destruction.

Those are the two topics that I would like to talk—

Senator REED. I don't mean to artificially cut you off either. Take as much time as you like, but you don't have to just read the statement.

Dr. Tegnelia: Yes, sir. I didn't intend to read, sir.

Let me start with the loose nuclear weapons. As I indicated at the start, one of the significant purposes of the Nunn-Lugar program is to secure nuclear weapons, secure nuclear material, and destroy nuclear—strategic nuclear weapons delivery systems. We think we have, over the 15 years, a pretty good track record with regard to that.

The subject of loose nuclear weapons begins if some of those safeguards should happen to fail and a nuclear weapon or nuclear material ends up in the hands of a terrorist group with the intent to detonate a device either in a city in the United States or the city of an allied government. That is the topic of loose nuclear weapons.

Now we are very active in that program and, in fact, have a capability today to deal with loose nuclear weapons. It is the capability that we have today and the ability to improve that capability, which serves as the challenge to the research and development activity.

We—the fundamental element associated with finding loose nuclear weapons today is the fact that we either must have precise intelligence information as to the location of that device, or it has to pass through a portal on a foreign border or in a harbor before that device could enter into the United States. We and the Department of Energy work on those portals, and we have them deployed outside of the United States to try to find those nuclear devices.

One of the significant research and development challenges is to do nuclear detection technology so that we can increase the range and increase that range from a few tens of meters to hundreds of meters and kilometers. So that we no longer are limited by the fact that we have to have precise intelligence information or that they must pass through a portal in order to be able to find it. That is probably the most challenging research and development task that we have today.

Now we work that problem with the Department of Energy, with the National laboratories, and also you may be familiar with an initiative, which is called the Global Initiative on Combating Nuclear Terrorism, which President Bush and President Putin started 2 years ago. One of the elements of that global initiative is to do cooperative international research associated with this detection of nuclear material and detection of nuclear weapons problem, and we work cooperatively with several other participants in the global initiative on nuclear detection.

In the event that you find a weapon, the next important problem is how do you demilitarize it or disarm it? What we would like to do is what we are working on is research associated with how do you disarm the weapon at a distance, at standoff ranges? Today, you have got to be in close proximity to the weapon.

And second, to be able to disarm it in a manner that doesn't require you to have precise information having to do with the construct of the weapon. That represents again a significant challenge to us, and we are in the process of working that activity as well.

Lord forbid, if both of those fail and a nuclear weapon ends up or nuclear material ends up in a city in the United States or in a city of an allied country and there is a detonation, then two significant problems occur to the first responders. The first problem is the subject of attribution. How do we know who did it?

And that is an important question because of three points. The first one is if we know how to attribute, then that serves as a deterrent in its own right from people doing this kind of an action. The second thing is it is very important for us to make sure that we can attribute quickly enough that we can stop a second or subsequent event from occurring. And then, finally, should the decision be made for retribution, then the information that you get from attribution is critical in making the decisions to do that.

Now you saw several devices around the room today on the subject of attribution. We are just now at the point where the research and development is beginning to produce product for which we can field a first nuclear forensics capability for the subject of attribution. And the biggest challenge that we have now is putting that kind of a capability into the field.

The research challenge is to be able to reduce the time to do that analysis and also to make sure that we are getting good certain information from the analysis that we are doing. I will indicate that Dr. Cerveny's operation in the Department of Energy and in conjunction with Department of Homeland Security and the FBI are very active in developing the capability for attribution.

The last topic that one would address with loose nuclear weapons is the subject of consequence management. Now I would suggest to you that the Department of Defense has done several exercises with regard to RDDs or dirty bombs, improvised nuclear explosives, and we have done those in States, in Hawaii and in Indianapolis.

We also have been part of a series of interagency tests called TOPOFF associated with RDDs, dirty bombs. And as I mentioned on the Global Initiative for Combating Nuclear Terrorism, we are now doing international activities associated with consequence management.

I would leave you with the following conclusion with regard to those—what we found in those exercises, and that is INDs and RDDs represent a very large spectrum of consequences, from few deaths and economic disruption to large numbers of deaths and significant economic disruption on the part of both INDs and RDDs. I believe our local responders and the State units, assisted by the Federal Government, are capable of handling the lower end of this spectrum.

Our exercises show that the local responders are capable of dealing with this kind of an activity. It is when you get closer to the higher end of the spectrum, where there are significant yields, significant numbers of deaths, where the operational and research challenges are in the extreme. And that represents a significant research challenge to us.

You saw some activities here associated with decontamination. You saw some activities associated with medical therapeutics for radiation poisoning. And finally, you saw modeling that was going on in this room to help with the—with helping the first responders

and knowing the very difficult environment that they are going to be working in.

Sir, that completes—ma'am, that completes my comments with regard to loose nuclear weapons. And I would just ask you for a time check. Do I have a few minutes to talk about biological sciences for just a second?

Senator REED. You are still making sense. Go on. [Laughter.]

Dr. Tegnelia: Thank you, sir. That is the check. Thank you, sir.

Let me spend just a few minutes on the biological thing, as I don't want to take time away from the other members of the panel.

Biological sciences today represents the most advancing scientific discipline worldwide. The fact is we are probably in a situation which is analogous to the dawning of the atomic age in the 1930s before somebody had really demonstrated a modern biological weapon or designed such a biological weapon. So the fact is that we are in the process of trying to develop a toolkit in order to be able to be prepared for the advancing of biological sciences and the fact that almost every advancing science has a negative side to it, even though it has been beneficial to mankind.

So we—I believe that our significant challenge is being prepared for, having the toolkit available for advancing biological sciences, and I just want to summarize two things very briefly.

