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Report to the Ranking Member, Committee on Homeland Security, House of Representatives

October 2016

RADIATION PORTAL MONITORS

DHS's Fleet Is Lasting Longer than Expected, and Future Acquisitions Focus on Operational Efficiencies

Accessible Version

GAO-17-57

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GAO Highlights

Highlights of GAO-17-57, a report to the Ranking Member, Committee on Homeland Security, House of Representatives

Why GAO Did This Study

Preventing terrorists from smuggling nuclear or radiological materials to carry out an attack in the United States is a top national priority. Terrorists could use these materials to make an improvised nuclear device that could cause hundreds of thousands of deaths and devastate buildings and other infrastructure. DHS's fleet of almost 1,400 RPMs helps secure the nation's borders by scanning incoming cargo and vehicles for radiological and nuclear materials. DHS began deploying RPMs to seaports and border crossings in fiscal year 2003. As RPMs began to approach the end of their expected 13-year service lives, DHS raised concerns over the sustainability of the fleet, the ability to maintain current scanning coverage, and the need for fleet recapitalization.

GAO was asked to report on the sustainability of the RPM fleet. This report provides information on (1) DHS's assessment of the condition of its RPM fleet and how, if at all, that assessment has changed over time; and (2) DHS's plans for meeting detection requirements in the future. GAO reviewed agency documentation, analyzed data on RPM age and condition, and reviewed budget justifications. GAO interviewed DHS officials and officials from a national laboratory on the current status of the RPM fleet and DHS's plans for future RPM acquisitions.

GAO is not making recommendations in this report. DHS provided technical comments on a draft of this report. These comments are incorporated as appropriate in the final report.

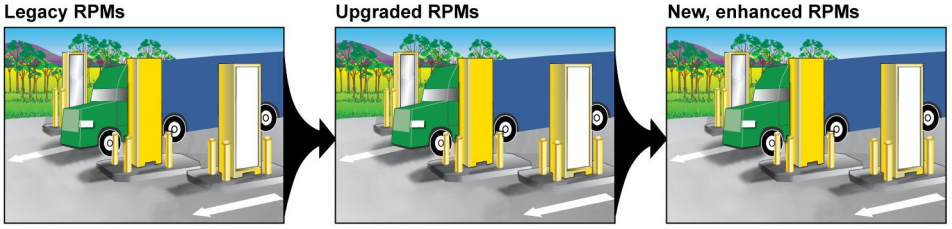
View GAO-17-57. For more information, contact Shelby S. Oakley at (202) 512-3841 or oakleys@gao.gov.

What GAO Found

The Department of Homeland Security's (DHS) assessment of its fleet of radiation portal monitors (RPM)—large, stationary radiation detectors through which vehicles and cargo containers pass at ports of entry—shifted over time and, as a result, DHS has changed the focus of its RPM replacement strategy. During fiscal years 2014 and 2015, as some RPMs began to reach the end of their estimated 13-year service life, DHS began planning for replacing the entire fleet of almost 1,400 RPMs. However, as of September 2016, the fleet remains nearly 100 percent operational and recent studies indicate that the fleet can remain operational until at least 2030 so long as proactive maintenance is carried out and RPM spare parts remain available. As a result, in 2016, DHS changed the focus of its RPM replacement strategy to selective replacement of RPMs—using existing RPMs that have been upgraded with new alarm threshold settings or purchasing enhanced, commercially available RPMs—to gain operational efficiencies and reduce labor requirements at some ports.

During fiscal years 2016 through 2018, DHS plans to replace approximately 120 RPMs along the northern U.S. border with upgraded RPMs and, during fiscal years 2018 through 2020, plans to replace between 150 and 250 RPMs at select high-volume ports with enhanced, commercially available RPMs. Specifically, DHS plans to replace some legacy RPMs—those that cannot be upgraded with the new alarm thresholds—at northern U.S. land border crossings with RPMs from existing inventory that have been upgraded. This upgrade enables improved threat discrimination and minimizes "nuisance" alarms created by naturally occurring radioactive materials (NORM) in commonly shipped cargo such as ceramics, fertilizers, and granite tile. Improved discrimination between NORM and threat material will create efficiencies for the movement of cargo through ports and minimize time that DHS's Customs and Border Protection (CBP) officers spend adjudicating the nuisance alarms. DHS is also planning limited replacement of upgraded RPMs at select high-volume ports with enhanced, commercially available RPMs that offer nuisance alarm levels significantly lower than even the upgraded RPMs. Currently, upgraded RPMs at some high-volume ports do not reduce nuisance alarm rates enough to implement remote RPM operations—which allows CBP officers to carry out other duties at the ports when not responding to an RPM alarm—because of the high number of vehicles and cargo containers passing through the ports daily.

Nuisance Alarms by Type of Radiation Portal Monitor (RPM)



Source: GAO analysis of Department of Homeland Security data. | GAO-17-57

Contents

Tables

Figures

Abbreviations

CBP	U.S. Customs and Border Protection
DHS	Department of Homeland Security
DNDO	Domestic Nuclear Detection Office
ECCF	express consignment courier facility
NORM	naturally occurring radioactive materials
PNNL	Pacific Northwest National Laboratory
RPM	radiation portal monitor
SAFE Port Act	Security and Accountability for Every Port Act of 2006

U.S. GOVERNMENT ACCOUNTABILITY OFFICE
441 G St. N.W.
Washington, DC 20548

October 31, 2016

The Honorable Bennie G. Thompson
Ranking Member
Committee on Homeland Security
House of Representatives

Dear Mr. Thompson:

Preventing terrorists from smuggling nuclear or radiological materials to carry out an attack in the United States is a top national priority. Terrorists could use these materials to make an improvised nuclear device or a radiological dispersal device (also called a "dirty bomb"). The detonation of an improvised nuclear device in an urban setting could cause hundreds of thousands of deaths and devastate buildings and other physical infrastructure for miles. A radiological dispersal device would be less damaging but could nonetheless inflict hundreds of millions of dollars in socioeconomic costs if a large part of a city had to be evacuated until extensive radiological decontamination was completed. The Department of Homeland Security's (DHS) U.S. Customs and Border Protection (CBP) is responsible for securing the U.S. border against dangerous goods. To detect and interdict smuggled contraband—including illicit nuclear and radiological materials—CBP scans incoming cargo and vehicles for elevated radiation levels at seaports, land border crossings, airports, and international mail facilities throughout the United States using its fleet of almost 1,400 deployed radiation portal monitors (RPM)—large, stationary radiation detectors through which vehicles and cargo containers pass.

