The Florida Senate

Interim Project Report 2008-146 *October 2007*

Committee on Military Affairs and Domestic Security

DOMESTIC SECURITY - RADIATION DETECTION DEVICES

SUMMARY

Current generation radiation detection devices are employed to interdict and prevent the importation of threat radiological materials that could be used in weapons to attack the United States homeland. This generation of devices has technological limitations that present gaps which could be exploited for illicit radiological material smuggling.

The U. S. Department of Homeland Security has contracted to spend $1.2 billion to acquire and deploy the next generation of radiation detection devices. However, the technological capabilities of the next generation of radiation detection devices and the cost effectiveness of the decision to deploy such devices have been called into question.

The U. S. Department of Homeland Security is primarily responsible for funding, deploying, and operating the radiation detection devices used to protect Florida's seaports. As the department undertakes to deploy the next generation of radiation detection devices, Florida should closely monitor this effort to ensure Florida's seaports receive the maximum protection benefit possible.

BACKGROUND

Gaining control of nuclear and radiological materials took on a sense of urgency after the break-up of the Soviet Union. Throughout the 1990's, programs were established to ensure the safety and security of former Soviet nuclear weapons and the materials necessary to make those weapons. However, the terrorist events of September 11, 2001, drove the effort to control radiological materials from all sources to a whole new level.

Today, the U. S. Department of Homeland Security (DHS) is proposing to spend $1.2 billion to deploy a new generation of radiation detection devices. Current radiation detection devices have limitations that may leave gaps for exploitation prompting DHS to seek improvement in its technological capability. However, the effectiveness of the proposed next generation of detection technology has been called into question. The Government Accountability Office (GAO) does not believe that DHS conducted a proper cost benefit analysis prior to beginning acquisition. Further, GAO questions the effectiveness of this developing technology believing that it is only marginally better than existing equipment. As a result, Congress has acted to delay the project.[1]

This delay has direct impact on Florida because radiation detection technology used to scan cargo containers currently is in use at seven Florida ports[2] including newly installed next generation technology at Port Everglades.[3] All of the detection technology that is currently deployed is capable of detecting radiological materials. The question that now arises is:

- Will the next generation of radiation detection technology be a cost-beneficial improvement and if so when will it be deployed?

To address the question, this report reviews current radiation detection device capabilities as well as emerging technologies and assesses the impact on seaport security, emergency preparedness, and disaster response.

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[1] National Journal Group, *DHS Oversold Radiation Sensors, Report Says*, Global Security Newswire found on website, http://www.nti.org, July 20, 2007.

[2] Note: Port of Miami, Port Everglades, Jaxport, Port of Palm Beach, Port of Fernandina, Port of Panama City, and Port of Tampa.

[3] National Journal Group, *DHS Oversold Radiation Sensors, Report Says*, Global Security Newswire found on website, http://www.nti.org, July 20, 2007.

A Mix of Devices are Needed to Detect Radiological Materials

Radiation detection devices have been deployed world-wide in an effort to protect against the illicit movement of radiological materials. In the U. S., they are used primarily to interdict materials that might be shipped into this country for possible use as a weapon. Overseas, detection equipment has been provided to 36 countries since 1994 by the U. S. Departments of Energy, Defense, and State in order to combat nuclear smuggling.[4]

There are essentially three types of detection devices used in Florida's seaports for detecting radiological materials:

- Radiation Portal Monitors (RPM)
- Radioisotope Identifiers (RIID)
- Personal Radiation Detectors (PRD)

The operation of radiation detection equipment in Florida's ports is primarily the responsibility of U. S. Customs and Border Protection (CBP) officers. The GAO describes the use of radiation detection devices by CBP personnel this way:

"To screen commerce for radiation, CBP uses several types of detection equipment and a system of standard operating procedures. Current detection equipment includes radiation portal monitors, which can detect gamma radiation (emitted by all the materials of greatest concern) and neutrons (emitted only by a limited number of materials, including plutonium – a material that can be used to make a nuclear weapon). CBP officers also carry personal radiation detectors– commonly referred to as "pagers" - small handheld devices that detect gamma radiation, but not neutron (*radiation*). For the most part, pagers are meant to be personal safety devices, although they are used in some locations to assist with inspections. Finally CBP officers also use radioactive isotope identification devices, which are handheld devices designed to determine the identity of radioactive material - that is, whether it is a nuclear material used in medicine or industry, a naturally occurring source of radiation, or weapons-grade material. All of these devices have limitations in their ability to detect and identify nuclear material."[5]

Portal monitors are generally placed in fixed locations and constructed so that a cargo container or trailer that is being hauled by a truck or placed on a rail car may be driven through the monitor for screening. Truck mounted portable RPMs have also been designed to allow flexibility in conducting screening operations.