The first thing is you are probably aware of the fact that very important research is being done on the part of the Nunn-Lugar program. They are creating a series of what are called central research laboratories in Central Asia, where they are collecting rare pathogens, centralizing them, and categorizing them. And those pathogens represent setting the challenge for us to be able to develop therapeutics to be able to respond to those pathogens should an entity be able to isolate them and create a biological weapon from a rare species.

So that is the first problem. First problem is how do you detect the presence of it? How do you understand the pathogens you are going to be dealing with, and how do you prepare for those?

Then there is a second program, which is how do you respond to those diseases should, in fact, they present themselves to either our forces or to civil society? Now, General Reeves is going to talk to a program called the TMTI, Transformational Medical Technology Initiative. I will just summarize it by saying that DTRA works with Steve's operation, and their purpose is to create medical therapeutics that can respond to this advancing biological sciences activity and also to work on means of producing those therapeutics rapidly and safely in order to be able to respond quickly to the presentation of a new biological weapon or a rare strain of a particular disease.

Sir, with that in mind, ma'am, with that in mind, I would like to summarize and just tell you that I appreciate the opportunity to be on this panel today and represent the effort of the Defense Threat Reduction Agency. This is our tenth anniversary. I think it is a witness to the founding fathers' foresight that they were concerned about weapons of mass destruction in the hands of terrorists long before 9/11 occurred. And I think you can see that there are dedicated people that are concerned about that.

I also, as you mentioned, in my second hat work with STRATCOM. STRATCOM is the element of the combatant commanders who are responsible for making this capability available to the combatant commanders to help combat weapons of mass destruction. And General Chilton, who is the commander of STRATCOM, is an assist in us producing what are now rare, highly expensive, and, therefore, scarce units, getting the concept of operations prepared for those units and getting them out into the field and exercised in order to be prepared for this advance of weapons of mass destruction.

So, again, I thank you very much, both for your participation with our displays and for your attention this afternoon. [The prepared statement of Dr. Tegnelia follows:]

Senator REED. Thank you very much, Doctor.

And General Reeves? And again, you can summarize, but don't feel constrained by the clock.

STATEMENT OF MAJOR GENERAL STEPHEN V. REEVES, USA, JOINT PROGRAM EXECUTIVE OFFICER FOR CHEMICAL AND BIOLOGICAL DEFENSE, DEPARTMENT OF DEFENSE

General Reeves: Thank you, Mr. Chairman. And I am honored to testify today on behalf of the Department of Defense chem/bio defense program, the United States Army as the program's executive agent, and as the Joint Program Executive Officer for Chemical and Biological Defense.

As requested, I will summarize my remarks. On a daily basis, we are asked to do three things in this program. One is support for the force in current operations. Second is to improve our fielded capability. And the third thing is to build for the future.

It is the rapid pace that Dr. Tegnelia referred to of chemical and biological technology development and, unfortunately, its proliferation in the information age and the globalization of that technology and expertise that tends to broaden our threat context today. And this is going to make uncertainty the defining characteristic of the present and future environment. And so, we now have to prepare our forces for a much broader array of threats, including toxic industrial chemicals and materials, while also preparing for those future threats.

To counter that existing threat, in the past year, we have fielded over 1.2 million individual items of equipment, and you saw some of the examples of that equipment today in this room. In coordination with the Department of Health and Human Services, we have provided anthrax and smallpox vaccine to both our warfighters as well as to the U.S. Strategic National Stockpile.

We have also strengthened our partnerships over the last 5 years with Federal, State, and local agencies to ensure our military installations are prepared to mutually support and interoperate in the civilian communities in which they reside. We fielded critical incident response and protection capabilities in support of the National Guard as well as the U.S. Army Reserve.

As we look to the future, our goal is to ensure that we are never technologically surprised. And again, as Dr. Tegnelia alluded to, it is the emerging sciences of genomics and proteomics and the tools of genetic engineering that are not only creating great opportuni-

ties for us, but also the potential for our adversaries to develop new and previously unknown toxins, viruses, and bacterias.

So we are working with nano biological information and cognitive technologies to develop a broad spectrum capability needed to counter these uncertain advance threats. For example, we are leveraging information in biotechnology developments that are enabling us to develop capabilities for rapid identification and the genetic sequencing of unknown threats and the creation of a broad spectrum therapeutic countermeasure that we refer to as the Transformation Medical Technology Initiative.

We also have multiple interagency and international partners. For example, in the physical sciences, we work collaboratively with the Department—or the Defense Advanced Research Projects Office and the Department of Homeland Security. And in pharmaceutical development, we work very closely with the Department of Health and Human Services.

Even with this progress, challenges remain. Standoff identification of chemical and biological agents, developing detection protection and decontaminant capabilities for all hazards, common test and performance standards across our agencies and our operations, and toxic industrial chemicals and the unique atmospheric conditions in an urban environment for CBR protection.

Mr. Chairman, Mrs. Dole, I do want to thank you for allowing me to testify today. Your continued support to the chem/bio defense program is crucial for our military and for our Nation to succeed in defeating weapons of mass destruction. We fully recognize that even the smallest use of these weapons can create an environment of instability, doubt, and fear among our allies and citizens at home, and we believe we are fielding equipment and pharmaceuticals for our armed forces and deploying interoperable systems at our installations worldwide to address this threat.

We are in the process of developing broad spectrum technologies to counter the evolving threat, and we are working closely with our interagency partners to defend the homeland. With your guidance and assistance, we believe together we are bringing future technologies forward to protect our military and the Nation against chemical, biological, radiological, and nuclear threats.

