Testimony before the House Committee on Homeland Security
Subcommittee on Emerging Threats, Cybersecurity, and Science and Technology
Status Report on Federal and Local Efforts to Secure Radiological Sources

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I. INTRODUCTION

Chairwoman Clarke, Ranking Member Lungren and members of the Subcommittee, thank you for giving me the opportunity to testify on the role that the National Nuclear Security Administration's (NNSA) Global Threat Reduction Initiative (GTRI) plays in further improving the security on high-risk radioactive sources. GTRI's mission is to reduce and protect vulnerable nuclear and radiological materials located at civilian sites worldwide. These efforts are focused on the first line of defense, namely securing or removing vulnerable nuclear and radiological material at their source. GTRI has three goals that provide a comprehensive approach to achieving its mission and denying terrorists access to nuclear and radiological materials:

1. **CONVERT** research reactors and isotope production facilities from the use of highly enriched uranium (HEU) to low enriched uranium (LEU);
2. **REMOVE** and dispose of excess nuclear and radiological materials;
3. **PROTECT** high priority nuclear and radiological material from theft and sabotage.

To achieve its mission, GTRI is working in over 100 countries. For today's hearing I will focus my remarks on GTRI's efforts that are aimed at further enhancing the security of radioactive sources located in the United States that could potentially be used in a radiological dispersal device (RDD) or "dirty bomb." I will begin by describing our approach to defining and prioritizing the risks from radiological materials. From there I will describe the programs GTRI is leading to mitigate these risks, our efforts to coordinate with Federal, State, and local agencies and the private sector, and lessons we have learned to improve radiological security.

II. RADIOLOGICAL RISKS

The attacks of September 11, 2001, heightened the nation's concerns regarding the potential use of radioactive materials in a terrorist act. The possibility of such an attack has been of particular concern because of the widespread use and availability of radioactive materials in the United States and abroad by industry, hospitals, and academic institutions. Loss or theft of such materials, in risk-significant quantities, could lead to their diversion for malicious use in an RDD.

An RDD is a device or mechanism that is intended to spread radioactive material from the detonation of conventional explosives or other means. An RDD detonation would likely result in a few deaths (mainly from the explosion), but significant social and economic impacts could result from public panic, decontamination costs, and denial of access to the area for extended periods of time.

To better understand the potential consequences of malevolent use of radiological materials, the specific isotopes of concern, and the vulnerabilities of devices using these materials, GTRI commissioned three key studies to examine these issues in depth. These studies formed the basis for GTRI's voluntary security enhancement efforts and have been shared with our federal partners.

II.A Economic Impacts

GTRI commissioned an economic impact study to better understand the likely economic disruption were an RDD to be detonated in a major metropolitan area. A joint study by Los Alamos National Laboratory and Sandia National Laboratory prepared for GTRI modeled the impacts of four specific radioactive sources in amounts normally found in devices commonly used in their respective industry. Even without weaponization of the radioactive materials or optimization of the device the study found that the economic cost to the nation could be in the billions of dollars.[1] Costs included evacuation, relocation, cleanup, and lost wages.

II.B Material of Concern

Although any amount of radioactive material could cause public panic, GTRI's focus is on radiation sources that could be used by a terrorist to cause a significant impact. A second GTRI study tasked Sandia National Laboratories with developing a down-selection methodology that used a rigorous and reproducible process to identify, prioritize and determine threshold quantities of radioactive materials that could be used in a RDD of national significance.

This "down-selection study"[2] began by examining the comprehensive list of nuclides to ensure all were considered. The first step was to eliminate all stable,

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[1] *Economic Impacts of Detonating Radiological Dispersion Devices*, Los Alamos National Laboratory, February 15, 2008, LA-CP-08-00973.

[2] *Radioactive Material Downselection and Source Prioritization Methodology*, Sandia National Laboratory, November 21, 2008

i.e., nonradioactive, nuclides. The list was then culled according to half-life and specific activity. Shorter lived nuclides likely would not be effectively used in an RDD because they would decay away too quickly. Nuclides with half-lives greater than 100,000 years were also not of concern because the mass of material required for a significant RDD would be excessively large, making use and dispersion of these materials very difficult. The final step was to identify radionuclides that are commercially available to end users worldwide or may be available in bulk quantities to a limited number of suppliers and manufacturers in quantities greater than 0.1 curie (alpha emitters) and 1 curie (beta/gamma emitters). The final result was 14 radionuclides and spent fuel that GTRI determined could be used to make a significant RDD and were candidates for voluntary security enhancements.