Standard procedures at Florida's ports, where RPMs are installed, require that all cargo containers and trailers exiting the port must pass through the portal. This is considered the primary inspection used to screen for the presence of radiological materials.

"This 'primary inspection' serves to alert CBP officers that a radioactive threat might be present. All traffic that causes an alarm during primary inspection is to undergo a 'secondary inspection' that consists of screening with another portal monitor to confirm the presence of radiation, and includes CBP officers using radiation isotope identification devices to determine the source of radiation being emitted, (e.g. harmless sources, such as ceramic tile, or dangerous sources, such as weapons-grade nuclear material). If CBP officers identify a nuclear or radiological threat during a secondary inspection, or if the officers' pagers register a dangerously high level of radiation, then officers are to establish a safe perimeter around the nuclear material and contact scientists in CBP's Laboratories and Scientific Services for further guidance. In some cases, CBP identifies incoming sea-bound cargo containers through a system that targets some containers for inspection based on their perceived level of risk. In these situations, CBP works with seaport terminals to have containers moved to an agreed-upon location for inspection. These inspections include the use of active imaging, such as an x-ray (*or a gamma-ray emitting device such as the vehicle and cargo inspection system known as VACIS in use by both CBP and the State of Florida*), and passive radiation detection, such as a radiation isotope identification device. Typically, if CBP officers find irregularities, physical examinations are conducted."[6]

During one site visit, committee staff observed CBP officers processing a primary inspection alarm from a

[4] Government Accountability Office, GAO-06-311, COMBATING NUCLEAR SMUGGLING, Corruption, Maintenance, and Coordination Problems Challenge U.S. Efforts to Provide Radiation Detection Equipment to Other Countries, Washington, DC, March 2006, p. 3.

[5] Government Accountability Office, GAO-06-389, *COMBAT NUCLEAR SMUGGLING, DHS Has Made Progress Deploying Radiation Detection Equipment at U.S. Ports-of Entry, but Concerns Remain*, Washington, DC, March 2006, p. 2.

[6] Ibid., pp. 2-3.

cargo container being hauled by a truck. The truck was directed to a secondary RPM where it again alarmed. CBP officers subsequently directed the vehicle to pull to an inspection area where officers screened the outside of the container using hand-held RIID devices. When the officers were not able to satisfactorily identify the source, they conducted a physical inspection by breaking the container's seal and opening the container. Ultimately, the officers were able to identify the source of the radiation as ceramic tile through physical inspection coincident with the isotope reading on the RIID.

In addition to use by CBP officers, PRD devices have been widely distributed among local port security personnel and first responders statewide using initial Department of Homeland Security grant funding. Further, RIID equipment has also been deployed with local and regional Hazardous Material Teams (HAZMAT) for use in responding to radiological emergency events.

Currently Deployed Radiation Detection Devices Have Limitations

Committee staff observed one limitation of the RIID. The device had to be placed in very close proximity to the source (approximately two inches) in order to obtain an accurate reading. This limitation appears to be a function of the strength of the radiation emitting from the source. The weaker the strength, the closer the device has to be held to the source in order to obtain a reading for identification.

An additional limitation of some older generation RPMs deployed at sites outside the U. S. is that they are only capable of detecting gamma radiation and not neutron radiation. This limits their effectiveness in detecting weapons-grade materials.[7]

Further, "The radiation portal monitors in use today can detect the presence of radiation, but they cannot distinguish between types of radiological material. For example, they cannot tell the difference between harmless products that emit radiation, such as ceramic tile, and dangerous materials, such as highly enriched uranium (HEU), that could be used to construct a nuclear weapon… DHS would like to improve the capabilities of its portal monitors so that they can perform the dual roles of detecting radiation and identifying radiological materials."[8]

According to the GAO, "Detecting highly-enriched uranium, in particular is difficult because of its relatively low level of radioactivity. Furthermore, a potential terrorist would likely attempt to shield the material to reduce the amount of radiation reaching the detector and thereby decrease the probability of detection."[9] Shielding can be accomplished in several ways including enclosure in a high density metal container or by interspersion among naturally occurring sources of radiation such as kitty litter, ceramic tile, welding rods, or medical radionuclides. Therefore, it is a necessity to be able to accurately identify the isotope that is causing an alarm while balancing detection sensitivity in order to screen out normal background radiation. DHS is supporting research on a new system to better detect radiation sources, even when shielded with materials designed to hide their presence. However, the high cost of this technology so far limits its commercial effectiveness.[10]

There are several other related problem areas that are not essentially device limitations but have an impact on the effective employment of detection devices.

