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GAO

Report to Congressional Requesters

March 2006

COMBATING NUCLEAR SMUGGLING

DHS Has Made Progress Deploying Radiation Detection Equipment at U.S. Ports-of-Entry, but Concerns Remain

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GAO-06-389

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Highlights

Highlights of GAO-06-389, a report to congressional requesters

Why GAO Did This Study

Preventing radioactive material from being smuggled into the United States is a key national security objective. To help address this threat, in October 2002, DHS began deploying radiation detection equipment at U.S. ports-of-entry. This report reviews recent progress DHS has made (1) deploying radiation detection equipment, (2) using radiation detection equipment, (3) improving the capabilities and testing of this equipment, and (4) increasing cooperation between DHS and other federal agencies in conducting radiation detection programs.

What GAO Recommends

The Secretary of Homeland Security should work with other agencies, as necessary, to (1) streamline internal review procedures so that spending data can be provided to the Congress in a more timely way; (2) update the current deployment plan; (3) analyze the benefits and costs of advanced portals, then revise the program's cost estimates to reflect current decisions; (4) develop ways to effectively screen rail containers; (5) revise agency procedures for container inspection; and (6) develop a way for CBP officers to verify NRC licenses.

In commenting on a draft of this report, DHS stated that it agreed with, and will implement, our recommendations.

www.gao.gov/cgi-bin/getrpt?GAO-06-389.

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

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COMBATING NUCLEAR SMUGGLING

DHS Has Made Progress Deploying Radiation Detection Equipment at U.S. Ports-of-Entry, but Concerns Remain

What GAO Found

The Department of Homeland Security (DHS) has made progress in deploying radiation detection equipment at U.S. ports-of-entry, but the agency's program goals are unrealistic and the program cost estimate is uncertain. As of December 2005, DHS had deployed 670 portal monitors and over 19,000 pieces of handheld radiation detection equipment. However, the deployment of portal monitors has fallen behind schedule, making DHS's goal of deploying 3,034 by September 2009 unlikely. In particular, two factors have contributed to the schedule delay. First, DHS provides the Congress with information on portal monitor acquisitions and deployments before releasing any funds. However, DHS's lengthy review process has caused delays in providing such information to the Congress. Second, difficult negotiations with seaport operators about placement of portal monitors and how to most efficiently screen rail cars have delayed deployments at seaports. Regarding the uncertainty of the program's cost estimate, DHS would like to deploy advanced technology portals that will likely cost significantly more than the currently deployed portals, but tests have not yet shown that these portals are demonstrably more effective than the current portals. Consequently, it is not clear that the benefits of the new portals would be worth any increased cost to the program. Also, our analysis of the program's costs indicates that DHS may incur a $342 million cost overrun.

DHS has improved in using detection equipment and in following the agency's inspection procedures since 2003, but we identified two potential issues in Customs and Border Protection (CBP) inspection procedures. First, although radiological materials being transported into the United States are generally required to have a Nuclear Regulatory Commission (NRC) license, regulations do not require that the license accompany the shipment. Further, CBP officers do not have access to data that could be used to verify that shippers have acquired the necessary documentation. Second, CBP inspection procedures do not require officers to open containers and inspect them, although under some circumstances, doing so could improve security. In addition, DHS has sponsored research, development, and testing activities to address the inherent limitations of currently fielded equipment. However, much work remains to achieve consistently better detection capabilities.

DHS seems to have made progress in coordinating with other agencies to conduct radiation detection programs; however, because the DHS office created to achieve the coordination is less than 1 year old, its working relationships with other agencies are in their early stages of development and implementation. In the future, this office plans to develop a "global architecture" to integrate several agencies' radiation detection efforts, including several international programs.

Contents

Abbreviations

ANSI	American National Standards Institute
CBP	Customs and Border Protection
CMTB	Counter Measures Test Bed
DHS	Department of Homeland Security
DNDO	Domestic Nuclear Detection Office
DOD	Department of Defense
DOE	Department of Energy
FBI	Federal Bureau of Investigation
FLETC	Federal Law Enforcement Training Center
GAO	Government Accountability Office
LSS	Laboratories and Scientific Services
NIST	National Institute for Standards and Technology
NTS	Nevada Test Site
NRC	Nuclear Regulatory Commission
PNNL	Pacific Northwest National Laboratory
S&T	DHS Science and Technology Directorate
TSA	Transportation Security Administration

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Congressional Requesters

Since the attacks of September 11, 2001, combating terrorism has been one of the nation's highest priorities. As part of that effort, preventing radioactive material from being smuggled into the United States—perhaps to be used by terrorists in a nuclear weapon or in a radiological dispersal device (a "dirty bomb")—has become a key national security objective. The Department of Homeland Security (DHS) is responsible for providing radiation detection capabilities at U.S. ports-of-entry.[1] Until April 2005, U.S. Customs and Border Protection (CBP) managed this program. However, on April 15, 2005, the president directed the establishment, within DHS, of the Domestic Nuclear Detection Office (DNDO), whose duties include acquiring and supporting the deployment of radiation detection equipment.[2] CBP continues its traditional screening function at ports-of-entry to prevent illegal immigration and to interdict contraband, including the operation of radiation detection equipment. The Pacific Northwest National Laboratory (PNNL), one of the Department of Energy's (DOE) national laboratories, manages the deployment of radiation detection equipment for DHS.[3]

DHS's program to deploy radiation detection equipment at U.S. ports-of-entry has two goals. The first is to use this equipment to screen all cargo, vehicles, and individuals coming into the United States. The United States has over 380 border sites at which DHS plans to deploy radiation detection equipment. The volume of traffic entering the United States also adds to the size and complexity of the job. For example, each day, DHS processes about 64,000 containers arriving in the United States via ships, trucks, and

[1]The Departments of Energy, Defense, and State are also implementing programs to combat nuclear smuggling in other countries by providing radiation detection equipment and training to foreign border security personnel. See Pub. L. No. 107-296 (2002) Title IV, § 402. We recently reported on these programs in *Combating Nuclear Smuggling: Corruption, Maintenance, and Coordination Problems Challenge U.S. Efforts to Provide Radiation Detection Equipment to Other Countries*, GAO-06-311 (Washington, D.C.: Mar. 14, 2006).

[2]See National Security Presidential Directive 43/Homeland Security Presidential Directive 14, Domestic Nuclear Detection (April 15, 2005).