The 14 radionuclides documented in the down-selection report include isotopes in wide commercial and medical use in the United States. The GTRI funded study was subsequently used by the Radiation Source Protection and Security Task Force, Chaired by the Nuclear Regulatory Commission (NRC), to develop the interagency cleared report of July 8, 2009, *Reevaluation of the List of Radioactive Sources That Warrant Enhanced Security and Protection and Quantities of Radioactive Material Sufficient to Create a Significant Radiological Dispersal Device or Radiation Exposure Device*. In addition, a study by the National Academy of Sciences identified Cesium Chloride (CsCl) as posing a greater concern than the other radionuclides because it is widely used in significant quantities and is soluble and dispersible.[3]

II.C Cesium Irradiator Vulnerabilities

The third study sponsored by GTRI and co-sponsored by the Department of Homeland Security (DHS) Domestic Nuclear Detection Office (DNDO) and conducted by Sandia National Laboratory and the Southwest Research Institute looked at the specific vulnerabilities to devices commonly found in research and medical settings. These include blood and research irradiators which use Cs-137 and gamma knifes which use Co-60. These reviews improved our understanding of device vulnerability to theft or sabotage in the absence of any NRC security increased controls or GTRI voluntary security enhancements.

The key finding of this study was that the radioactive sources within self-shielded cesium irradiators could be extracted more quickly than initially thought. GTRI, DNDO, and NRC agreed that adding additional hardening to cesium irradiators was prudent. This study led to the cesium chloride In-Device Delay (IDD) effort that will be described in section III.B below.

[3] *Radiation Source Use and Replacement*, National Academy of Sciences (February 20, 2008).

II.D Multiple Open Sites

Radiological sources are located at thousands of civilian sites across the United States and around the world. Medical, university and research facilities are, by nature and design, "open" environments that allow a larger set of people access to these materials. These types of facilities are more difficult to secure than isolated military installations or nuclear power plants which are designed to be closed to all but a very limited number of personnel.

II.E Insider Threat

It is important to not focus solely on attacks from outside terrorists attempting to penetrate and steal material. GTRI also looked at threats from the insider, i.e., someone who works at a facility and likely has intimate knowledge of security procedures and vulnerabilities. The possibility and probability of a passive insider, e.g., one who simply arranges access to the facility for the adversary, or an active insider, one who participates in the theft, diversion or sabotage of radiological material, is greater given the "open" environment of a university campus or city hospital in which many radiological devices are used.

III. GTRI'S ROLE IN MITIGATION OF RISKS

GTRI works very closely with its federal partners, each of which has a unique role ensuring a comprehensive system of oversight, prevention, and protection of civilian radiological sources. DHS's mission is to prevent terrorist attacks within the United States; reduce the vulnerability of the United States to terrorism; and, minimize the damage, and assist in the recovery, from any terrorist attacks that do occur within the United States across multiple sectors (e.g. nuclear, chemical, etc.), leading the Government Coordinating Council(s) (GCC) and collaborating with the industry-led Sector Coordinating Council(s) (SCC) to protect critical infrastructure and key resources. NRC's mission is to license and regulate the Nation's civilian use of byproduct, source, and special nuclear materials to ensure adequate protection of public health and safety, promote the common defense and security, and protect the environment. The Federal Bureau of Investigation (FBI) is the lead Federal law enforcement agency and plays a significant role preventing, interdicting, and investigating potential acts of nuclear and radioactive theft, sabotage or terrorism. NNSA brings the science and expertise of our National Laboratories to create innovative solutions to prevent the acquisition of nuclear and radiological materials for use in weapons of mass destruction (WMD) and other acts of terrorism. Specifically, GTRI and the DOE laboratories provide unique expertise to evaluate radiological issues and threats because of our significant work both internationally and domestically which allows us to identify "best practices" available in each circumstance.