Thank you very much. [The prepared statement of General Reeves follows:]

Senator REED. Thank you very much, General.

Dr. Cerveny?

STATEMENT OF DR. T. JAN CERVENY, ASSISTANT DEPUTY ADMINISTRATOR FOR NONPROLIFERATION RESEARCH AND ENGINEERING, NATIONAL NUCLEAR SECURITY ADMINISTRATION, DEPARTMENT OF ENERGY

Dr. Cerveny: Good afternoon, Chairman Reed, Senator Dole.

I am pleased to be here this afternoon to testify on behalf of NNSA to your Subcommittee on the critical nature of work underway in NNSA and how we work closely with other executive branch organizations, many of which are represented in this hearing room, to advance the nonproliferation objectives of this Nation.

Acquisition of weapons of mass destruction by rogue states or terrorists stands as one of the most potent threats to the United

States and international security. The continued pursuit of nuclear weapons by terrorists and states of concern underscores the urgency of NNSA's defense nuclear nonproliferation efforts to secure vulnerable nuclear weapons and weapons-usable nuclear materials, to detect and interdict nuclear and radiological materials and WMD-related equipment, to halt the production of fissile material, and, ultimately, to dispose of surplus weapons- usable materials.

Our Office of Nonproliferation R&D supports NNSA programmatic missions by providing innovative technology and scientific advice. The core mission of the Office of Nonproliferation Research and Development is to develop the next generation of nuclear nonproliferation sensors and detection capabilities, as you stated earlier.

We execute our programs through a variety of high-tech institutions and organizations, such as leading universities, small businesses, industry, and, most importantly, the U.S. national laboratories. The laboratories are truly our go-to guys for unique, cutting-edge R&D, and they play a critical role in transitioning our technology into operational systems and platforms.

Our programs focus on providing long-term, stable guidance and funding for R&D through two primary programmatic offices—Proliferation Detection, or pre- detonation or pre-boom, and Nuclear Detonation Detection, or post detonation, post boom.

Proliferation Detection focuses R&D resources on detection of foreign production of highly enriched uranium, detection of foreign production of plutonium, and advancing the state-of-the-art for detection of illicit movement of enriched uranium or plutonium or special nuclear materials, as we call them.

These mission areas are supported by enabling technology development in areas like remote sensing, as in our display, advanced radiation detection materials, and simulation algorithms and modeling. Further, we have a robust test and evaluation program focused on ensuring that new technologies are suitable for transitioning to our operational partners.

The other office in my area, Nuclear Detonation Detection, the post boom piece, provides the operational systems and know-how to detect nuclear detonations anywhere in the world, 24/7, 365 days, whether they are underground, in the atmosphere, or in space. NDD also develops the tools, technologies, and science related to collecting and analyzing forensic information gathered after a nuclear detonation in conjunction with the work of DHS and DTRA.

I would like to turn now to NNSA's long-standing close and collegial relationship with the Department of Defense, specifically the Defense Threat Reduction Agency. I am pleased to be here testifying with my colleague Dr. Tegnelia of DTRA. DTRA and NNSA, as well as our collective predecessor organizations, have nearly 60 years of close technical cooperation.

From the earliest days of the Manhattan Project through the nuclear testing era of the Cold War and into our current programs to counter the threat of WMD, we have enjoyed a healthy and continuous set of joint programs. A key premise of the NNSA nonproliferation R&D program is that research projects may have many different users, those within NNSA, the Defense Department

agencies, the military services, the director of national intelligence agencies, and/or the Department of Homeland Security agencies.

We concentrate on advancing the fundamental state-of- the-art in the particular technology area and then pass that technical capability on to a user for incorporation into a specific piece of equipment or a specific concept of operation.

In the case of the Department of Defense, this often means a close association not only with their R&D components of the various DOD organizations, but also with the operational components of DOD.

Turning to our continuing interactions with other Government agencies, I would like to highlight a four-way memorandum of understanding with NNSA, DTRA, the Domestic Nuclear Detection Office from DHS, and the Director of National Intelligence's Science and Technology Office, wherein we coordinate our radiation detection R&D programs. Not only do we review each other's research proposals jointly, we sit on merit review committees for each other's programs annually and thus benefit from this very close collaboration of knowing what each other is doing.

We collectively work to ensure that duplication of effort across the agencies is minimized. But more importantly, we bring significantly more resources, emphasis, and senior attention to bear on the areas critical to national and homeland security.

All of the projects on our display today that I believe both of you had the opportunity to see have been either developed in conjunction with DTRA or with DTRA's DOD customer set in mind. And these projects were consciously focused to meet operational needs and requirements.

In conclusion, I have provided but a few highlights of our program and touched upon the collaborative interface and interactions our program has shared with other Federal partners. We continue to serve as a primary long-term investor into nuclear nonproliferation R&D technologies to keep our National and homeland security operational associates on the cutting edge.

In summary, I would like to thank the Committee for this opportunity to provide information on the critical nuclear nonproliferation-related research and development underway at NNSA and the ways we link this work with partner organizations.

With that said, I am happy to answer any questions. [The prepared statement of Dr. Cerveny follows:]

Senator REED. Thank you very much, Dr. Cerveny.

I want to thank the witnesses for their excellent testimony. I also want to thank all of your colleagues, some that are here today and some that are across the globe, for the work they do. Not only are they employees of DOD and DOE, but also civilian contractors who work with you. They provide extraordinary advantage to us as we confront these serious problems.

I would like to ask a few questions, then recognize my colleague. And I would assume also the opportunity to do a second round, too. But it was excellent testimony.