[3]DOE manages the largest laboratory system of its kind in the world. The mission of DOE's 22 laboratories has evolved. Originally created to design and build atomic weapons, these laboratories have since expanded to conduct research in many disciplines—from high-energy physics to advanced computing.

rail cars; 365,000 vehicles; and more than 1.1 million people. The second goal of the program is to screen all of this traffic without delaying its movement into the nation. To illustrate the difficulty of achieving this second goal, CBP's port director at the San Ysidro, California, land border crossing estimated that prior to initiating radiation screening, the volume of traffic through the port-of-entry was so great that, at times, the wait to enter the United States from Mexico was about 2.5 hours. He noted that had radiation detection screening added a mere 20 seconds to the wait of each vehicle, the wait during those peak times could have increased to about 3.5 or 4 hours—an unacceptable outcome in his view. DHS's current plans call for completing deployments of radiation detection equipment at U.S. ports-of-entry by September 2009.

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 of the materials of greatest concern) and neutrons (emitted by only 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 neutrons. 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.

Generally, CBP's standard procedures direct vehicles, containers, and people coming into the country to pass through portal monitors to screen for the presence of radiation. 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 ceramics, 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 (LSS) for further guidance.[4] 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, and passive radiation detection, such as a radiation isotope identification device. Typically, if CBP officers find irregularities, physical examinations are conducted.

In September 2003, we reported on CBP's progress in completing domestic deployments. In particular, we reported that certain aspects of CBP's installation and use of the equipment diminished its effectiveness and that coordination among agencies on long-term research issues was limited. Since the issuance of our 2003 report, questions have arisen about the efficacy of the detection equipment CBP has deployed—in particular, its purported inability to distinguish naturally occurring radioactive materials from a nuclear bomb.

Because of the complexity and importance of these issues, you asked us to assess the progress made in (1) deploying radiation detection equipment at U.S. ports-of-entry and any problems associated with that deployment, (2) using radiation detection equipment at U.S. ports-of-entry and any problems associated with that use, (3) improving the capabilities and testing of this equipment, and (4) increasing the level of cooperation between DHS and other federal agencies in conducting radiation detection programs.

To address these objectives, we (1) analyzed CBP's project plan, including the project's costs and deployment schedules, to deploy radiation detection equipment at U.S. ports-of-entry; (2) visited several ports-of-entry, including two international mail and express courier facilities, five seaports, and three land border crossings; (3) participated in radiation detection training for CBP officers; and (4) visited four national laboratories, the Nevada Test Site, and an Air Force base involved with

[4] Laboratories and Scientific Services coordinates technical and scientific support to all CBP trade and border protection activities. These activities include, among other things, providing scientific/forensic support, including on-site support, to CBP officers and other government agencies with regard to the investigation and interdiction of Weapons of Mass Destruction.

testing and deploying radiation detection equipment. We focused primarily on the issues surrounding radiation portal monitors because they are a major tool in the federal government's efforts to thwart nuclear smuggling. We also focused on this equipment because its procurement and installation cost far exceeds the cost of procuring and deploying other radiation detection equipment such as handheld equipment also used at U.S. ports-of-entry. We reviewed documentation, such as deployment and cost figures, equipment test plans and results, and agency agreements to cooperate in detecting radiation. We also interviewed key program officials at each of these agencies to discuss the deployment of radiation detection equipment, attempts to improve the equipment's capabilities, and cooperation among agencies to protect the United States from nuclear terrorism. We performed a data reliability assessment of the data we received, and interviewed knowledgeable agency officials on the reliability of the data. We determined the data were sufficiently reliable for the purposes of this report. More details on our scope and methodology appear in appendix I. We conducted our review from March 2005 to February 2006 in accordance with generally accepted government auditing standards.

Results in Brief

Between October 2000 and October 2005, the United States spent about $286 million to deploy radiation detection equipment at domestic ports-of-entry. However, the deployment of portal monitors has fallen behind schedule, making DHS's goal of deploying 3,034 by 2009 unlikely. To meet its long-term goal, DHS would have to deploy about 52 portal monitors a month for the next 4 years—a rate that far exceeds the 2005 rate of about 22 per month. Moreover, the program's estimated total cost of $1.3 billion is highly uncertain. Several factors have contributed to the slow pace of deployment. First, program officials typically disburse funds to the contractor managing the deployment late in the fiscal year. For example, the contractor did not receive its fiscal year 2005 allocation until September 2005. These delays have caused the contractor to postpone or cancel contracts, sometimes delaying deployments. According to the House Appropriations Committee report on the CBP portion of DHS's fiscal year 2005 budget, CBP should provide the Congress with an acquisition and deployment plan for the portal monitor program prior to funding Pacific Northwest National Laboratory (PNNL). This plan took many months to finalize, mostly because it required multiple approvals within DHS and the Office of Management and Budget (OMB) prior to being submitted to the Congress. The lengthy review process delayed the release of funds and, in some cases, disrupted and delayed deployment. In fiscal year 2005, this process was further delayed by the creation of DNDO, and the uncertainty regarding the new office's responsibilities. Second, negotiations with seaport operators to deploy portal monitors have taken longer than anticipated because some operators believe screening for radiation will adversely affect the flow of commerce through their ports. DHS has adopted a deployment policy designed to achieve cooperation with seaport operators because agency officials believe such arrangements are more efficient and, in the long term, probably more timely. Third, devising an effective way to conduct secondary inspections of rail traffic departing seaports without disrupting commerce has delayed deployments. This problem may worsen because the Department of Transportation (DOT) has forecast that the use of rail transit out of seaports will probably increase in the near future. Addressing and solving the problems with screening rail transport is critical to the successful completion of the DHS program.

Regarding the total cost of the project, CBP's $1.3 billion estimate is highly uncertain and overly optimistic. The estimate is based on CBP's plans for widespread deployment of advanced technology portal monitors currently being developed. However, the prototypes of this equipment have not yet been shown to be more effective than the portal monitors now in use, and DHS officials say they will not purchase the advanced portal monitors unless they are proven to be superior. Moreover, when the advanced technology portal monitors become commercially available, experts estimate that they will cost between about $330,000 and $460,000 each—far more than the currently-used portal monitors which cost between $49,000 and $60,000. The installation cost for both types of portal monitor is roughly $200,000. Even if future test results indicate better detection capabilities, without a detailed comparison of the two technologies' capabilities it is not clear that the dramatically higher cost for this new equipment would be worth the investment. Finally, our analysis of CBP's deployment data indicates that the program will probably experience a significant cost overrun of between $88 million and $596 million, with a $342 million overrun most likely.