To address the risks outlined above, GTRI, in cooperation with its federal partners, has initiated a number of voluntary security efforts to further mitigate these potential threats. These include eliminating unwanted sources, hardening kits for specific irradiators, facility wide voluntary security enhancements,

specialized training courses for security and law enforcement personnel, and table top exercises for first responders. **GTRI's voluntary security enhancements complement and do not replace NRC's increased controls requirements**. When requested by the licensee, GTRI works to assess existing security conditions, provide recommendations on security enhancements, and when warranted, fund the procurement and installation of jointly agreed upon security best practices. GTRI considers all 14 isotopes of concern above threshold quantities (10 Ci or greater), and addresses several areas of security including Deterrence, Control, Detection, Delay, Response, and Sustainability.

GTRI's voluntary security enhancement efforts have been endorsed by the NRC, DHS, FBI, Organization of Agreement States (OAS), and Conference of Radiation Control Program Directors, Inc. (CRCPD). NRC has issued Regulatory Information Summaries (RIS) describing both the IDD and voluntary security enhancement efforts of GTRI and recommends that licensees volunteer for these GTRI efforts.[4]

III.A Elimination – Removing Unwanted Sources

Since 1997 GTRI's Off Site Source Recovery Project (OSRP) operated by Los Alamos National Laboratory, Idaho National Laboratory and the CRCPD has reduced the radiological risk by recovering and eliminating disused and unwanted sealed sources. GTRI, in coordination with NRC, developed recovery prioritization criteria based on risk reduction. As of August 31, 2009, GTRI has recovered over 22,700 sources (totaling more than 720,000 curies) in twelve years.

At present, only 14 states in the U.S. have access to commercial disposal for sealed sources (with the exception of Ra-226 sources which have a commercial disposal pathway in all 50 states). With the decline in commercial disposal options, GTRI has seen an increase in the number of sources being registered as excess and unwanted. GTRI has found that without disposal access, source owners have no option other than long-term storage, which increases the vulnerability of becoming lost or forgotten.

III.B Delay – CsCl Irradiator In-Device Delay (IDD)

A fundamental component of GTRI's voluntary security enhancements is delay. By increasing delay (the amount of time needed by the adversary to gain access to the radioactive sources) we give more time for law enforcement to interrupt the adversary before they can steal the radioactive source. As a result of the GTRI/DNDO cesium irradiator vulnerability study, NNSA, DNDO, and NRC along

[4] RIS 2008-17, July 18,2008, "Voluntary Security Enhancements for Self-Contained Irradiators Containing Cesium Chloride Sources", and RIS 2008-23, October 3, 2008, "The Global Threat Reduction Initiative (GTRI) Domestic Threat Reduction Program & Federally Funded Voluntary Security Enhancements For High-Risk Radiological Material"

with cesium irradiator manufacturers developed In-Device Delay (IDD) hardening kits for the most widely used models of CsCl blood and research irradiators. The IDD kits make it orders of magnitude more difficult for an adversary to illicitly access and steal the radiological source.

In cooperation with the three principal manufactures (Best Theratronics, LTD., JL Shepherd and Associates, Pharmalucence) and the NRC, GTRI and DNDO developed these kits and in August 2008 launched a voluntary pilot program to install them. Some of the first sites to volunteer for the IDD kits included New York's Sloan-Kettering Institute for Cancer Research, Mt. Sinai School of Medicine, St. Vincent's Hospital and Medical Center, University of Pennsylvania, University of Rutgers, Wake Forest University, Baylor College of Medicine, University of Miami – Miller School of Medicine, and Geisinger Health System.

The installation of these kits is often carried out in extremely sensitive and very busy research and hospital environments. This requires the installers to use special measures (e.g. sound dampening, exhaust and fume hoods, etc.) and that coordinate installation schedules in order to minimize the impact on these facilities. Installations generally take 8 to 16 hours depending on the type of device, and are usually scheduled during evening hours to minimize the impact on research or medical operations. In May 2009, DNDO transferred their portion of the IDD project to GTRI in order to streamline the IDD effort and consolidate all relevant voluntary source security activities under one federal agency (many licensees have irradiators from more than one manufacturer at their site). This transfer of scope has allowed GTRI to standardize processes and procedures across all three manufacturers, and ensures that the project is coordinated with other GTRI source security efforts. The pilot project has been deemed a success and GTRI has initiated a national rollout plan to outfit all qualifying irradiators in the United States.