Such scanning is part of a broader effort spearheaded by DHS's Domestic Nuclear Detection Office (DNDO). The mission of DNDO is to counter the risk of nuclear terrorism against the United States by continuously improving capabilities to deter, detect, respond to, and attribute attacks, in coordination with domestic and international partners.[1]

[1]DNDO was established in 2005 by National Security Presidential Directive (NSPD)-43/Homeland Security Presidential Directive (HSPD)-14 and codified in statute by the Security and Accountability for Every Port Act of 2006 (SAFE Port) Act, Pub. L. No. 109-347 § 501, 120 Stat. 1884, 1932 (codified as amended at 6 U.S.C. § 591).

To fulfill its mission, DNDO's activities are focused on developing the Global Nuclear Detection Architecture, which is a multilayered framework encompassing approximately 74 independent federal programs, projects, or activities, as well as partnerships with local, state, tribal, and territorial governments; the private sector; and international partners. This framework comprises an integrated system of radiation detection equipment and interdiction activities to combat nuclear smuggling in foreign countries, at the U.S. border, and inside the United States.

Under the Security and Accountability for Every Port Act of 2006 (SAFE Port Act), DHS is required to scan all cargo containers that pass through the 22 seaports with the greatest volume of cargo containers for radiation and to have a strategy for deployment of radiation detection capabilities at all other U.S. ports of entry. DHS began acquiring RPMs in fiscal year 2002 and began deploying them in fiscal year 2003. DHS initially projected RPMs to last 10 years, after which they would need to be replaced or refurbished—at a cost of hundreds of millions of dollars—to avoid a decrease in the percentage of vehicles and cargo containers scanned at seaports and land border crossings. You asked us to examine the sustainability of the RPM fleet and review DHS's plans for meeting detection needs in the future. This report describes (1) DHS's assessment of the condition of its RPM fleet and how, if at all, that assessment has changed over time and (2) DHS's plans for meeting detection requirements in the future.

To address both of our objectives, we reviewed relevant federal laws, our past work,[2] and reports by DHS and others on the Global Nuclear Detection Architecture and DHS's radiation detection activities. We also visited the Pacific Northwest National Laboratory (PNNL), which provides scientific and technical expertise related to RPMs, to learn more about the

[2]See, for example, GAO, *Combating Nuclear Smuggling: DHS Research and Development on Radiation Detection Technology Could Be Strengthened*, GAO-15-263 (Washington, D.C.: Mar. 6, 2015); *Combating Nuclear Smuggling: Lessons Learned from Cancelled Radiation Portal Monitor Program Could Help Future Acquisitions,* GAO-13-256 (Washington, D.C.: May 13, 2013); *Combating Nuclear Smuggling: Inadequate Communication and Oversight Hampered DHS Efforts to Develop an Advanced Radiography System to Detect Nuclear Materials*, GAO-10-1041T (Washington, D.C.: Sept. 15, 2010); and *Combating Nuclear Smuggling: Additional Actions Needed to Ensure Adequate Testing of Next Generation Radiation Detection Equipment*, GAO-07-1247T (Washington, D.C.: Sept. 18, 2007).

condition of the RPM fleet, including planned upgrades to older RPMs, and to learn about characteristics of enhanced, commercially available RPM technologies. To describe DHS's assessment of the condition of its RPM fleet and how, if at all, that assessment has changed over time, we collected agency summary data on RPM inventory, including acquisition dates, deployment history, and vendors, as well as data on RPM maintenance and calibration history. We assessed the reliability of these data by interviewing DHS staff about data sources and data quality control steps taken by the agency, and we determined that these data were sufficiently reliable for the purposes of this report. We interviewed officials from DNDO and CBP headquarters to learn about the fleet's condition and how DHS has assessed it; the steps DHS has taken to budget for needed improvements; and existing or projected shortfalls in scanning coverage, among other things. In addition, we visited one land border crossing and two seaports to learn more about RPM operations and the condition of RPMs in deployed settings.[3] To describe DHS's plans for meeting detection requirements in the future, we reviewed agency strategic plans, program management plans, project plans, budget documents, acquisition plans, and other agency documents relevant to the RPM program. We interviewed DNDO and CBP headquarters officials regarding scanning requirements; planned system upgrades, replacements, and decommissionings; and agency plans for meeting detection requirements in the future.

We conducted this performance audit from August 2015 to October 2016, in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Under the SAFE Port Act, DNDO is required, among other functions, to develop, in coordination with other federal agencies, an enhanced Global

[3]These sites were selected based on proximity to the GAO field office leading the review.

Nuclear Detection Architecture.[4] DNDO serves as the primary entity in the United States to develop programs and initiatives related to the Global Nuclear Detection Architecture, identify any gaps in it, and improve radiological and nuclear detection capabilities. DNDO also assists DHS agencies with implementing the domestic portion of the Global Nuclear Detection Architecture, including deployment of radiation detection equipment at ports of entry along the U.S. border.[5] Accordingly, DNDO acquires and deploys RPMs and provides for associated scientific and technical expertise, with assistance from the Department of Energy's national laboratories, including PNNL and Los Alamos National Laboratory. CBP operates the RPMs and maintains them after their first year of deployment.[6]

As of August 2016, CBP operates approximately 1,300 RPMs,[7] which can detect radiation but cannot identify the type of material causing an alarm, as well as almost 2,700 handheld radiation detectors, which can identify the sources of radiation. RPMs are the primary means by which CBP scans cargo and vehicles at U.S. ports of entry for nuclear and radiological material.[8] Before leaving a port of entry, most cargo containers and vehicles first travel through an RPM. (See fig. 1.)