The CBP officers we observed conducting primary and secondary inspections appeared to use radiation detection equipment correctly and to follow inspection procedures. In contrast, in 2003 we reported that CBP officers sometimes used radiation detection equipment in ways that reduced its effectiveness and sometimes did not follow agency procedures. Generally, CBP requires that its officers receive formal training in using radiation detection equipment, and many officers have gained experience and proficiency in using the equipment since the program's inception. However, we also identified two potential issues in CBP inspection procedures that, if addressed, could strengthen the nation's defenses against nuclear smuggling. For example, individuals and organizations shipping radiological materials to the United States generally must acquire a Nuclear Regulatory Commission (NRC) license, but regulations do not require that the license accompany the shipment. Further, according to CBP officials, CBP officers lack access to NRC license data that could be used to verify that shippers of radiological material actually obtained required licenses, and to authenticate licenses that accompany shipments. The second potential issue pertains to CBP's guidance for conducting secondary inspections. Currently, CBP procedures require only that officers locate, isolate, and identify radiological material. Typically, officers perform an external examination by scanning the sides of cargo containers with a radiation isotope identification device during secondary inspections. The guidance does not specifically require officers to open containers and inspect their interiors, even when an external examination cannot unambiguously resolve an alarm. However, at one port-of-entry we visited, CBP officers routinely opened and entered commercial truck trailers to conduct secondary inspections when an external inspection could not locate and identify the radiological source. This approach increases the chances that the source of the radioactivity that originally set off the alarm will be correctly located and identified. According to senior CBP officials at this port-of-entry, this additional procedure has had little negative impact on the flow of commerce and has not increased the cost of CBP inspections, despite being implemented at one of the busiest commercial ports-of-entry in the nation.

DHS would like to improve the capabilities of currently-fielded radiation detection equipment. Today's equipment lacks a refined capability to rapidly determine the type of radioactive materials they detect, which means that CBP officers often conduct secondary inspections of containers carrying non-threatening material. To address this limitation, DHS has sponsored research, development, and testing activities that attempt to improve the capabilities of existing radiation portal monitors and to produce new, advanced technologies with even greater detection and identification enhancements. However, much work remains for the agency to achieve consistently better detection capabilities, as the efforts undertaken so far have had only mixed results. For example, DHS sponsored the development of a software package designed to reduce the number of false alarms from portal monitors already in widespread use. However, tests of the software have been largely inconclusive. In some test scenarios, there was little difference in detection capability between portal monitors equipped with—and without—the new software. Experts have recommended further testing to improve the software's capabilities. Further, DHS is testing new, advanced portal monitors that use a technology designed to both detect the presence of radiation and identify its source. However, in tests performed during 2005, the detection capabilities of the advanced technology prototypes demonstrated mixed results—in some cases they worked better, but in other cases, they worked about the same as already deployed systems. In addition, DHS also sponsors a long-range research program aimed at developing innovative technologies designed to improve the capabilities of radiation detection equipment. For example, DHS is supporting research at two national laboratories on a new system designed to better detect radiation sources, even when shielded with materials designed to hide their presence. The two laboratories have constructed several prototypes, but currently the high cost of this technology limits its commercial attractiveness. Finally, DHS plans to use its new testing facility being built at the Nevada Test Site to improve on existing test capabilities and to support the agency's development, testing, acquisition, and deployment of radiation detection technologies.

Historically, cooperation between agencies conducting radiation detection programs has been limited. Currently DHS, largely through DNDO, cooperates with DOE, the Department of Defense (DOD), and other agencies to coordinate these programs; however, because DNDO was created less than 1 year ago, its cooperative efforts—and its working relationships with other federal agencies—are in their early stages of development and implementation. Currently, other federal agencies are providing staff to work directly with DNDO. However, it is too soon to determine the overall effectiveness of these efforts. DHS also works with other agencies to make current detection efforts more efficient and effective. For example, in April 2005, DHS and DOE entered into a memorandum of understanding to, among other things, exchange information on radiation detection technologies to improve the effectiveness of their deployment; the agencies also agreed to share lessons learned from operational experiences, and data received from radiation detection equipment deployed at U.S. and foreign ports. Also in April 2005, DHS entered into an agreement with the Port Authority of New York and New Jersey to, among other things, integrate lessons learned from field experience into domestic radiation detection efforts. In the future, DNDO intends to develop an integrated worldwide system. The resulting "global architecture," as it is being called by DNDO officials, would be a multi-layered defense strategy that includes programs that attempt to secure nuclear materials and detect their movements overseas, such as DOE's

Second Line of Defense program; to develop intelligence information on nuclear materials' trans-shipments and possible movement to the United States; and to integrate these elements with domestic radiation detection efforts undertaken by governments—federal, state, local, and tribal—and the private sector.

We are recommending a series of actions designed to help DHS speed up the pace of portal monitor deployments, better account for schedule delays and cost uncertainties, make the most efficient use of program resources, and improve its ability to interdict illicit nuclear materials.

We provided a draft of this report to DHS for its review and comment. DHS stated that it agreed with, and will implement, our recommendations.

Background

Initial concerns about the threat posed by nuclear smuggling were focused on nuclear materials originating in the former Soviet Union. As a result, the first major initiatives concentrated on deploying radiation detection equipment at borders in countries of the former Soviet Union and in Central and Eastern Europe. In particular, in 1998, DOE established the Second Line of Defense program, which, through the end of fiscal year 2005, had installed equipment at 83 sites mostly in Russia.[5] In 2003, DOE implemented a second program, the Megaports Initiative,[6] to focus on the threat posed by nuclear smuggling overseas by installing radiation

[5]We originally reported on U.S. efforts to combat nuclear smuggling in 2002. See GAO, *Nuclear Nonproliferation: U.S. Efforts to Help Other Countries Combat Nuclear Smuggling Need Strengthened Coordination and Planning*, GAO-02-426 (Washington, D.C.: May 16, 2002). See also, GAO, *Combating Nuclear Smuggling: Corruption, Maintenance, and Coordination Problems Challenge U.S. Efforts to Provide Radiation Detection Equipment to Other Countries*, GAO-06-311 (Washington, D.C.: Mar. 14, 2006).

[6]We recently reported on the Megaports Initiative. See GAO, *Preventing Nuclear Smuggling: DOE Has Made Limited Progress in Installing Radiation Detection Equipment at Highest Priority Foreign Seaports*, GAO-05-375 (Washington, D.C.: Mar. 31, 2005).

detection equipment at major seaports around the world.[7] In the United States, the U.S. Customs Service began providing its inspectors with portable radiation detection devices in 1998. After September 11, 2001, the agency expanded its efforts to include the deployment of portal monitors—large-scale radiation detectors that can be used to screen vehicles and cargo.[8] In March 2003, the U.S. Customs Service was transferred to DHS, and the border inspection functions of the Customs Service, including radiation detection, became the responsibility of CBP.[9]

Deploying radiation detection equipment at U.S. borders is part of DHS's strategy for addressing the threat of nuclear and radiological terrorism. DHS's strategy includes: (1) countering proliferation at the source by assisting foreign governments in their efforts to detect and interdict nuclear and radiological smuggling; (2) controlling the illegal export of technology and equipment from the United States that terrorists could use to develop a nuclear or radiological weapon; (3) detecting and interdicting potential smuggling attempts before they reach the United States; and (4) securing U.S. ports-of-entry through multiple technologies that include radiation detection and nonintrusive inspections to view images of cargo in sea containers.