The total number of cesium devices in the United States is about 1,100. Nearly 260 of these devices are small calibration units or self-contained irradiators located at nuclear power plants or other secure locations. The remaining 840 devices are self contained irradiators located at universities, hospitals and research institutes. Each one of these 840 CsCl irradiators has enough material that could be used in several RDDs of national significance.

As of August 31, 2009 IDD kits have been installed on 32 irradiators. The remaining 808 irradiators can be hardened by FY2016. The implementation schedule is primarily constrained by human resource needs, scheduling complexities, and budget. Each manufacturer has a limited staff of trained employees that are approved to work on these devices. Locating, hiring and training additional staff to supplement this effort is a lengthy process. Scheduling the installations is also a rate-limiting factor. Critical research schedules and blood bank operations cannot be disrupted. Simply finding a time when both manufacturer and facility can accommodate the installation adds time to the

process. Each kit costs between $4K - $8K in hardware and about $25K in installation labor and travel. The total estimated cost for 840 irradiators is $26M. In addition, the manufacturers have agreed that starting in 2010 all new CsCl irradiators will have the IDD kits installed prior to sale and delivery.

In addition to the IDD hardening kits for CsCl irradiators, GTRI voluntary security enhancements also include other delay elements such as device tie downs, locks, hardened doors/windows, walls, cages, and safes. All of these elements increase the time it takes the adversary to gain access to and steal the radioactive source.

III.C Detection – Remote Monitoring Systems (RMS)

A second fundamental component of GTRI's voluntary security enhancements is detection. Thirty minutes of delay with detection that allows responders to arrive in twenty minutes is considered to be effective. Thirty minutes of delay without detection that could allow the adversary to attack the source/device all weekend is considered to be not effective.

GTRI detection upgrades include biometric access control devices, door alarms, motion sensors, cameras, wireless electronic tamper indicating seals, and area radiation monitors. Each of these technologies provides a specific deterrence, control, and/or detection function that, when integrated together and with delay, provides a significant security enhancement in a holistic manner.

However, the most important feature of GTRI's detection enhancements is the remote monitoring system. This is because the remote monitoring system directly mitigates the two greatest vulnerabilities in securing an open civilian facility like a hospital or university: which are (1) reliable transmission of alarms to the responders and (2) the insider threat.

Reliable transmission of alarms to the responders; At military facilities and nuclear power plans, there are highly-trained operators who are located in hardened central alarm stations (CAS) who monitor the detection devices 24-7. These detection alarms are hardwired into the CAS and if an alarm goes off or the power is turned off, there is nearly 100% probability that the CAS operator will receive the alarm and immediately notify the large, well-trained, well-armed on-site response team as to the exact location and condition causing the alarm. In comparison, at many hospitals or universities, the alarms are not monitored by well-trained CAS operators sitting in a secure location. The alarms are instead sent to normal facility employees or unarmed guards on-site. Assuming the adversary hasn't already neutralized these lightly-armed on-site personnel, the emergency call will be handled by a 911 operator who will have little understanding of what an irradiator is or why cesium warrants an emergency response. The chances that a large, well-trained, well-armed off-site response will arrive in time from local law enforce under these conditions is greatly reduced due to the limited amount of reliable transmission of alarms.

Insider threat; The greatest potential threat at hospitals and universities is that an insider could be the guard or employee who is on duty during off-hours an merely turns off or ignores the alarms. No one will know the source is gone until the next shift begins perhaps 12 hours or more later.