[4]6 U.S.C. § 592(a)(4) (2016). Neither the SAFE Port Act nor the presidential directive defined the term "architecture." DNDO has interpreted "architecture" as a time-phased, geographic approach to reducing the risk of a radiological or nuclear attack.

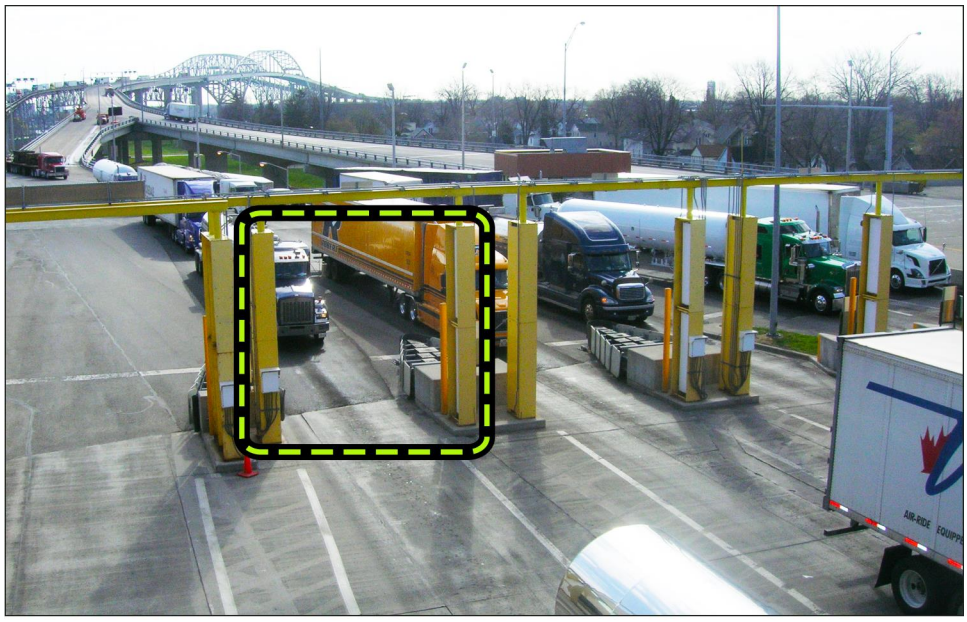
[5]Ports of entry are the facilities that provide for the controlled entry into or departure from the United States for persons and materials. Specifically, a port of entry is any officially designated site (airport, seaport, or land port) where CBP officers or employees are assigned to clear passengers and accept merchandise, collect duties, and enforce applicable laws.

[6]DNDO maintains RPMs during their first year after deployment.

[7]Approximately 1,400 total RPMs are deployed, although about 100 of these are not current being operated.

[8]According to DHS, as a matter of policy, consistent with the goals of the Global Nuclear Detection Architecture, CBP scans vehicles at land border crossings and international mail passing through airports even though such scanning is not required by the SAFE Port Act.

Figure1: Radiation Portal Monitor at a Land Border Crossing



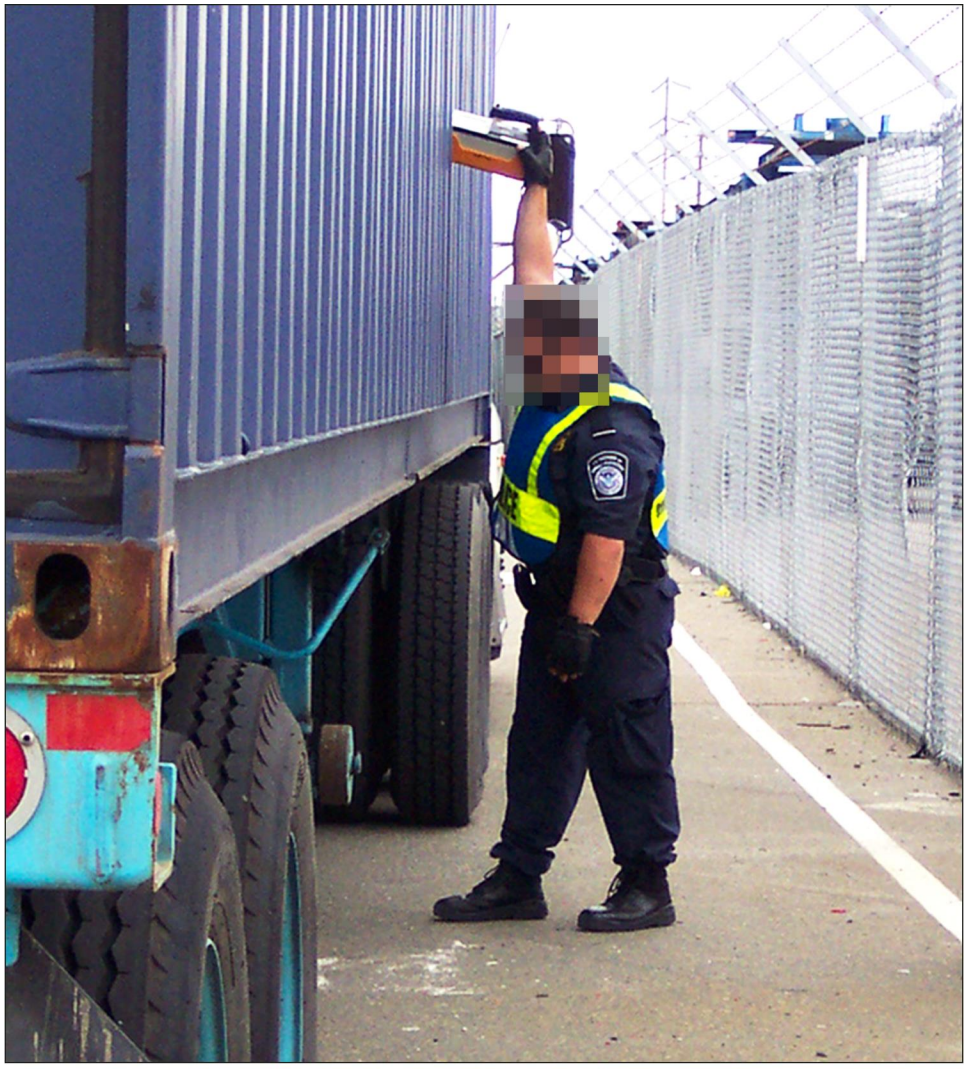
Source: GAO. | GAO-17-57

Note: The dashed yellow square highlights a single radiation portal monitor unit.