CBP plans to deploy radiation portal monitors in five phases, or "categories of entry": (1) international mail and express courier facilities; (2) major northern border crossings; (3) major seaports; (4) southwestern border crossings; and (5) all other categories, including international airports, remaining northern border crossings and seaports, and all rail crossings. In this final phase, CBP also plans to replace the currently-fielded portal monitors with newer, more advanced technology. Generally, CBP

[7] U.S. radiation detection assistance programs at foreign seaports are coordinated with—and complementary to—DHS's Container Security Initiative (CSI). Under CSI, which began operating in January 2002, U.S. Customs officials stationed in foreign ports review the cargo manifests of containers bound directly for the United States and attempt to identify containers with potentially dangerous cargo, such as explosives or weapons of mass destruction. GAO recently reported on CSI. See GAO, Container Security: *A Flexible Staffing Model and Minimum Equipment Requirements Would Improve Overseas Targeting and Inspection Efforts*, GAO-05-557 (Washington, D.C.: Apr. 26, 2005).

[8] We initially reported on the U. S. Customs Service's efforts to deploy radiation detection equipment at U.S. ports-of-entry in 2002. See GAO, *Customs Service: Acquisition and Deployment of Radiation Detection Equipment*, GAO-03-235T (Washington, D.C.: Oct. 17, 2002).

[9] See Pub. L. No. 107-296 (2002) and DHS Reorganization Plan (Nov. 25, 2002).

prioritized these categories according to their perceived vulnerability to the threat of nuclear smuggling. CBP did not, however, conduct a formal threat assessment. International mail and express courier facilities present a potential vulnerability because mail and packages arrive with no advance notice or screening. Northern border crossings are also vulnerable, according to CBP, because of the possible presence of terrorist cells operating in Canada. The third category, major seaports, is considered vulnerable because sea cargo containers are suitable for smuggling and because of the large volume of such cargo. Seaports account for over 95 percent of the cargo entering the United States. Southwestern borders are vulnerable because of the high volume of traffic and because of the smuggling that already occurs there. Although airlines can quickly ship and deliver air cargo, CBP considers air cargo to be a slightly lesser risk because the industry is highly regulated.

In deploying radiation detection equipment at U.S. borders, CBP identified the types of nuclear materials that might be smuggled, and the equipment needed to detect its presence. The radiological materials of concern include assembled nuclear weapons; nuclear material that could be used in a nuclear weapon but that is not actually assembled into a weapon ("weapons-grade nuclear material"); radiological disbursal devices, commonly called "dirty bombs;" and other illicit radioactive material, such as contaminated steel or inappropriately marked or manifested material. Detecting actual cases of attempted nuclear smuggling is difficult because there are many sources of radiation that are legal and not harmful when used as intended. These materials can trigger alarms (known as "nuisance alarms") that are indistinguishable from those alarms that could sound in the event of a true case of nuclear smuggling. Nuisance alarms are caused by patients who have recently had radiological treatment; a wide range of cargo with naturally occurring radiation, such as fertilizer, ceramics, and food products; and legitimate shipments of radiological sources for use in medicine and industry. In addition, 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.

The process of deploying portal monitors begins with a site survey to identify the best location at an entry point for installing the equipment. While in some cases the choice may be obvious, operational considerations at many entry points require analysis to find a location where all or most of the cargo and vehicles can pass through the portal monitor without interfering with the flow of commerce. After identifying the best option, CBP works with local government and private entities to get their support. At many U.S. entry points, the federal government does not own the property and therefore collaborates with these entities to deploy the equipment. It is CBP's policy to depend exclusively on such negotiations, rather than to use any kind of eminent domain or condemnation proceeding. The actual installation of the portal monitors involves a number of tasks such as pouring concrete, laying electrical groundwork, and hooking up the portal monitors to alarm systems that alert officers when radiation is detected. Finally, PNNL tests the equipment and trains CBP officers on its operation, including how to respond to alarms.

To coordinate the national effort to protect the United States from nuclear and radiological threats, in April 2005, the president directed the establishment of DNDO within DHS. The new office's mission covers a broad spectrum of responsibilities and activities, but is focused primarily on providing a single accountable organization to develop a layered defense system. This system is intended to integrate the federal government's nuclear detection, notification, and response systems. In addition, under the directive, DNDO is to acquire, develop, and support the deployment of detection equipment in the United States, as well as to coordinate the nation's nuclear detection research and development efforts. For fiscal year 2006, DNDO's total budget is approximately $318 million, which includes at least $81 million for research and development of advanced nuclear detection technologies and $125 million for portal monitor purchase and deployment.

The Homeland Security Act of 2002 gave DHS responsibility for managing the research, development, and testing of technologies to improve the U.S. capability to detect illicit nuclear material.[10] Prior to the creation of DNDO, DHS's Science and Technology (S&T) directorate had this responsibility. DNDO has assumed these responsibilities and works with S&T's Counter Measures Test Beds (CMTB) to test radiation detection equipment in New York and New Jersey. As of January 2006, DNDO has provided $605,000 to DOE national laboratories that support this effort. Additional funding for fiscal year 2006 from S&T and DNDO to support test and evaluation activities at the CMTB is yet to be determined. The Homeland Security Act also provided DHS the authority to use DOE national laboratories for

[10]Pub. L. No. 107-296 (2002).

research, development, and testing of new technologies to detect nuclear material.[11]

DHS Has Made Progress in Deploying Radiation Detection Equipment, but the Agency's Program Goals Are Unrealistic and the Cost Estimate Is Uncertain

As of December 2005, DHS had completed deployment of portal monitors at two categories of entry—a total of 61 ports-of-entry—and has begun work on two other categories; overall, however, progress has been slower than planned. According to DHS officials, the slow progress has resulted from a late disbursal of funds, and delays in negotiating deployment agreements with seaport operators. Further, we believe the expected cost of the program is uncertain because DHS's plans to purchase newer, more advanced equipment are not yet finalized; also we project that the program's final cost will be much higher than CBP currently anticipates.