The GTRI remote monitoring system directly mitigates both of these threats by:

- Integrating alarms from multiple detection sensors and prioritizing alarms to ensure that critical alarms receive immediate attention even if the operator is not an expert in alarm assessment. The GTRI remote monitoring system includes statement of health and power level reports so external responders know immediately if the system is turned off.
- Alarms are simultaneously sent to multiple on-site and off-site locations such as ADT, local police departments, or regional fusion/operation centers. This ensures a timely response by sending a reliable transmission of alarms directly to trained off-site experts and responders. It also prevents against a single-point failure if the insider is the on-site alarm monitor or guard.

To address the sustainability portion of our security enhancement concept, GTRI provides a three to five year maintenance and warranty contract for each security enhancement device, contacts each site quarterly to follow-up on the status of the enhanced security system, and re-visits each site annually to determine if changes to the operating or threat environment warrant additional system enhancements.

GTRI prioritizes which sites receive voluntary security enhancements by assessing the attractiveness of the site's materials for possible use in an RDD, the site's proximity to DHS Urban Area Security Initiative (UASI) locations, , and the site's proximity to other volunteer sites. GTRI estimates that there are about 2,200 buildings in the United States that house IAEA Category I or II levels of radiological materials. As of August 31, 2009, 37 buildings have been completed with the remaining buildings to be complete by FY2016.

GTRI also provide responders with radios, repeaters, and personal detection devices.

III.D Response – Alarm Response Training

The most important aspect of any security system is a timely, well equipped, well trained response team of appropriate size to interrupt and neutralize the adversary before they gain access to the radioactive source. GTRI has therefore made a focused effort to provide security personnel and local law enforcement with the tools and training needed to adequately respond to a security incident.

Most on-site guards at facilities with radioactive sources are not armed or large enough force strength to neutralize the threat. Therefore, the key responders are often off-site local law enforcement. Unfortunately, many local law enforcement officials are not made aware of the nature of the material which is in use at hospitals, blood banks, universities, oil fields and manufacturing plants in their jurisdiction. It is important for their safety, and the safety of their communities, that they receive proper training about radiological sources. To ensure that both on-site and off-site responders understand how to respond to enhanced security system alarms, GTRI has developed an alarm response training course run by the Y-12 National Security Complex in Oak Ridge, TN.

This alarm response training prepares responders to protect themselves and the public when responding to events involving radiological materials. The participants conduct hands-on training in a realistic setting using actual protection equipment and real radioactive sources. The courses include operational exercise scenarios that build on classroom instructions and allow response forces to exercise their own procedures during realistic alarm scenarios.

As of August 31, 2009 we have conducted 6 training courses for 175 responders from 7 cities.

III.E Table Top Exercises (TTX)

As the capstone of GTRI's voluntary security enhancement support, GTRI has partnered with NNSA's Office of the Undersecretary for Counterterrorism and the FBI's Weapons of Mass Destruction Directorate to provide table top exercises at select nuclear and radiological sites. The purpose is to provide a no-fault, site-specific scenario where senior managers from various Federal, State and Municipal organizations can exercise their crisis management and consequence management skills in response to a terrorist incident. The overall objectives are:

- Promote cross-sector communication, cooperation, and team-building among Federal, State, Local, and private sector first responders
- Exercise FBI lead responsibility for criminal investigation
- Examine newly developed tactics, techniques, and procedures resulting from GTRI voluntary security enhancements
- Promote attack prevention through intelligence sharing and coordinated approach to neutralize the threat
- Prepare site specific integrated response plan with Federal, State, Local, and private sector partners

As of August 31, 2009 we have conducted 3 TTXs at facilities located in Honolulu, HI, Philadelphia, PA, and Manhattan, KS. A fourth TTX was recently completed in Houston, TX in early September.

III.F Transportation

Radioactive sealed sources may be at their most vulnerable when in transit. Recognizing this, GTRI has begun to implement security upgrades beyond regulatory requirements on our own source recovery shipments. GTRI has undertaken a number of pilot projects testing existing security devices/systems and has found that there is not a commercially available system that meets all our needs. Therefore, we are putting the best available compatible equipment on our vehicles and will continue to improve our system as additional technology advances are made. Because we are looking for a system(s) that private industry can adopt, we are working with the DHS-lead interagency group and directly with some in industry to demonstrate a prototype system using the best available devices. GTRI is offering industry a test bed to evaluate their devices for compatibility and capability to operate in the harsh transit environment, (e.g., heat, cold, jarring, etc).