If an alarm is triggered, the cargo container or vehicle is directed to a secondary inspection area for further inspection and clearance by a CBP officer using a handheld radiation detector that can identify the source of the radiation.[9] (See fig. 2.)

[9]In some cases, the container or vehicle is also sent through a second RPM to confirm the alarm before the handheld device is used.

Figure 2: Customs and Border Protection Officer Using a Handheld Radiation Detector at a Secondary Inspection Area



Source: GAO. | GAO-17-57

RPM alarms can result from naturally occurring radioactive materials (NORM), which are often emitted from certain consumer and trade goods, such as ceramics, fertilizers, and granite tile. RPM alarms from NORM are termed “nuisance” alarms by DHS and require CBP officers to spend time determining that the source of the alarm is NORM and not nuclear or radiological threat materials before the cargo container or vehicle can

leave the port. Although fewer than 2 percent of cargo containers have historically set off an RPM alarm, according to DHS, with more than 20 million cargo containers and more than 100 million vehicles passing through the nation's ports annually, nuisance alarms account for hundreds of thousands of alarms per year.

To reduce nuisance alarms and decrease the need for secondary scanning by CBP officers, in 2014 and 2015, CBP developed and deployed a new set of RPM alarm threshold settings, with support from DNDO and scientists at PNNL. This upgrade, which is referred to as revised operational settings, is implemented during calibration. It optimizes RPM effectiveness by tuning the threshold settings of individual RPMs to account for local background radiation and common NORM passing through the RPMs. These new threshold settings result in a similar sensitivity to materials that pose a threat but significantly reduce nuisance alarms from NORM. According to CBP, as of the end of fiscal year 2015, DNDO and CBP had upgraded RPMs at 28 seaports and 15 land border crossings, which has reduced nuisance alarms by more than 75 percent, on average, at these sites.

Before fiscal year 2015, DHS had acquired 1,706 RPMs, including 384 from Ludlum Measurements, Inc. (Ludlum) and 1,322 from Leidos Holdings, Inc. (Leidos). The Ludlum RPMs were the first to be acquired and were deployed beginning in fiscal year 2003, and the Leidos RPMs were first acquired and deployed in fiscal year 2004.[10] (See table 1.)

Table 1: Radiation Portal Monitors (RPM) Acquired from Ludlum and Leidos, Fiscal Years 2002 through 2015

Fiscal year	Ludlum RPMs	Leidos RPMs	Total
2002	25	0	**25**
2003	307	0	**307**
2004	3	102	**105**
2005	4	580	**584**
2006	4	140	**144**
2007	0	85	**85**

[10]DHS acquired 25 Ludlum RPMs in fiscal year 2002 but did not begin deployment until fiscal year 2003.

Fiscal year	Ludlum RPMs	Leidos RPMs	Total
2008	16	106	**122**
2009	17	267	**284**
2010	8	0	**8**
2011	0	0	**0**
2012	0	0	**0**
2013	0	0	**0**
2014	0	42	**42**
2015	0	0	**0**
Total	**384**	**1,322**	**1,706**

Source: Domestic Nuclear Detection Office. | GAO-17-57

Ludlum and Leidos RPMs have comparable designs—both use specialized detection panels made of plastic as well as helium-filled tubes—and provide similar technical capacity to detect nuclear and radiological materials. However, because of limitations in the design of the plastic panels in the Ludlum RPMs that DHS acquired, these RPMs cannot be upgraded with the revised operational settings and thus do not have the threat discrimination capabilities equal to the upgraded Leidos RPMs. Threat discrimination refers to the ability of the RPM to distinguish between radiation emitted from NORM and radiation emitted from radioactive materials that could be used in a nuclear device or a dirty bomb.

As of August 5, 2016, DHS had 1,386 RPMs deployed—including 277 Ludlum RPMs and 1,109 Leidos RPMs—with the remaining RPMs in storage. Of the deployed RPMs, 885 were at northern and southern border crossings; 320 were at seaports; and 181 were at airports, ferry terminals, or other facilities. (See table 2.) According to DHS officials, the actual number of deployed RPMs varies on a day-to-day basis in response to port reconfigurations and expansions and because DHS periodically decommissions RPMs that are infrequently used.[11]

[11]According to DHS officials, some RPMs are decommissioned through a low-use, no-use policy based on a review of the RPMs' operational utility and alarm rates. Decommissioned RPMs are not considered to be operational; however, they can be redeployed to other sites.

Table 2: Deployed Radiation Portal Monitors (RPM) by Pathway, as of August 2016

	Pathway	Number of RPMs deployed
Land border crossings	Cargo containers and vehicles at northern U.S. border	465
	Cargo containers and vehicles at southern U.S. border	420
Seaports	Cargo containers[a]	320
Airports	Cargo containers[b]	4
	Mail/ECCF packages[c]	46
	Preclearance airports[d]	53
Ferries	International rail crossings[e]	0
	Other (e.g., mobile RPMs and testing facilities)	64
	Total	**1,386**

Source: Domestic Nuclear Detection Office. | GAO-17-57

[a]Some smaller seaports that receive cargo are not equipped with RPMs, and other radiation detection is employed.