The Program to Install Portal Monitors Has Fallen Behind Schedule

Between October 2000 and October 2005, DHS, mainly through its prime contractor PNNL, has spent about $286 million to deploy radiation detection equipment at U.S. ports-of-entry. As of December 2005, DHS had deployed 670 of 3,034 radiation portal monitors—about 22 percent of the portal monitors DHS plans to deploy.[12] The agency has completed portal monitor deployments at international mail and express courier facilities and the first phase of northern border sites—57 and 217 portal monitors, respectively. In addition, by December 2005, DHS had deployed 143 of 495 portal monitors at seaports and 244 of 360 at southern borders. In addition, three portal monitors had been installed at the Nevada Test Site to analyze their detection capabilities and four had been retrofitted at express mail facilities. As of February 2006, CBP estimated that with these deployments CBP has the ability to screen about 62 percent of all containerized shipments entering the United States, and roughly 77 percent of all private vehicles (POVs). Within these total percentages, CBP can screen 32 percent of all containerized seaborne shipments; 90 percent of commercial trucks and 80 percent of private vehicles entering from Canada; and

[11]Pub. L. No. 107-296, § 309.

[12]CBP's most recent *Project Execution Plan* (December 2004) calls for deploying a total of 2,397 portal monitors. However, by December 2005, the scope of the deployments had grown to 3,034.

approximately 88 percent of all commercial trucks and 74 percent of all private vehicles entering from Mexico.

CBP does not maintain a firm schedule for deploying handheld radiation detectors, such as pagers and radiation isotope identification devices. This is equipment used mainly to help pinpoint and identify sources of radiation found during inspections. Instead, according to CBP officials, the agency acquires and deploys such equipment each fiscal year as needed. The handheld radiation detectors are procured to coincide with portal monitor deployments to ensure mission support. Since fiscal year 2001, CBP has spent about $24.5 million on pagers, and about $6.6 million on radiation isotope identification devices. At present, CBP can field roughly 12,450 pagers—enough to ensure that all officers conducting primary or secondary inspections at a given time have one. The agency intends to deploy about 6,500 additional pagers. Similarly, CBP's 549 radiation isotope identification devices are deployed at domestic ports-of-entry. CBP intends to acquire another 900 to ensure that all needs are met.

Overall, CBP and PNNL have experienced difficulty meeting the portal monitor deployment schedule. None of the planned portal monitor deployments has progressed according to schedule, and monthly deployments would have to increase by almost 230 percent to meet a September 2009 program completion date. For example, in November 2005, deployments at land crossings were about 20 months and $1.9 million behind schedule, while deployments at the first 22 seaports were about 2 years and $24 million behind schedule.[13] Despite these delays, PNNL reported in November 2005 that the overall project schedule should not extend beyond its current completion date of September 2009. However, our analysis indicates that CBP's deployment schedule is too optimistic.

[13]CBP and PNNL use an earned value management system (EVM) to report the domestic portal monitor deployment program's status against its baseline—scope, schedule, and budget. Essentially, an EVM approach compares the value of the work accomplished during a given period with the value of the work scheduled to be accomplished during that period. Differences from the schedule are measured in both cost and schedule "variances." For example, program activities (such as deploying portal monitors at a specific site) that are completed ahead of schedule would be reported as positive variances, while activities that are completed behind schedule would be reported as negative variances. Similarly, the EVM system tracks whether completed activities are costing more or less than expected. A negative cost variance would indicate that activities are costing more than expected, while a positive cost variance would mean activities are costing less than expected. We report schedule differences in both calendar and EVM terms. Appendix II provides more details on the EVM methodology and our analysis.

In fact, for CBP and PNNL to meet the current deployment schedule, they would have to install about 52 portal monitors per month from November 2005 to September 2009. In our view, this is unlikely because it requires a rate of deployment that far exceeds recent experience. For example, during calendar year 2005, PNNL deployed portal monitors at the rate of about 22 per month, and deployments have fallen further and further behind schedule. Between February and December 2005, for example, PNNL did not meet any of its scheduled monthly deployments, never deploying more than 38 portal monitors during any single month. If CBP continues to deploy portal monitors at its 2005 pace, the last monitor would not be deployed until about December 2014. Table 1 details the status of portal monitor deployments, as of December 2005.

Table 1: Status of Portal Monitor Deployments as of December 2005

Portal monitor deployment phase	Total portals planned	Status
International mail and express consignment facilities[a] (23 facilities)	57	Completed April 2004 4 months late
Land border and rail ports-of-entry (205 crossings)	967	20 months late
Seaports (106 terminals) and international airports	1,205	24 months late
Retrofits[b]	82[c]	Projected September 2009 completion
Other sites[d]	3	
Excess equipment[e]	721	
Total	**3,035[f]**	

Sources: PNNL and CBP.

[a]Excludes FedEx and UPS, both of whom screen packages overseas as agreed in a memorandum of understanding with CBP.

[b]"Retrofitting" refers to replacing currently-fielded portal monitors with advanced-technology portal monitors.

[c]PNNL plans a "net" increase of 82 portal monitors as a result of retrofits.

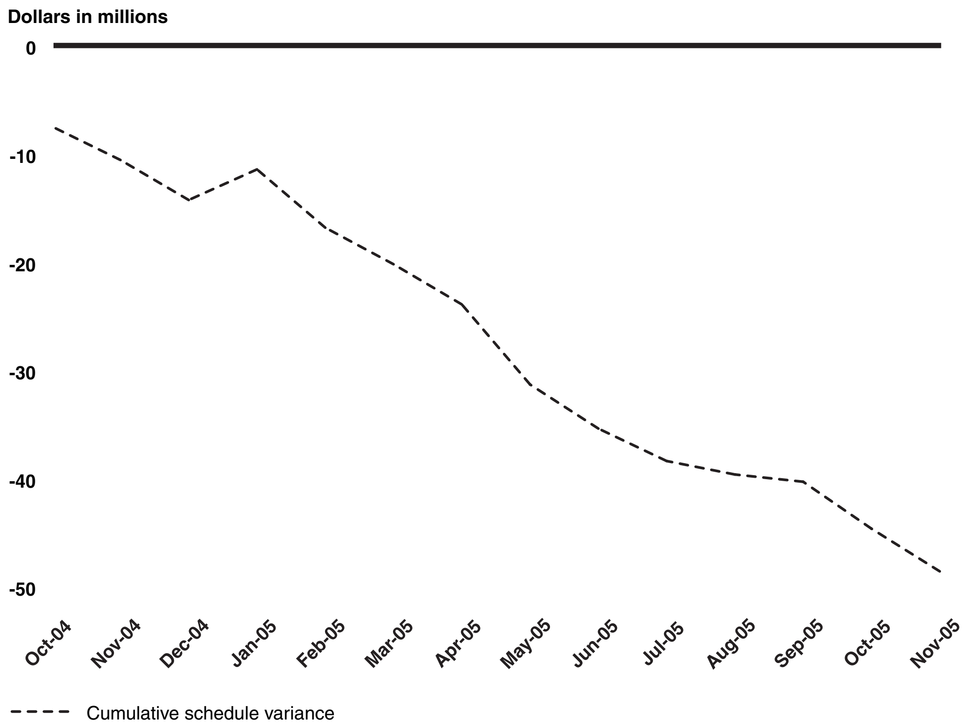
[d]"Other sites" refers to portal monitors installed at the Nevada Test Site for testing purposes.