III.G Alternative Technologies

The ultimate risk reduction would be to replace radioactive sources with non-radioactive alternative technologies. NNSA's Office of Nonproliferation Research and Development is currently funding research into technologies such as is x-ray for blood irradiation, which uses electricity to create x-rays and cannot be used in a dirty bomb.

There have been recommendations to replace some radionuclides, particularly cesium chloride, with another form or radionuclide, e.g., cesium ceramic or cobalt. Caution must be given to ensure the new form will result in enough risk reduction to off-set the cost of developing the alternative and retrofitting/replacing current irradiators. GTRI is working with Sandia National Laboratories and Federal partners to perform a relative material risk reduction study to evaluate the amount of risk reduction that may be derived from an alternate form or alternate radionuclide to cesium chloride.

IV. COORDINATION AND COOPERATION

In implementing these voluntary security enhancements, GTRI has maintained close coordination and cooperation with Federal, State, and local agencies and the private sector. In particular, we have established strong working relationships with the NRC, DHS, and the FBI.

To coordinate these complementary efforts, GTRI participates regularly in meetings of the DHS-chaired Nuclear Sector Government Coordinating Council, the NRC-led Radiation Source Protection and Security Task Force, Tri-lateral meetings comprised of senior representatives from NNSA, DHS and NRC, and many additional working level meetings. These coordination venues have helped ensure that officials throughout the government are aware of new initiatives, ongoing implementation efforts, and challenges encountered with enhancing radiological source security.

V. CONCLUSION

I am proud to report that GTRI, working in concert with our Federal, State, local and private sector partners, has helped to further enhance security on radioactive sources and reduce the risk of a dirty bomb.

V.A Lessons Learned

Through our security efforts in the United States and overseas, we have learned several important lessons, paramount of which is that a well-trained, well-equipped, and timely response force is the single most important element in ensuring security. All the delay and detection in the world does not defeat the "bad guys" – the response team does. Since most non-power plant commercial sites do not have armed, 24-hour, on-site security personnel, it is the off-site local law enforcement that becomes the defacto 24/7 response to an incident of radiological theft or sabotage. Local law enforcement officers are not full-time radiological police, they have much broader duties to serve and protect the public, and they are not regulated by a federal agency for radiological response effectiveness. It is for these reasons that GTRI has concentrated the vast majority of our voluntary security enhancements on helping these dedicated first responders. From our remote monitoring (which ensures they receive timely alarms and knowledge of the threat environment they will face) to personal protection equipment (radios and radiation pagers) to the realistic training and exercises. In addition, GTRI serves as a conduit to share lessons learned because we learn as much from local law enforcement as they learn from us. GTRI is able to share these lessons from site-to-site, city-to-city, and state-to-state to improve the collective security preparedness.

V.B Should Voluntary Efforts Be Mandated?

One of the most frequent questions we are asked is should these voluntary security enhancement be required? And if so when? These are very difficult questions to give specific answers to given the myriad of complex and interdependent risks that must be considered. For example:

- Which approach results in the faster implementation of effective security practices and risk reduction?
- How flexible will regulations be to take into account different industry sectors and the uniqueness of each site?
- How would you regulate local law enforcement or other off-site response team?
- What will be the cost burden imposed upon licensees and will it impact their ability to provide other critical services?
- How sustainable are voluntary upgrades that are not enforced through inspections?
- How do we encourage the licensees to ask security questions and push for best practices?

Our experience has shown that in most cases the fastest, most effective, and lasting way to improve security is to (1) fully engage the private sector, local law enforcement and the States in helping to create the appropriate security culture/program and (2) by combining voluntary best practices to quickly and cost-effectively improve security at most sites and then follow that up in a few years with a new regulation to close the gaps.

In closing, Madam Chairwoman, thank you for inviting us to participate in today's important hearing. The Department of Energy has a dedicated team focused on reducing domestic and foreign radiological threats. GTRI's voluntary program has had an effective beginning, and we believe is well positioned to bring about comprehensive solutions in a timely manner to the potential threat posed by radiological sources used in vital civilian applications.