[b]We previously reported on limitations of cargo scanning at airports. See GAO, *Combating Nuclear Smuggling: DHS Has Developed Plans for Its Global Nuclear Detection Architecture, but Challenges Remain in Deploying Equipment*, GAO-12-941T (Washington, D.C.: July 26, 2012).

[c]An express consignment courier facility (ECCF) is a separate or shared facility approved by a port director solely for examining express consignment shipments.

[d]A preclearance airport is a foreign airport where uniformed U.S. Customs and Border Protection (CBP) officers scan passengers and baggage before departure to the United States.

[e]CBP uses non-intrusive inspection technology to scan nearly all inbound rail cargo.

As of August 2016, 100 percent of cargo containers and vehicles entering land border crossings and nearly 100 percent of cargo containers passing through seaports are scanned by RPMs, according to DNDO. However, as we found in 2012,[12] significant technological and logistical challenges exist for scanning cargo at airports and international rail ports of entry, and as of August 2016, some cargo containers that enter through these pathways are not being scanned by RPMs. Scanning of air cargo is primarily carried out with handheld radiation detectors, and scanning of international rail cargo is mainly conducted with such detectors and radiographic imaging systems. Radiographic imaging systems use gamma rays or X-rays to produce an image of cargo to detect anomalies,

[12]GAO, *Combating Nuclear Smuggling: DHS Has Developed Plans for Its Global Nuclear Detection Architecture, but Challenges Remain in Deploying Equipment*, GAO-12-941T (Washington, D.C.: July 26, 2012).

such as high-density material or hidden cargo, but they do not detect radioactivity.

DHS Changed Its Assessment of the Condition of the RPM Fleet and Consequently Altered Its RPM Replacement Strategy

DHS's assessment of its RPM fleet shifted over time, and as a result DHS has changed the focus of its RPM replacement strategy. More specifically, in fiscal years 2014 and 2015, DHS began planning to replace the full fleet based on a conservatively estimated 13-year service life. However, recent DNDO studies indicate the fleet can remain operational until at least 2030, with proactive maintenance and sufficient availability of spare parts, so DHS has refocused its strategy on selective replacements to improve efficiency.

During Fiscal Years 2014 and 2015, DNDO Used a 13-Year RPM Service Life Estimate to Plan and Budget for RPM Replacements

Before the RPMs began to reach the end of their estimated service life, DNDO commissioned a field study assessing how well the RPM systems were aging and a separate study specifically assessing the aging of the RPM's key component—the plastic detection panels.[13] These studies were published in 2011 and both concluded that the original 10-year RPM service life estimate should be updated. One of the studies concluded that the plastic detection panels could last up to 20 years—with 13 years as a conservative estimate of the panels' life spans. The other study concluded that the panels would last between 15 and 20 years and that the RPMs could be sustained for an extended period with routine inspections, maintenance, and repairs as needed. According to DNDO officials, after these studies were published, DNDO began using a 13-year service life estimate for RPM life-cycle planning and budgeting purposes. Echoing one of the studies, a DNDO management official told us that the 13-year RPM service life was considered a conservative estimate that resulted in an acceptable level of risk to the program. The official further stated that although the 13-year estimate contained a great deal of uncertainty, DHS was trying to ensure that the necessary steps would be taken to keep the fleet fully functional.

[13]Most RPMs contain four plastic detection panels, but some contain two and some contain six or more.

DNDO used the 13-year service life estimate for its RPM program planning and budget justifications throughout fiscal years 2014 and 2015, including in the following cases:[14]

- DNDO's RPM Program Management Plan for fiscal years 2014 through 2019,[15] published in January 2014, stated that more than 500 of the then-deployed RPMs would reach the end of their service lives by 2019 and would require either refurbishment or replacement. The plan outlined DNDO's efforts to extend the service life of the RPMs while working on a strategy for RPM replacement.
- DHS's budget justification for fiscal year 2015 referred to RPMs exceeding the end of their estimated service lives as part of a discussion of RPM program needs.
- DHS's June 2014 Global Nuclear Detection Architecture Strategic Plan of Investments highlighted a need for significant funding increases to replace RPMs as they reached the end of their estimated service lives.[16] The plan projected significant decreases in RPM scanning coverage—the percentage of vehicles or cargo containers scanned—beginning in fiscal year 2016 based on the service life estimate, anticipated port expansions and reconfigurations, and projected budget levels. Specifically, the plan projected that RPM scanning coverage at seaports would fall from 100 percent in fiscal year 2014 to 69 percent in fiscal year 2019. For land border crossings, it projected a decrease from 98 percent scanning coverage to 39 percent over the same period.

[14]A budget justification provides written explanation for the amount an agency requests for its annual operating budget and is released soon after the release of the President's annual budget submission and before congressional hearings on agency budget requests. Agencies are directed to post their budget justification materials on the Internet within 2 weeks of transmittal to Congress. DHS's fiscal year 2015 budget justification was online in April 2014 and its fiscal year 2016 budget justification was online in July 2015.

[15]Department of Homeland Security, Domestic Nuclear Detection Office, Customs and Border Protection, *Program Management Plan, Version 1.0 for the Radiation Portal Monitor Program* (January 2014).

[16]Department of Homeland Security, *DHS Global Nuclear Detection Architecture Strategic Plan of Investments: Fiscal Year 2014 Report to Congress* (June 9, 2014).

In its February 2015 update to its RPM Program Management Plan,[17] DHS again emphasized the need for RPM replacements because RPMs would begin reaching the end of their estimated 13-year service lives. In addition, the plan stated that projected budget levels through fiscal year 2019 were sufficient for the program to begin to replace the RPMs reaching the end of their service life. The plan also highlighted the importance of efforts to extend RPM service life to retain the ability to perform required scanning. DHS's budget justification for fiscal year 2016 referred to the 13-year RPM service life as it called for increased funding for replacements based on service life concerns. The budget justification stated that funding increases would address sustainability of aging RPMs and ensure compliance with the SAFE Port Act as DHS formulates a long-term strategy for the replacement of RPMs at the end of their life cycle.