[e]"Excess equipment" refers to the older portal monitors being replaced through the retrofit process.

[f]The total number of portal monitors planned for deployment is based on December 2005 estimates from CBP and PNNL. It represents a recent estimate of CBP's requirements, and according to CBP, it will be used to update the agency's current deployment plan, which calls for deploying 2,397 portal monitors by September 2009.

Further, we analyzed CBP's earned value management data as of November 2005 and determined that, although CBP planned for the deployment program to be 20.5 percent complete by that date, the program is only about 16 percent complete. In addition, our analysis indicates that since the program's inception, work valued at $48.6 million has fallen behind schedule. Moreover, the trend over the past 14 months shows CBP and PNNL falling further behind schedule, as seen in figure 1.

Figure 1: Monthly Cumulative Values of Work Planned but Not Finished As Planned



Source: GAO analysis based on the PNNL November 2005 Monthly Progress Report.

Note: The "zeropoint" on this figure denotes work that was completed at its planned cost. A positive number means that all the work completed to that point costs *less* than planned, while a negative number means that all the work completed to that point costs *more* than planned.

There have been at least three major sources of delay that have affected the portal monitor deployment program: funding issues, negotiations with seaport terminal operators, and problems in screening rail cars—particularly in a seaport environment.

Funding Issues

According to CBP and PNNL officials, recurrent difficulties with the project's funding are the most important explanations of the schedule delays. Specifically, according to DHS and PNNL officials, CBP has been chronically late in providing appropriated funds to PNNL, thereby hindering its ability to meet program deployment goals. For example, PNNL did not receive its fiscal year 2005 funding until September 2005. According to PNNL officials, because of this delay, some contracting activities in all deployment phases had to be delayed or halted, but the adverse effects on seaports were especially severe. For example, PNNL reported in August 2005 that site preparation work at 13 seaports had to cease because the Laboratory had not yet received its fiscal year 2005 funding allocation. According to senior CBP officials, their agency's inability to provide a timely spending plan to the Congress for the portal monitor deployment program is the main reason for these funding delays. According to the House Appropriations Committee report on the CBP portion of DHS's fiscal year 2005 budget, CBP should provide the Congress an acquisition and deployment plan for the portal monitor program prior to funding PNNL.[14] However, these plans typically take many months for CBP to finalize—in part because CBP requires that the plans undergo several levels of review—but also because these plans are reviewed by DHS and OMB before being submitted to the Congress. In fiscal year 2005, this process was further delayed by the creation of DNDO, uncertainty regarding DNDO's responsibilities, and negotiations regarding the expenditure of the fiscal year 2005 appropriations.

CBP has tried to address this problem by reprogramming funds when money from other programs is available. In some cases, the amount of reprogrammed funds has been fairly large. For example, about 15 percent of fiscal year 2005's funding included money reprogrammed from other CBP sources, or almost $14 million. In fiscal year 2004, about $16 million was reprogrammed—or about a third of the fiscal year's total. And in fiscal year 2003, the total of reprogrammed money was about $18 million—about 20 percent.

Delays in Gaining Agreements Have Slowed Seaport Deployments

Negotiations with seaport operators have been slow and have also delayed the portal monitor deployment program. According to CBP and PNNL officials, one of the primary reasons behind the seaport phase's substantial delay in deployments is the difficulty in obtaining contractual agreements

[14] H.R. Rep. No. 108-541, at 25-26 (2004).

with port and terminal operators at seaports. DHS has not attempted to impose agreements on seaport operators because, according to officials, cooperative arrangements with the port operators are more efficient and, in the long term, probably more timely. According to CBP and PNNL officials, many operators believe screening for radiation will adversely affect the flow of commerce through their ports. In addition, deploying portal monitors in major seaports presents several unique challenges. For example, seaports are much larger than land border crossings, consist of multiple terminals, and may have multiple exits. Because of these multiple exits, seaports require a greater number of portal monitors, which may entail more negotiations with port and terminal operators. In addition, port operators at times have insisted on late-stage design changes, requested various studies prior to proceeding with final designs, insisted on inefficient construction schedules, and delayed their final review and approval of project designs. According to CBP and PNNL, these efforts often reflect the port and terminal operators' uneasiness with portal monitor deployments, and their resolve to ensure that the outcome of the deployment process maintains their businesses' competitiveness. For example, port officials at one seaport requested several changes late in the process, including performing an unscheduled survey for laying cable, revising portal monitor locations at two gates, and adding a CBP control booth at a third terminal. According to CBP and PNNL officials, the agency prefers to accommodate these types of changes, even late in the process and even if they slow deployment, because in the long term they believe it is more efficient and effective.

Screening Rail Cars in Seaports Presents Unique Problems

The difficulty of devising an effective and efficient way to conduct secondary inspections of rail traffic departing seaports without disrupting commerce has created operational issues that could further delay deployments. Four of the five seaports we visited employ rail cars to ship significant amounts of cargo. In one seaport, the port director estimated that about 80-85 percent of the cargo shipped through his port departs via rail. For the other three seaports, the percentages for rail traffic were 5 percent, 13 percent, and 40 percent respectively. According to port officials, these seaports would like to accommodate CBP's efforts to install radiation detection equipment designed to screen rail traffic, but they are concerned that the logistics of conducting secondary inspections on trains as they prepare to depart the seaport could back up rail traffic within the port and disrupt rail schedules throughout the region—potentially costing the port tens of thousands of dollars in lost revenue. For example, one senior port authority official told us that his port lacked ample space to park trains for secondary inspections, or to maneuver trains to decouple the rail car(s) that may have caused a primary inspection alarm. As a result, trains that cause a primary alarm would have to wait, in place, for CBP to conduct a secondary inspection, blocking any other trains from leaving the port. According to this port official, any delay whatsoever with a train leaving the port could cause rail problems down the line because track switches are geared to train schedules. To avoid these kinds of problems, CBP has delayed deploying portal monitors in this seaport until technical and operational issues can be overcome. As of December 2005, no portal monitors had been deployed at this seaport, although according to PNNL's schedule, 5 of its 11 terminals—a total of 19 portal monitors—should have been deployed by October 2005. According to the port director at another seaport we visited, a port that actually has a rail portal monitor installed, similar operational issues exist. However, in addition to backing up rail traffic within the port, trains awaiting secondary inspections at this port could block the entrance/exit to a nearby military base. The director of the state's port authority told us that his solution has been to simply turn off the portal monitor. According to CBP officials, this was entirely a state decision, since this portal monitor is the state's responsibility and not part of CBP's deployment. However, these officials also noted that they agreed with the states and noted that they would not attempt to impose a solution or deadline on either port. CBP officials noted that most seaport operators seem willing to accommodate portal monitors, but until a better portal monitor technology evolves that can help ensure a smooth flow of rail traffic out of the port, negotiations with seaport operators will continue to be slow.