You have laid out several serious challenges, and I just wonder if each of you could respond because of your experience. What is the issue that causes you most concern? Some have already high-

lighted in your initial remarks, but you might want to emphasize it or provide additional perspective.

And also if you were to advise the Subcommittee, which, in fact, you are, what should we be focused on? What should we be making sure gets done throughout the research structure? Dr. Tegnelia?

Dr. Tegnelia: Yes, sir. I would give you the perspective that, you know, there is this question, which is usually asked of our leaders, which is what keeps you up at night or what is your worst nightmare? And I would second the thought, as I indicated in my testimony, that it is a loose nuclear weapon in a city in the United States. I would just suggest that. I think that is today's current problem.

And I just would reiterate, I think you have heard testimony on this before, that the expansion of the Nunn- Lugar program to help prevent that kind of an activity, both we and the Department of Energy, is maybe the most important function that we are performing today.

For the future, I think the problem that General Reeves and I discussed, which is the advancing of biological sciences and the potential for negative that is associated with that and preparing for that, I think, is the threat of the future.

And again, I would suggest to you that in addition to the research and development, you have heard some ideas, I think, in testimony about the idea of expanding Nunn-Lugar to be able to do worldwide prevention of these kinds of problems, and the idea of migrating to these biological tools that we are building, biological weapons tools that we are building worldwide, I think, would be a very valuable thing.

So, summary, today it is the nuclear problem, and tomorrow, it could be the biological problem.

Senator REED. Thank you.

Major General Reeves?

General Reeves: Thank you, Mr. Chairman.

I would certainly second for the future threat what Dr. Tegnelia just mentioned. It is the biological threat that potentially concerns us the most. As you may know, 4 years ago, a university in New York, simply by ordering strands of DNA on the Internet, put together a polio virus. Just a few weeks ago, a California firm announced that they had created the first synthetic bacteria.

Things that are being done today in high schools, in colleges just a few years ago were only done by post- doctorate students. That is how fast the biological sciences are advancing. And so, that certainly concerns us the most.

In the near term, our experience with the terrorist threat in DOD is that it is strategically sophisticated, but tactically very simple. They use what is available, and what is most predominantly available are toxic industrial chemicals. I know the Congress is currently taking action on securing the U.S. chemical industry, and I certainly applaud those actions.

As we look at where we need to do additional research, particularly in understanding the performance of these toxic industrial chemicals to protect our force is where we are focusing some of our efforts. And let me just give you a very simple example.

Many of the models that you have seen that show what happens when a chemical starts to proliferate through an urban area or over open terrain simply models that chemical. Take something like boron trifluoride, which is a common chemical that is used in the semiconductor industry.

When that chemical hits the air, it changes. It changes into hydrogen chloride. It changes into an acid. Models don't accommodate for those changes. It has different performance characteristics. And so, we need to go through literally our entire inventory of equipment to look at how do we deal with those threats, and how do we provide immediate and near-term protection for our force?

Senator REED. Thank you. I want to ask the same question of Dr. Cerveny. But if I may follow up, essentially, the barriers—as you have said, the barriers to entry to the biological business are much lower than the nuclear business.

General Reeves: Yes, sir.

Senator REED. And you know, the model and the mindset we have applied to nuclear deterrence and nuclear nonproliferation might not be adequate because, again, it seems everybody can get in this business of biological or chemicals, and it raises the question of even if we are innovative and improvise very well, can we keep up?

And you might comment, then I will recognize Dr. Cerveny. Do you have a sense—I mean, this is a different dynamic than the nuclear situation?

General Reeves: It certainly is, and I think what you have to do is look at how do you go about developing the tools for rapid broad-based identification of these threats. And that is exactly where we are focusing our efforts right now. We are focusing them on things like genetic sequencing and bio informatics.

How do we leverage the, if you will, mega technologies of information technology and biotechnology to, first, develop a platform so that we can identify what is going on? Second, you have to develop a very rapid means of developing a countermeasure and then, ultimately, producing that countermeasure.

That is a lot of what the Transformational Medical Technology Initiative is all about is the identification and having prepositioned, if you will, platform technologies that we can rapidly build on to develop countermeasures and, with our partners in DARPA, developing the manufacturing capabilities to rapidly produce the countermeasure.

Senator REED. Thank you, General Reeves.

Dr. Cerveny, the larger question was, as Dr. Tegnelia said, what keeps you up at night?

Dr. Cerveny: The concerns that I have have to do with the three major missions that we have to ensure that we can try to accomplish them. One is to look at the nuclear fuel cycle and try to find those who may be trying to proliferate. That is a big issue for us.

In addition, if we miss that and it does get into a weapon system, we want to be able to find that weapon system. And then, God forbid, it should go to the end and a nuclear weapon that is already full-up gets stolen and detonated somewhere. We want to be able to do the aftermath, detection of what is going on, to be able to do

all the forensics associated with that. So those are my three major areas of concern.

Senator REED. Well, following up on that, Dr. Cerveny and Dr. Tegnelia, the National Security Presidential Decision Directive 17 and Homeland Security Presidential Decision Directive 4 assigned nuclear forensic and attribution responsibilities—your final point—across the executive branch. Could you comment on essentially your responsibilities and how this is proceeding, the coordination process? And if you could start, Dr. Cerveny?

Dr. Cerveny: I am doing some of the research at the front end. So I have transitioned that both to DTRA as well as to the FBI as well as DOD and/or other components of DHS.

Senator REED. Dr. Tegnelia?

Dr. Tegnelia: Sir, NSDD–17, HSD–4 basically indicated that DHS was the lead in the attribution and detection—attribution and forensics capability. They work with the intelligence community, which has the responsibility to provide the information for decisions.