Furthermore, in October 2015, a senior DNDO official told us that DNDO was using 13 years as a conservative estimate for RPM service life. Fiscal year 2016 House and Senate appropriations committee reports discussed the need for RPM replacement, and specifically referenced RPM aging issues. The Consolidated Appropriations Act, 2016 increased funding for acquisition and deployment of radiological detection systems, including RPMs, to $113 million from $73 million in the previous year.[18] This money can be used through fiscal year 2018.

DHS's Recent Assessments Indicate the Fleet Is Sustainable, and DHS Has Shifted Its Replacement Strategy to Focus on Efficiency

According to DHS data, as of August 2016, DHS's RPM fleet remains almost 100 percent operational,[19] even as almost 20 percent of the RPMs have reached the end of their original estimated 13-year service life and another 40 percent are within 2 years of that date. DNDO and PNNL officials we interviewed told us that, based on more recent studies and analysis, they believe the RPM fleet can last at least 20 years longer if it is properly maintained and spare parts remain available. Specifically, a January 2015 study by CBP's Data Analysis Center that examined 8

[17]Department of Homeland Security, Domestic Nuclear Detection Office, *Program Management Plan for the Radiation Portal Monitor Program, Version 2.0* (February 2015).

[18]Pub. L. No. 114-113, 129 Stat. 2242 (2015).

[19]In other words, almost 100 percent of the RPMs are operating at any given time, on average.

years of RPM performance data concluded that the fleet is in acceptable condition and will operate effectively for several years.[20] The study also noted that the functionality of the plastic detector panels does not degrade significantly over time. A May 2015 DHS study—carried out expressly to determine the best alternatives for replacing RPMs as they began to reach the end of their service lives—concluded that, assuming proper maintenance and parts availability continues, the concept of RPM life span is not useful, in part because there has been no measurable operational degradation of the RPM fleet.[21] The study noted that CBP intends to continue to maintain RPMs at nearly 100 percent operability, resulting in no loss of functionality as they age.[22] The study found no reason to believe that parts would become obsolete or unavailable, and noted that, under RPM maintenance contracts, parts are replaced or repaired as soon as they are observed to have failed. The study concluded that the RPMs could operate until 2030 at current levels of functionality, and stated that any decision to replace the systems should be predicated on the need for improved functionality rather than because of concerns over aging. Underlying this conclusion was an assumption that maintenance costs would not increase appreciably over the period evaluated.

DNDO officials we interviewed explained that CBP has maintenance contracts with the RPM vendors that ensure the fleet can remain nearly 100 percent operational for many years. Furthermore, CBP and PNNL track maintenance data for trends in component failure rates that might indicate problems with the fleet or any significant maintenance cost increases, and officials told us that no troubling trends exist. In March 2016, Leidos confirmed to CBP in writing that it is capable of and committed to supplying parts for its RPMs until at least 2021 and expects to be able to do so through 2026. In addition, officials told us that they

[20]Customs and Border Protection, Data Analysis Center – Threat Evaluation and Reduction, *Assessment of RPM Aging Based on Review of RPM Data from 2003-2013* (Washington, D.C.: Jan. 8, 2015).

[21]Between fiscal year 2011 and fiscal year 2015, DNDO undertook several efforts aimed at improving operational efficiencies, extending RPM service life, and identifying technology alternatives that could replace the existing fleet of RPMs. These activities provided input for this study.

[22]Department of Homeland Security, *Radiation Portal Monitor Replacement: Analysis of Alternatives, Final Report* (Washington, D.C.: May 23, 2015).

have not faced any barriers to replacing RPM components to date. For instance, CBP has replaced more than 1,100 computer interface boards and more than 1,200 vehicle presence sensors since 2007. CBP officials that we interviewed indicated that they have no reason to believe that parts will not remain available as long as the RPMs are still in use.

Based on the new conclusions about RPM service life, in 2016 DNDO changed the focus of its strategy from replacing the RPM fleet because of aging to selective replacement of RPMs at specific sites to gain operational efficiencies, as discussed later in this report. This change is reflected in DHS's budget justification for fiscal year 2017 in which DHS focused its funding request on the need to replace some upgraded Leidos RPMs to gain further operational efficiencies. Consistent with the stated planning assumptions, DNDO has not used funds received in fiscal year 2016 for RPM acquisitions.

DHS Plans to Replace RPMs at Selected Ports of Entry to Gain Operational Efficiencies

DHS plans to replace legacy RPMs at selected ports of entry with RPMs that have greater threat discrimination capabilities to gain operational efficiencies and reduce labor needs while continuing to meet detection requirements. Specifically, from fiscal year 2016 through fiscal year 2018, DHS is planning to replace more than 120 Ludlum RPMs at northern U.S. land border crossings with upgraded Leidos RPMs from existing inventory. The Ludlum RPMs are among the oldest in the fleet, with most acquired in fiscal years 2002 and 2003.[23] Replacing them with upgraded Leidos RPMs would allow for improved threat discrimination—an RPM's ability to distinguish between radiation emitted from NORM and radiation emitted from materials that pose a threat—which, according to DHS officials we interviewed, is expected to minimize CBP officer time spent responding to nuisance alarms. DHS therefore expects to be able to redirect some CBP officers to other critical law enforcement duties, such as interdiction of smuggled currency, illicit drugs, or other contraband, at border crossings where upgraded Leidos RPMs are installed.

CBP officials told us in May 2016 that DHS will study the operations at each land border crossing before deciding on RPM replacement to

[23]DNDO officials stated that the Ludlum RPMs would be used for spare parts or excessed to state or local organizations, universities, or private entities.

ensure the benefits outweigh the costs. DNDO and CBP replaced Ludlum RPMs with upgraded Leidos RPMs at two sites—one seaport and one land border crossing—in fiscal year 2015. In total, 22 Ludlum RPMs were replaced with 20 upgraded Leidos RPMs. DNDO did not carry out a cost-benefit analysis before these RPM replacements. CBP officials explained that one site was the last remaining seaport where Ludlum systems were deployed. These officials explained that the second site resulted from a public-private partnership agreement initiated by a port authority to address operational concerns in which the private entity paid for the majority of labor costs associated with the replacement. DNDO provided us with documentation of a cost-benefit analysis for a third site, a land border crossing where CBP is considering replacing Ludlum RPMs with upgraded Leidos RPMs, and indicated that DNDO is in the final stages of completing an analysis addressing the remaining northern land border crossings.