- Providing secondary inspections for containers loaded on rail cars often presents a logistics problem. Ports lack ample space to park trains for secondary inspections or to maneuver trains to decouple the rail car(s) that may have caused the alarm. Trains awaiting secondary inspections may block the port for other trains entering or departing the port as well as disrupting departure schedules. Screening containers before they are placed on rail cars and mobile portal monitors may offer some solutions; however, this issue is yet to be effectively resolved.[11]

- Support and maintenance of deployed devices, particularly overseas, also has been identified as a problem. The GAO noted that hand-held radiation

[7] Government Accountability Office, GAO-06-311, COMBATING NUCLEAR SMUGGLING, Corruption, Maintenance, and Coordination Problems Challenge U.S. Efforts to Provide Radiation Detection Equipment to Other Countries, Washington, DC, March 2006, p. 4.

[8] Government Accountability Office, GAO-07-581T, *COMBAT NUCLEAR SMUGGLING, DHS's Decision to Procure and Deploy the Next Generation of Radiation Detection Equipment Is Not Supported by Its Cost-Benefit Analysis*, Washington, DC, March 14, 2007, pp. 1- 2.

[9] Government Accountability Office, GAO-06-389, *COMBAT NUCLEAR SMUGGLING, DHS Has Made Progress Deploying Radiation Detection Equipment at U.S. Ports-of Entry, but Concerns Remain*, Washington, DC, March 2006, p. 10.

[10] Ibid., p. 7.

[11] Ibid., p. 18.

detection equipment provided to foreign countries was not systematically maintained. GAO staff found significant instances where required periodic recalibration of equipment to ensure proper functioning had not been performed.[12]

- Port officials at sites visited by Military Affairs and Domestic Security committee staff reported problems with PRD batteries. Some replacement batteries were only available through the original manufacturers, replacements were in some cases expensive, and on occasion battery replacement would necessitate a software reboot by the vendor in order to return the device to proper functioning. Committee staff also observed that wearing an available PRD was beginning to decline among some officials. Officials reported that pagers were distributed initially under homeland security grants without subsequent support funding. It appeared that as the current generation of PRDs break, they are being abandoned. Replacing PRDs is generally dependent upon obtaining additional federal grant funding.

DHS Believes the Next Generation Portal Monitors are Effective and Has Begun Operational Deployment

According to senior DHS officials, the department planned to deploy 60 of the 80 next generation advanced spectroscopic portal monitors (ASP) it purchased with FY 2006 funds.[13] Further, the U. S. Department of Energy's Pacific Northwest National Laboratory (PNNL) has conducted small-scale preliminary studies to compare current generation RPMs with next generation ASPs. "In the first test PNNL concluded that the relative performance to the two technologies was highly dependent on variables such as the radioactive sources being targeted and the analytic methods used. The results of test were mixed. In the second test, PNNL concluded that the ASP monitor's ability to detect shielded threat sources was equal to or no better than, those of currently-fielded portal monitors. However, because spectroscopic portal monitors have the ability to identify isotopes, they produced fewer nuisance alarms than the current portal monitors."[14]

"Spectroscopic portal monitors outperformed currently-fielded equipment in detecting numerous small, medium-sized, and threat-like radioactive objects, and were able to identify and dismiss most naturally occurring radioactive material. However, as the amount of source material declined in size, the detection capabilities of both types of portal monitors converged."[15]

However, there is belief among PNNL staff that currently deployed radiation portal monitors are approaching the limits of the current approach to radiation screening. Moreover, spectroscopic portal monitors may reduce nuisance rates and might improve operational sensitivity to threats of interest.[16]

GAO's criticism remains, "The unsure efficacy and uncertain cost associated with the advanced portal monitor technology means that DHS cannot determine with confidence, how much the program will eventually cost. In particular, even if the advanced portal monitor technology can be shown superior to current technology - which currently does not seem certain - DHS does not yet know whether the new technology will be worth its considerable additional cost. Only after testing of the advanced portal monitors has been completed and DHS has rigorously compared currently-fielded and advanced portal monitor, taking into account for their differences in cost, will DHS be able to answer this question."[17]

On a positive note, GAO states, "CBP appears to have made progress in using radiation detection equipment correctly and adhering to inspection procedures." These improvements including physically opening and

[12] Government Accountability Office, GAO-06-311, COMBATING NUCLEAR SMUGGLING, Corruption, Maintenance, and Coordination Problems Challenge U.S. Efforts to Provide Radiation Detection Equipment to Other Countries, Washington, DC, March 2006, p. 5.