According to CBP and port officials, they have considered several potential solutions. For example, there is widespread agreement that screening sea cargo containers *before* they are placed on rail cars offers the best solution, but this option is operationally difficult in many seaports. Mobile portal monitors, when commercially available, may also offer a partial solution. In addition, CBP is optimistic that advanced portal monitors, when they become commercially available, may help solve some of the problems in the rail environment by limiting the number of nuisance alarms. However, according to the CBP and port officials we contacted, screening rail traffic continues to pose a vexing operational problem for seaports.

The concerns that seaport operators and CBP expressed regarding screening rail commerce in seaports may increase and intensify in the future because rail traffic, in general, is expected to increase substantially by 2020. DOT has forecast that by 2020, rail will transport roughly 699 million tons of international freight—up from 358 million tons carried in

1998. Officials at 3 of the 5 seaports we visited expect rail traffic through their facilities to increase dramatically during the next 10 to 15 years. As the volume of trade increases, so too will the economic stakes for the port and terminal operators, while the regulatory burden for CBP is likely to increase as well. Delays—for any reason, including radiation detection—are likely to become more costly, and CBP will likely have ever-increasing numbers of rail cars to screen.

In addition, although CBP is not scheduled to begin deploying portal monitors to screen rail shipments at land border crossings until 2007, the agency will likely experience operational challenges at land border crossing similar to those it is now experiencing at seaports. For example, at both land border crossings and seaports, if a rail car alarms as it passes through a portal monitor, that car will possibly have to be separated from the remaining train—sometimes a mile in length—to undergo a secondary inspection. Furthermore, because trains transport numerous types of cargo containing large quantities of naturally occurring radioactive material, CBP faces the challenge of maintaining a nuisance alarm rate that does not adversely affect commerce. CBP and PNNL are currently conducting testing of a prototype rail portal monitor to determine the potential impact of naturally occurring radioactive material on rail operations at land border crossings.

Other Factors Have Delayed Portal Monitor Deployments

Unforeseen design and construction problems have also played a role in delaying portal monitor deployments. For example, deployments at six southern border sites have been delayed to coincide with the sites' expansion activities. According to CBP officials, there are two approaches to accommodating a port-of-entry's alterations, both of which may delay portal monitor deployments. First, CBP and PNNL may decide to delay the start of portal monitor projects until the port-of-entry completes its alterations, to make certain that portal monitor placements are properly located. Second, port-of-entry expansion activities may alter existing traffic flows and require that PNNL redesign its portal monitor deployments. The portal monitor deployments at three southern border ports-of-entry has taken much longer than planned because of the port's expansion activities. According to PNNL, there is now considerable schedule uncertainty associated with these deployments, which may ultimately impact the completion of the southern land border deployments.

Portal monitor deployments have also been hampered by poor weather. For example, cold weather at several northern sites caused some unexpected work stoppages and equipment failures that resulted in construction delays of 2 to 3 months. Finally, one southern border site has been delayed because of major flooding problems. The flooding issue must be resolved before the deployment can be completed.

DHS's Portal Monitor Deployment Program Cost Estimate Is Uncertain and Overly Optimistic

DHS's current estimate to complete the program is $1.3 billion, but this estimate is highly uncertain and overly optimistic. First, DHS's cost estimate is based on a plan to deploy advanced-technology portal monitors that have so far shown mixed results for detecting radiation compared to currently-fielded portal monitors. Since the efficacy of the advanced portal monitors has not yet been proven conclusively, there is at least some uncertainty over whether—and, if so, how many—of the new portal monitors may be deployed. In addition, the final cost of the new portal monitors has not been established. Second, our analysis of CBP's earned value data also suggests that the program will likely cost much more than planned.