GAO Recommended That the Department of Homeland Security (DHS) Examine Use of Optimization Techniques to Maximize Radiation Portal Monitor (RPM) Potential

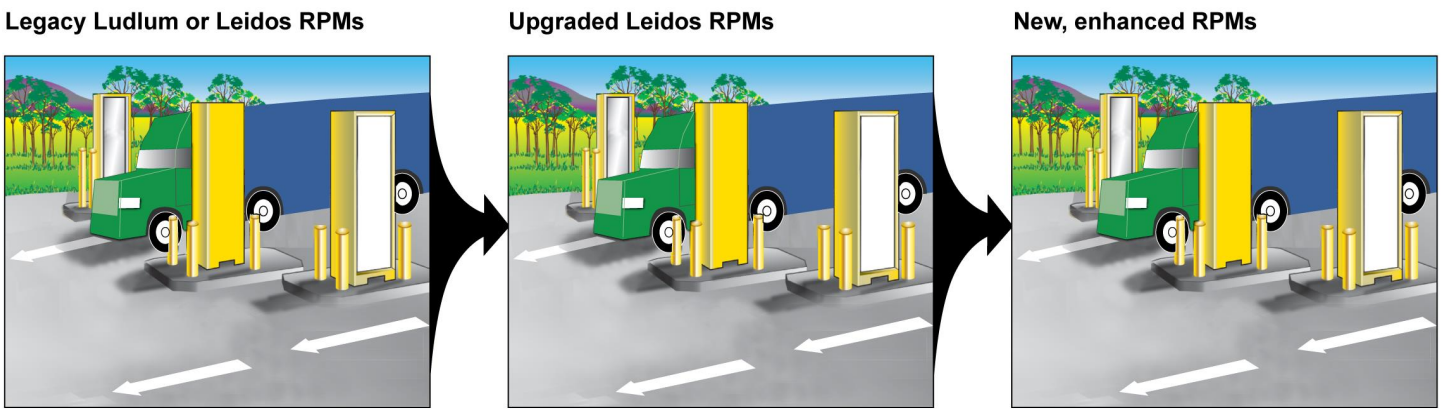
In 2009, we examined DHS's Domestic Nuclear Detection Office's (DNDO) development and testing of a new type of RPM and, among other things, found that DNDO had not completed efforts to fine-tune the current fleet of RPMs to provide greater sensitivity to threat materials. We recommended that DNDO do so before spending billions of dollars acquiring new RPMs. (See GAO-09-655.) Beginning in 2014, DHS's U.S. Customs and Border Protection (CBP) took action to upgrade some of its RPMs by optimizing RPM threshold settings. CBP estimates that the upgraded RPMs prevent more than 200,000 alarms from naturally occurring radioactive materials per year at the sites where the upgrades have been implemented, allowing for 88 CBP officers to be redirected to other high-priority mission areas, according to CBP officials. In addition, 70 percent of the sites where the upgrades were implemented reported safety improvements, according to an agency survey. These improvements were attributed to such things as reduced congestion and better traffic flow.

Source: GAO-09-655 and CBP data. | GAO-17-57

During fiscal years 2018 through 2020, DHS is planning to replace upgraded Leidos RPMs at selected high-volume ports of entry with between 150 and 250 enhanced, commercially available RPMs that have even greater ability to discriminate between NORM and materials that pose a threat. According to DNDO and CBP officials, the improved threat discrimination offered by these new, enhanced RPMs will further reduce nuisance alarms and may enable high-volume ports of entry to implement remote RPM operations. Under remote operations, RPM scanning lanes would be monitored from a centralized location at each port using video cameras and traffic control devices, with CBP officers dispatched to inspection areas only in response to an RPM alarm. The staff formerly stationed at each RPM scanning site would be reassigned to other mission needs within a port of entry.

CBP officials told us that, although CBP has yet to make a final determination, implementing remote operations would require a reduction of nuisance alarms to about one or two alarms per lane per day on average. Currently, upgraded Leidos RPMs—which have reduced nuisance alarms by more than 75 percent, on average, across the sites with the upgrades—provide alarm levels under one per day at many sites, according to CBP data. However, the data indicate that some high-volume ports of entry have lanes with higher nuisance alarm rates. According to a DHS analysis, the new, enhanced RPMs will provide nuisance alarm levels up to 99 percent lower than the legacy RPMs without upgrades, which is expected to be low enough to implement remote operations at these high-volume sites. (See fig. 3.)

Figure 3: Nuisance Alarms by Type of Radiation Portal Monitor (RPM)



Source: GAO analysis of Department of Homeland Security data. | GAO-17-57

According to DNDO and CBP officials, RPM acquisition decisions will be informed by several factors, including available budget levels, performance of the upgraded Leidos RPMs, performance of new, enhanced RPMs as they are deployed, and the status of port expansions and reconfigurations. DNDO and CBP have conducted, or are planning, studies of nuisance alarm rates at sites with upgraded Leidos RPMs and new, enhanced RPMs. For example, DNDO and CBP collaborated on a preliminary study of nuisance alarm rates at ports of entry where upgraded Leidos RPMs are operating. Officials told us that further studies are necessary before DNDO and CBP determine how many of these sites will need new, enhanced RPMs to achieve nuisance alarm rates low enough to implement remote operations. According to CBP officials, CBP is also planning to test remote operations using new, enhanced RPMs. Specifically, according to officials, CBP has begun planning a pilot project at a seaport in Savannah, Georgia, to demonstrate the feasibility of remote operations using a test lane outfitted with a new, enhanced RPM.