They broke that activity up into two pieces. One was pre-detonation and one was post detonation. DTRA is responsible for worldwide post detonation collection of the debris for analysis. And we work with DHS, as I mentioned, as the lead. We work with the Department of Energy because their laboratories are the people who are going to do the analysis of these remains of a device and make the attribution as to who it is technically.

And then we also work with the FBI because the FBI has responsibility inside of the United States for the investigation of these types of devices. That is how the NSDD separates out the responsibilities.

Senator REED. And one follow-up question, Dr. Cerveny, and then I will recognize Senator Dole. And I do have more questions for the whole panel.

But this attribution process assumes that you have a database, which you can match up, that you can, in fact, identify and attribute to an ante or country. How are we doing on that database creation?

Dr. Cerveny: That database creation, I believe you are talking about the NMIP that is being created by the intel community? Is that what I am presuming you are saying?

Senator REED. I am just generally talking about from your perspective because you were doing research to identify materiel, but then you have to match it up with something. And I am asking from your perspective, how is the something coming, I guess?

Dr. Cerveny: Exactly. From the testing era, when we had the Cold War testing era, there is quite a bit of data from there from the Russians and from us, from our testing itself. And what we do with that is match against that.

Some of the newer stuff that the proliferants may be trying to make is going to be a bigger challenge for us because there is no database on that.

Senator REED. Any other comments? Dr. Tegnelia?

Dr. Tegnelia: I guess I would add to that that the subject of broadening that database is under active pursuit by the intel-

ligence community, and at least my experience is they are paying full attention to trying to do what you are suggesting.

Senator REED. Thank you very much.

Senator Dole?

Senator DOLE. Thank you, Mr. Chairman.

Dr. Tegnelia and General Reeves, let me ask you about a March 2007 report by the DOD inspector general. It was highly critical of the department's coordination and management of its combating WMD program. The report's main recommendations were for DOD to better coordinate the work of 40 offices involved with combating WMD, establish a process to measure performance, clearly identify the use of the funds budgeted for the program throughout the department, and propose legislation requiring that the Federal agencies involved in combating WMD coordinate with one another.

Could you give me your assessments of the IG report and what steps has the department, including your own organization, taken in response to the IG report? Could we start with you, Doctor, and then, General Reeves, ask you to respond?

Dr. Tegnelia: Yes, ma'am. As you indicated, there were two elements of the report. The first, there were 40 organizations who were all dealing with weapons of mass destruction. My—I would suggest to you that the report was written with data that was done in 2005, and a lot has happened since 2005 to address the issue that you are concerned about.

I would suggest to you that having a reasonable number of organizations concerned with WMD is a strength, not a weakness. For example, there are 50 civil support teams, all of which are trained to handle WMD. And so, having a reasonable number of organizations concerned with WMD is a strength, not a weakness.

The problem is to make sure that they are all working together and on the same page. And what has happened since that time is the formation of the Strategic Command as the lead combatant command for combating weapons of mass destruction. And their responsibility is to get all of these units working together, working in concert to be able to help both local communities and so on through NORTHCOM, but also our allies in the process of doing that.

So my sense is that the situation has changed significantly since STRATCOM has been on the scene in trying to help orchestrate the problems that that report indicated.

Senator DOLE. Thank you.

General Reeves?

General Reeves: Ma'am, I would second that and add to STRATCOM the Northern Command as well. Those two major commands between the homeland defense mission and the larger civil support mission, both have helped consolidate a number of the activities.

As you indicated earlier, in the case of the research, development, and acquisition of equipment, that has, in fact, all been consolidated under a single office and that that has been an ongoing program now for a number of years, which we continue to have a very robust single chain of command, if you will, to execute that program.

Senator DOLE. Thank you.

Dr. Cerveny, with the aging and gradual passing of the Manhattan Project generation of nuclear scientists, our Nation is facing a loss of scientific expertise in the nuclear field that will be hard to replace. Recent studies highlighted the need to replace the retiring generation of scientists who have the skills to contribute to the field of nuclear forensics through which scientists can discern the age and origin of nuclear materials.

Are you finding that this loss of expertise is a problem the research and development programs are experiencing under your purview?

Dr. Cerveny: It is starting to happen, Senator Dole. It is starting to occur. Within 5 years, we are probably going to have a pretty serious impact because of, as you said, the age that these folks are becoming. They are ready to retire now.

There are younger ones that are coming into the fold. And I don't want to in any way denigrate them, but they don't have the experience of any of the testing that we have done or even the Manhattan Project type of information that those senior scientists have available in their brains.

The younger ones are bright, no doubt about it. But lacking that experience and finding a way to maybe hook a wire to the older guys who are retiring heads and do a data dump into the younger folks would be wonderful. But it is very difficult to find, and we are working hard on that with the laboratory community to ensure we do get some of that transition occurring. And it is a challenge.

I did read the report that you are talking about, the NAS report. And it was quite sombering to read that.

Senator DOLE. Right. Yes, and I wonder if there is anything this Committee could do to be helpful? Perhaps by authorizing some kind of fellowship program to attract young scientists, more young scientists to the disciplines where you foresee shortfalls? And I understand what you are saying about the degree of expertise, but in general, do you think there is a need to just attract more young people into this area, and could we be of any help in that respect?

Dr. Cerveny: From the standpoint of do we need to attract more? Yes. And we are working very hard on that. In fact, it is interesting you should ask. We had a conversation with our laboratory partners yesterday about how we could do this, if we could develop fellowships or establish fellowships to encourage them to potentially come into the laboratory for a short timeframe and then rotate into the Washington office here in D.C. to get the flavor of what is going on from the overall standpoint.