[13] Government Accountability Officer Letter, *Combating Nuclear Smuggling: DNDO Has Not Yet Collected Most of the National Laboratories' Test Results on Radiation Portal Monitors in Support of DNDO's Testing and Development Program*, Washington, DC, March 9, 2007, p. 5.

[14] Government Accountability Office, GAO-06-389, *COMBAT NUCLEAR SMUGGLING, DHS Has Made Progress Deploying Radiation Detection Equipment at U.S. Ports-of Entry, but Concerns Remain*, Washington, DC, March 2006, p. 35.

[15] Id.

[16] Ely, James and Robert T. Kouzes, Pacific Northwest National Laboratory, *Spies, Lies, and Nuclear Threats*, HPS July 2005 Meeting Power Point Briefing, slide 25.

[17] Government Accountability Office, GAO-06-389, *COMBAT NUCLEAR SMUGGLING, DHS Has Made Progress Deploying Radiation Detection Equipment at U.S. Ports-of Entry, but Concerns Remain*, Washington, DC, March 2006, p. 44.

inspecting cargo containers enable the officers to confirm the nature of the radiological source. Since this procedure also addresses the issue of detecting shielded materials, it increases the likelihood of finding illicit radioactive material.[18]

Ultimately, the responsibility for funding and fielding the next generation of radiation detection devices remains with DHS. Further, it is the responsibility of CBP to operate RPMs where installed in our state ports in the most effective manner possible. To that end, state officials and port operators must maintain awareness of this issue and closely monitor DHS's progress and performance.

Given the skepticism expressed by members of Congress after GAO testimony and the resulting delay placed on the program,[19] the ability to improve upon the capabilities of current generation RPM devices appears uncertain.

Florida is Participating in a Pilot Project to Improve Radiation Detection Capabilities

Florida is providing leadership in implementing the Southeast Transportation Corridor Pilot (SETCP). This is a DHS funded pilot project that has as its objective the utilization of mobile nuclear and radiological detection equipment which will be deployed at various weigh stations, special event venues, and at intelligence driven locations. The pilot will introduce an additional layer of radiological material detection by placing detection capability out beyond the exit portals of the seaports. Further, it will be used to develop and test better methods of intelligence information sharing to enhance detection capabilities.

METHODOLOGY

In order to complete this project, committee staff interviewed members of the Department of Transportation, Office of Motor Carrier Compliance, U. S. Customs and Border Protection officers, and port officials. Committee staff conducted site visits to five ports including four that employ CBP operated radiation portal monitor devices. Committee staff conducted a review of pertinent reports to the U. S. Congress regarding radiation portal monitors and other radiological detection devices and programs as well as a review of other literature pertaining to detection of radiological materials.

FINDINGS

Committee staff made the following findings:

1. Funding, deploying, and employing radiation detection devices used in screening cargo exiting Florida's ports is primarily the responsibility of the U. S. Department of Homeland Security.

2. Current generation radiation detection devices have technology limitations that leave open the possibility of threat radiological materials evading detection during illicit smuggling.

3. Next generation radiation detection devices currently in deployment will likely require further development to meet DHS performance goals.

4. Employment of best practices inspection procedures in conjunction with currently available radiation detection devices can mitigate, to an extent, current equipment technology shortfalls.

5. Florida's participation in the Southeast Transportation Corridor Pilot project shows promise for effectively developing an additional detection layer outside the seaports' exit portals.

RECOMMENDATIONS

It is recommended that the Legislature continue to closely monitor federal government actions to fund, deploy, and operate radiation detection devices used to protect Florida's seaports. The purpose of this monitoring is to ensure that the state benefits from the best possible effort to protect it from potential radiological threat devices.

[18] Ibid., p. 45.

[19] O'Harrow, Robert Jr., Washington Post, "*Radiation Detector Program Delayed*, Washington, DC, July 20, 2007.