In addition to RPMs deployed as replacements, DHS estimates that, over the next several years, it will need to deploy approximately 200 RPMs because of port expansions and reconfigurations across the country. According to DHS officials, some of these will be Leidos RPMs out of existing inventory and some will be newly acquired, enhanced RPMs,

depending on the scanning requirements at each individual site and the availability of the Leidos RPMs in inventory.

According to DHS data, the agency had 143 upgraded Leidos RPMs in its inventory as of September 30, 2015, as well as approximately 85 low-use or no-use RPMs (75 Leidos and 10 Ludlum) expected to be available. DHS inventory data indicate that this existing RPM inventory would be adequate to support the planned replacements at the northern land border and the added RPM deployments for port expansions and reconfigurations through the end of fiscal year 2017. According to DNDO, starting in fiscal year 2018, when DHS plans to begin acquiring the enhanced RPMs, the upgraded Leidos RPMs that the new, enhanced RPMs replace will be used for the northern land border replacements and the anticipated port expansions and reconfigurations.

According to DNDO officials, DNDO is following the DHS acquisition directive as it plans for acquisition of the enhanced RPMs. This document directs DNDO to follow a four-phase acquisition life-cycle framework. The directive's implementing instruction outlines a series of "acquisition decision events" that include certain milestones. For example, prior to approval of an acquisition, DNDO must, among other things, develop

- a mission need statement outlining the capability need or gap that the acquisition will address;
- an analysis of alternatives that explores the alternatives for addressing the identified need;[24]
- a life-cycle cost estimate for the assets being acquired; and

[24]An analysis of alternatives is an analytical study used by many government agencies as a key first step in capital asset acquisitions. The process entails identifying, analyzing, and selecting a preferred alternative to best meet the mission need by comparing the operational effectiveness, costs, and risks of potential alternatives to address valid needs and shortfalls in operational capability. These practices can provide a framework to help ensure that entities consistently and reliably select the project alternative that best meets mission needs. See GAO, *DOE and NNSA Project Management: Analysis of Alternatives Could Be Improved by Incorporating Best Practices,* GAO-15-37 (Washington, D.C.: Dec. 11, 2014) and *Amphibious Combat Vehicle: Some Acquisition Activities Demonstrate Best Practices; Attainment of Amphibious Capability to be Determined*, GAO-16-22 (Washington, D.C.: Oct. 28, 2015) for additional details.

- a test and evaluation master plan outlining how the program will ensure that the acquisition will deliver the capabilities needed by the program.

As of August 2016, DNDO has completed an analysis of alternatives for the planned RPM acquisition, and officials told us that other required documentation is in process or waiting for management approval. Officials stated that DNDO plans to issue a request for proposals to industry before the end of the current calendar year and that the initial acquisition of the enhanced RPMs is planned for fiscal year 2018.

DNDO and CBP have also recognized that the enhanced RPMs may be suitable for scanning of international rail crossings. DNDO has identified the lack of RPM scanning of international rail crossings as a concern for at least a decade and as a Global Nuclear Detection Architecture capability gap since 2014. In 2007, Congress directed the Secretary of Homeland Security to develop a system to detect both undeclared passengers and contraband, with a primary focus on the detection of nuclear and radiological materials entering the United States by railroad.[25] In 2012, DNDO carried out an analysis of alternatives to identify solutions for international rail RPM scanning. Agency officials have cited technological and logistical challenges as key factors preventing RPM scanning of rail cars crossing the border. Specifically, according to DHS officials, international rail traffic represents one of the most difficult challenges for radiation detection systems, in part because of the length of the trains (up to 2 miles), the distance required to stop moving trains, and the difficulties in separating individual cars for further examination. In addition, the gamma ray or X-ray scans used to detect rail cargo anomalies, such as high-density material or hidden cargo, can interfere with RPM scanning if the two are in close proximity, which can cause nuisance alarms from the RPMs. In June 2015, CBP conducted a successful cargo-scanning demonstration project at an international rail port of entry using systems that integrate X-rays and enhanced RPM scanning technologies. This demonstration project showed the feasibility of adding RPM scanning to international rail crossings. DNDO and CBP are jointly planning an acquisition of these integrated systems and plan to

[25]Implementing Recommendations of the 9/11 Commission Act of 2007, Pub. L. No. 110-53, § 1524, 121 Stat. 266, 451 (2007) (codified at 6 U.S.C. § 1171 (2016)).

deploy them at international rail crossings beginning as early as fiscal year 2018.

Agency Comments and Our Evaluation

We provided a draft of this report to DHS for review and comment. DHS provided technical comments that we incorporated, as appropriate.

As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies of this report to the appropriate congressional committees, the Secretary of Homeland Security, and other interested parties. In addition, this report will be available at no charge on the GAO website at http://www.gao.gov.

If you or your staff members have any questions about this report, please contact me at (202) 512-3841 or oakleys@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report are listed in appendix I.

Sincerely yours,

Shelby S. Oakley
Acting Director, Natural Resources and Environment

Appendix I: GAO Contact and Staff Acknowledgments

GAO Contact

Shelby S. Oakley, (202) 512-3841 or oakleys@gao.gov.

Acknowledgments

In addition to the contact named above, Ned Woodward (Assistant Director), Rodney Bacigalupo, Antoinette Capaccio, Michael Krafve, Cynthia Norris, Steven Putansu, and Kevin Tarmann made key contributions to this report.

Appendix II: Accessible Data

Data Tables

Highlights Nuisance Alarms by Type of Radiation Portal Monitor (RPM) & Figure 3: Nuisance Alarms by Type of Radiation Portal Monitor (RPM)

Legacy RPMs	Upgraded RPMs	New, enhanced RPMs
Baseline	Approximately 75 percent fewer nuisance alarms, on average, compared with legacy RPMs	Expectation of up to 99 percent fewer nuisance alarms, on average, compared with legacy RPMs

Source: GAO analysis of Department of Homeland Security data. | GAO-17-57