So we are working on doing those sorts of things. Maybe not to the degree that you are interested in, but we are definitely working on trying to make that happen.

Senator DOLE. Okay, thank you.

General Reeves, how would you characterize our technical progress in improving the accuracy of our sensors, both detection of agents and reduction of false positives. What are the major technical challenges which remain to be solved in the area of sensor technology?

General Reeves: There are really two major areas. One has to do with standoff technology, which is clearly extremely problematic. In order to identify an agent, be it chemical or biological, at range—

or even radiological at range—presents a large variety of issues with atmospherics, the type of sensor, and literally where you can use that sensor.

The second major issue we have is in, as you point out, false alarms, which is sensitivity and selectivity. That has gotten progressively better and, I would argue, almost exponentially better over the last few years. In June of this year, because there has been so much work not only within the Government, but also by private industry in this area, we will be holding a technology readiness evaluation at Dugway Proving Grounds, where we will allow both laboratories both within DOD and from outside of DOD and private industry to come to Dugway to demonstrate their capabilities and then independently evaluate their technology readiness levels.

It is our view that they have gotten significantly better, that we can reduce our own investment to some degree for point sensors in the biological detection area and leverage good work that has already been done in lots of other areas. So it is actually a cost avoidance to us.

Senator DOLE. Thank you.

Thank you, Mr. Chairman.

Senator REED. Thank you very much, Senator Dole.

Dr. Tegnelia, in your comments, you said that local responders are proficient in handling a low-yield incident, but that there is a gap with high-yield incidents. How difficult it is relative to a low-yield to stage a high- yield, i.e., if the high-yield is something of a probability of 1 percent, then that gap is not as worrisome if that probability is something closer to 50 percent.

Can you give us an idea in this session of how much we have to worry about that lack of capability?

Dr. Tegnelia: Excuse me. I was thinking about that question, and it is an important question. I would just tell you that in an open hearing, it is hard to discuss that specifically. But we are thinking about the question that you are concerned about.

Senator REED. Fine, fine. It is an important question.

Dr. Tegnelia: Yes, sir.

Senator REED. It has to be handled, I think, in a more confidential manner.

Let me ask all of you because one of the issues that perennially arises when you develop technology is getting it into the hands of the field workers, the people out there that actually do it. Can you give us a notion of how do you think we are doing in transitioning technology? What are the chokepoints that we have to worry about? And I will ask each witness.

Dr. Tegnelia?

Dr. Tegnelia: My perspective, sir, is the mission, the military mission of combating weapons of mass destruction, as a mission, is a relatively new operational responsibility for the Department of Defense. We have just put together the National strategy and the military strategy for combating weapons of mass destruction, and we are now in the process of beginning to field capabilities not only with the individual soldier, which General Reeves spends a lot of time on, but also unit capabilities to handle the missions of weapons of mass destruction.

We have done something which I think is extremely important as a lesson learned from Iraq, and that is how would you eliminate chemical, biological, or nuclear weapons should you encounter them on the battlefield? Very important problem. Something we were concerned about in Iraq.

We have fielded a capability now through STRATCOM, which takes work from Edgewood Arsenal, from the research organizations at Edgewood Arsenal, and fields an operational capability that could help in South Korea, in —it is actually deployed now in Iraq, eliminating these kinds of weapons from the battlefield. That is a new capability. It is a brand-new thing that has been developed.

So you can see—another example of that is fielding an attribution capability, which the NSDD, as you pointed out, is just now calling for. So these new units are coming online through STRATCOM activities, and they are being deployed to our combatant commanders, including NORTHCOM. And we are beginning to exercise with them, and we are beginning to build the capability. So we are started, but we have a long way to do.

This is, as I indicated, a new mission, and it is now beginning to get the emphasis to field this kind of capability.

Senator REED. Thank you.

General Reeves?

General Reeves: Sir, in the chem/bio defense program, we do three things. First, we have a formal process to ensure that our investments in science technology transition to advance development. We use something called technology transition agreements, which are a formal agreement between the S&T developer and one of my project managers to ensure that they are mutually understanding what that technology is, and they are ready to accept it, and we have put the resources in place to use it.

Second, we conduct quarterly reviews. And third, on a biannual basis, our joint staff looks at the roadmaps to ensure that those investments are reaching to advance development and to procurement.

The second thing we do, as I mentioned a moment ago, are technology readiness evaluations, which are independently assessed, which gives laboratories and commercial industry the opportunity to demonstrate their technologies and what their technology readiness levels are. And we use a formal process by an independent assessor to do that.

The third part, which is just now beginning, and I think it is an important initiative—and I would specifically compliment the Edgewood Chemical and Biological Center for doing this—is an educational component. One of the things we need to do with our researchers and scientists is to get them to understand that not all technology is necessarily good or useful. At some point, you have to look at technology from the standpoint of is it affordable? Can it be produced? And can you sustain it in the field?

And they have developed a formal program to educate their basic research scientists to help think in those terms and use those kind of filters before we make substantial investments in a technology we discover we can't use in the end.

Senator REED. Thank you.

Dr. Cerveny?

Dr. Cerveny: Thank you. For my program, we have instituted a whole host of things because a transition for a program that is a long-term R&D program is considered to be like sort of the valley of death that can occur for research technology that you develop and suddenly nobody is really interested in it.

What we have tried to do is include the operators and—tried to do—we actually do include the operators on the upfront of developing what our roadmaps are going to be and where we are going to go to ensure we have what their needs and requirements are. In some cases, that requires translation on our part because oftentimes our users don't know how to tell us in technical terms what it is that they want to be made better or lighter or more power-friendly.

So we have to be able to do that integration in between. And having the users on our committees for deciding what proposals are actually going to get funded in an area once we decide where we are going to go, then having them also in our annual program reviews for each of the 13 separate programs that we have, it has seemed to become very easy for us, as the ones that I showed you back here on our display table, the integration or the movement, transitioning those to the users has happened quite easily for us. And they have actually been anxious to receive them.

Does that mean we have solved the entire problem? Not entirely. It is still a challenge for us, and we do many of the things that my two colleagues here have mentioned as well.

Senator REED. Thank you.

Dr. Cerveny, the budget request at NNSA for nonproliferation and verification in fiscal year 2009 is $275 million. That is $112 million below the fiscal year 2008 appropriation. That is a substantial reduction. What is not going to be accomplished as a result of that reduction?

Dr. Cerveny: The major difference there is the generosity of the Congress when they passed the Omnibus and gave me the $112 million plus-up, which was very kind of them. And what I did with it was place it into the prioritized areas that we have to ensure that we had full- up proposals funded.

The $275 million actually is level with the real 2008 request that we put in and the 2007 request. In 2010, I believe we are going to be going up, though that number has not been established yet for us.

Senator REED. The fiscal year 2009 budget eliminates a line called supporting activities. Can you describe what that is?

Dr. Cerveny: Yes, sir. The supporting activities was an unusual thing that was a leftover—I have been there for 4 years. And it was a leftover, none of the other components of NNSA really showed such a thing. And when I inquired what it was, it was really money that we transitioned into the two major programs that I discussed, the Proliferation Detection and Nuclear Detonation Detection.

What I did was just transfer those functions that belonged to them into them. So nothing really vanished. It just moved to where it belonged.

Senator REED. You know, I think the Congress was persuaded that you needed the money, and I think we, given what I have heard today, I am no less persuaded. So it is a substantial reduction, and the activities, and you are going to have, I think, a challenging time to manage with all of the responsibilities with $100 million or so less.

Dr. Cerveny: That is correct. But we have tided folks over to ensure that we could use the generosity of the Congress to cover them for a year or so, forward funding.

Senator REED. So we are sort of fasting for a year, but we are looking for something much better in the future?

Dr. Cerveny: No, I forward-funded specific projects to ensure that they had continuity to go to their conclusion.

Senator REED. You have also suggested that you would need additional funding in the succeeding budgets after 09?

Dr. Cerveny: Yes. And I will—I believe we are going to be getting that. But I don't know right now. It has not been given to me yet.

Senator REED. Okay. Thanks. Let me yield to Senator Dole, if she has additional questions, and I have a couple more. Senator Dole?

Senator DOLE. Okay. I would like to ask Dr. Tegnelia and also General Reeves, do you need additional resources or authorities to more effectively carry out the technology research and development programs that we have been discussing here today. Do you have unfunded priorities in your program areas, so to speak? And if so, what are they?

Dr. Tegnelia: I think if I were able to ask you for additional funds for programs that we are doing, I guess I would give you two or three examples of things that are important. The first one is funding the expansion of the Nunn-Lugar program because it really is the forward defense on preventing a lot of these things from happening. And the ability to extend that worldwide beyond the republics of the former Soviet Union would be a very important thing.

The second priority that I would give you, and I recall your question about young people—when your hair gets my color, you worry about the next generation of people who are coming along. And I think there is a very simple thing that can be done to bring this next generation onboard, and that is fund the basic research programs that the department is advocating.

That money ends up in the universities, and you can see behind you some of the examples that the universities are doing. In addition to getting good technology out, it introduces this topic to the people who are in school and ready to come out of school.

I would like to hope that the basic research money we put in would bring people into DTRA. But if they were introduced to it and they stayed in the field, that would be a win all by itself. So I would really suggest that you could help us a lot with funding the basic research program that we have.

The last comment that I would make to you is this idea of funding the research for the loose nuclear weapons activity and the international research on the nuclear detection of fissile material and the attribution activity, fielding attribution activity. Those things that are all related to the loose nuclear weapons, those are the kinds of things that I would accelerate.

Senator DOLE. All right. General Reeves?

General Reeves: Thank you, ma'am. We certainly have appreciated the Committee's support in the past on the Transformational Medical Technology Initiative, and we would ask simply that that funding remain constant.

Should additional funds become available, we would certainly like to apply funds towards advancing standoff technologies, both in chemical and biological detection as well as looking at the next generation of chemical threats and biological threats, and finally at automating certain sampling processes, particularly for biological detection, which has a very broad-based application across our systems.

In the area of procurement, our services are particularly interested in rapidly field the next generation of protective mask, which we have just produced—the Joint Service General Purpose Mask—as well as the next generation of chemical agent detectors, which, at the moment, are half the cost of the current detector. They are a quarter of the size, and they are a tenth of the weight. So they are very anxious to get them in the field.

We will be happy to provide the Committee a complete list, if you so request. [INFORMATION]

Senator DOLE. Thank you.

Dr. Cerveny, Dr. Tegnelia, in 2005 the Domestic Nuclear Detection Office, DNDO, was established within the Department of Homeland Security to improve the Nation's capability to detect and report unauthorized attempts to import, possess, store, develop, or transport nuclear or radiological material for use against the United States. How does DNDO coordinate its efforts with DOE and DOD, both of which have responsibilities related to nuclear detection and homeland defense against nuclear threats?

Has a division of labor been established that is workable and eliminates seams and gaps?

Dr. Cerveny: We work quite closely with the DNDO. They are part of that four-way MOU that I mentioned earlier. And the DNDO transformational R&D office is the one that we work the closest with. The coordination we do with them is extremely tight in that we fund maybe one half of something and they will fund the other half of something, and we coordinate it closely and then transition the data back and forth and information back and forth as it is needed.

With the DNDO office, we have had a very close collegial relationship with them transitioning information back and forth. There has been no difficulty with us working with them.

Senator DOLE. Doctor?

Dr. Tegnelia: Senator, we also have a good working relationship with DNDO. I mentioned to you this important area of working on longer-range nuclear detection devices. We do that on this joint MOU between—with DNDO as the lead, with DOE and DTRA. We share test facilities. We do joint tests together, and we work international programs together as well in DNDO.

I have a personal interest in it because the top three people in DNDO are ex-DTRA people. And the community, especially where you are concerned with things like nuclear detection and characterization, is a small community, and we share people. We share peo-

ple on a kind of continuing basis to make sure that we are coordinated.

Senator DOLE. Thank you very much.

Senator REED. Thank you very much.

If I may, I don't want to go too long, but a couple of other questions. Dr. Tegnelia, in response to Senator Dole's question about sort of the bench, if you will, for scientists, et cetera, it underscores that one of the key allies in this effort are university research programs, basic research.

One area that I have heard is not sufficiently supported with programs is radiochemistry. And I am just wondering if, in your view, that is right and, two, what are the other areas of shortage that we might think about in the future? Because without these talented scientists, this is a much more difficult problem.

Dr. Tegnelia: First of all, the subject of radiochemistry is the key technology associated with this problem of attribution, and Dr. Cerveny might comment on this. But my sense is we are using capabilities that were built in the nuclear weapons laboratories that go back quite a ways, and building the next generation of nuclear chemists capable of being able to do these 21st century problems is extremely important to us.

We put a lot of basic research into that particular activity aimed at finding new radiochemistry techniques to reduce the time and put in modern equipment to reduce the time of analyzing these nuclear events that we have. So that is a very important area.

I keep emphasizing, and maybe I am beginning to get repetitive here on the subject of nuclear detection. The problem doesn't start if you can't find the nuclear device. So it really is extremely important. And there has not been a lot of money that was put into innovative ideas associated with nuclear detection.

And like I mentioned in my opening statement, we do that with the Department of Energy. But bringing the universities into this problem to come up with new ideas is also an active area of research for us. And I think the people are interested in trying to do that kind of work.

Just give you a vignette. We are relatively new in the basic research activity. This is our second year. You have helped us a lot with the research there. In our second year, when we went out with our advertisement for new ideas in combating WMD, we got 1,000 proposals back from the universities to fund this work.

So there is a demand out there. The ability to spend basic research money well in the universities is there, and I think it gives us this dual benefit of new technology as well as people introduced to the topic. So I would encourage that kind of work.

Senator REED. Let me skip to Dr. Cerveny and then ask General Reeves the same question about shortages. Dr. Cerveny?

Dr. Cerveny: The radiochemistry is in the forensics arena that we are discussing here. As the National Academy of Science study that we just recently mentioned, when Mrs. Dole mentioned it and asked me a question about it, indicates that to manage the entire system the way we have it, if there are just less than 10—somewhere between 4 and 8—Ph.D. graduates per year, we would be able to replenish the entire workforce within about 5 to 10 years.

The number of people who do this work in the laboratory are really quite small. It is not a huge number of folks who are doing this and have this kind of expertise. So it is wonderful that we have the individuals who are senior and have the significant experience that we would like to do the data dump from. But at the same time, we do need to find the replacements and get them learning how to do the same sorts of things that they do.

Is there a shortage of radiochemists? Yes and no. From the yes side, the shortage is that they don't have the experience that we need, and that is what—where the lacking really is from the standpoint of what I do. Now from the standpoint of some of the other components, perhaps they need them for a different reason because there really is a deficit. But for me, it is the experience that I need for them to attain, and we are working on trying to get that for them.

Senator REED. Major General Reeves, your comments about the shortages, chokepoints in terms of talented scientists?

General Reeves: We absolutely recognize the problem and share the concern. And as Dr. Tegnelia alluded to, combine the aging workforce with a precipitous drop in math, science, and engineering graduates, and you have got a pretty bad recipe.

We engage in a range of programs in DOD as well as in the Army to address the issue. The good news is we have seen a small uptick in the number of biotechnologists or multidisciplined biologists. But hard math, hard science, engineering as an aggregate remains problematic.

Some examples of what is going on inside the chemical and biological defense program, the Edgewood Chemical and Biological Center is engaged with eight different universities and colleges, both at the undergraduate and graduate level, on an internship basis. The Army Medical Research Institute at Fort Detrick, Maryland, is engaged with four different colleges and universities on the same type of program. The chem/bio defense program itself funds some interns and postdoctoral studies.

And the Congress actually has indirectly assisted us in something called the Veterans Reassignment Act, which allows us to rapidly bring into the Government noncompetitively people. And so, as we look at our veterans, we look for those who have hard science backgrounds, and we get what we call a two-for. We get someone who has got not only the military background and experience and brings that operational perspective to us, but also the hard science background and then be able to apply that to the technology problems that they know are there.

Senator REED. Thank you very much, General.

Senator Dole, if you don't have any additional questions, I would ask that you be prepared perhaps to respond to written questions, if the staff would develop those questions.

But I want to thank you for excellent testimony and a wonderful demonstration. And you have outlined some significant challenges. And so, we will need your help going forward, just as we have needed it today.

Thank you very much. The hearing is adjourned.

[Whereupon, at 3:52 p.m., the hearing was adjourned.]