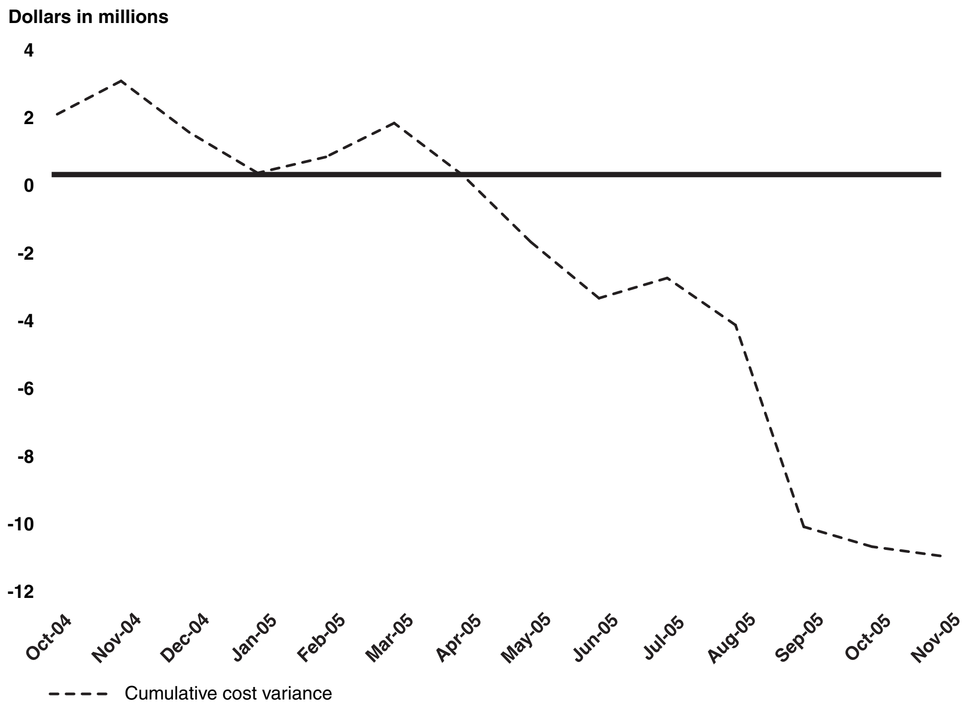
The current deployment plan calls for installing advanced portal monitors at all cargo primary and secondary inspection locations, at all secondary inspection locations for private vehicles, and also retrofitting many sites with the advanced equipment, when it becomes available. However, according to senior officials at DNDO, the advanced technology must meet all of DNDO's performance criteria, and must be proven superior to the portal monitors already in use, before DNDO will procure it for use in the United States. Recent tests of the new portal monitors indicate that DNDO's criteria have not yet been met. For example, S&T sponsored research in 2004 that compared the detection capabilities of currently-fielded portal monitors with the advanced portal monitors. The results of that research suggested that, in some scenarios, the detection abilities of the two portal monitor types were nearly equivalent. In other scenarios, the new equipment's detection capability was significantly better. S&T concluded that more work remains to be done in optimizing and comparing portal monitors so as to understand how they can be used to the greatest effect at U.S. ports-of-entry. In 2005, DNDO sponsored additional research designed to compare the two types of portal monitor, and determined that the advanced portal monitors' detection capabilities were somewhat better than those of the currently-fielded equipment. In addition, in October 2005, DNDO completed the first comprehensive tests for these advanced portal monitors at the Nevada Test Site. This advanced technology combines the ability to detect radiation and identify its source. According to an official who helped supervise these tests, the new portal monitors' performance did not meet all of DNDO's expectations with regard to providing significant detection improvements over currently-fielded equipment in all scenarios. CBP and DNDO officials also expressed concerns regarding the advanced portal monitors' detection capabilities in light of the Nevada test results. In particular, senior CBP officials questioned whether the advanced portal monitors would be worth their considerable extra costs, and emphasized finding the right mix of current and advanced-technology equipment based on the needs at individual ports-of-entry. According to DNDO officials, the potential improvement over currently fielded portal monitors in capability to identify radioactive sources, and hence to detect actual threats as opposed to simply detecting radiation, has not yet been quantified. However, these officials believe that the results to date have been promising, and DNDO intends to continue supporting the advanced portal monitor's development and believe the new technology may be ready for deployment early in calendar year 2007.

There is also considerable uncertainty regarding the eventual cost of the advanced portal monitors—if they become commercially available, and if DNDO opts to use them. Experts we contacted estimated that the new portal monitors could cost between \$330,000 and \$460,000 each. These estimates are highly uncertain because advanced portal monitors are not yet commercially available. As a point of reference, the portal monitors currently in use typically cost between \$49,000 and \$60,000. These costs include only the purchase price of the equipment, not its installation. According to CBP and PNNL officials, installation costs vary, but average about \$200,000 per portal monitor. Even if future test results indicate that the new technology exhibits much better detection and identification capabilities, it would not be clear that the dramatically higher cost for this new equipment would be worth the considerable investment, without the agency having first rigorously compared the portal monitors' capabilities taking their costs into account. Currently, DNDO and CBP are working together to determine the most appropriate technologies and concepts of operation for each port-of-entry site. The two agencies are also trying to determine the highest priority sites for advanced-technology portal monitors based on the extent to which the new portal monitors show improved performance.

In November 2005, PNNL reported that the portal monitor deployment program could experience an overall cost overrun of \$36 million. In contrast, our analysis of CBP's earned value data indicates that the agency should expect a cost overrun of between \$88 million and \$596 million. We based our cost overrun projections on the rates at which CBP and PNNL deployed portal monitors, through November 2005. The more efficient the agency and its contractor are in deploying portal monitors, the smaller the cost overruns; conversely, when efficiency declines, cost overruns increase.[15]

In fact, as shown in figure 2, recent cumulative program cost trends have been negative, indicating that CBP's cost overruns are deepening over time.

Figure 2: Monthly Cumulative Cost Overruns



Source: GAO analysis based on the PNNL November 2005 Monthly Progress Report.

Note: The "zero point" on this figure denotes work that was completed at its planned cost. A positive number means that all the work completed to that point costs *less* than planned, while a negative number means that all the work completed to that point costs *more* than planned.

[15]We also assessed PNNL's cost and schedule performance using earned value analysis techniques based on data captured in PNNL's contract performance reports. We also developed a forecast of future cost growth. We based the lower end of our forecast range on the costs spent to date added to the forecast cost of work remaining. The remaining work was forecast using an average of the current cost performance index efficiency factor. For the upper end of our cost range, we relied on the actual costs spent to date added to the forecast of remaining work with an average monthly cost and schedule performance index.

PNNL noted that its management reserve of $62 million should cover the anticipated overrun. However, we do not agree.[16] First, we believe the cumulative cost overrun will far exceed PNNL's estimate of $36 million. We believe an overrun of about $342 million, the midpoint of our projected overrun range, is more likely. Since 1977, we have analyzed over 700 acquisition projects on which EVM techniques have been applied. These analyses consistently show that once a program is 15 percent complete (as is the case with this program), cost performance almost never improves and, in most cases, declines. PNNL's recent cost trend follows this pattern. Second, based on these 700-plus studies, our estimate takes a more realistic view that the portal monitor deployment program's cost performance most likely will continue to decline; hence the management reserve will be consumed over time as the program incurs unexpected expenses. Finally, to meet the deployment program's planned costs, PNNL would have to greatly improve its work efficiency. However, our analysis of prior EVM-based projects indicates that productivity rates nearly always decline over the course of a project. We determined that PNNL's efficiency rate for the most recent 8 months has averaged about 86 percent—PNNL has been delivering about $.86 worth of work for every dollar spent. In order to complete the remaining work with available funding, PNNL's efficiency rate would have to climb to around 98 percent, a rate of improvement unprecedented in the 700-plus studies we have analyzed.

CBP Does Not Know If PNNL's Cost and Schedule Data Are Reliable

Federal agencies are required by OMB to track the progress of major systems acquisitions using a validated EVM system and to conduct an integrated baseline review.[17] We found that PNNL has an EVM system but has not certified it to show that it complies with guidance developed by the American National Standards Institute/Electronic Industries Alliance.[18] This guidance identifies 32 criteria that reliable EVM systems should meet. In addition, we found that PNNL has not conducted an integrated baseline review—a necessary step to ensure that the EVM baseline for the portal

[16]Management reserves are part of the total program budget intended to be used to fund work anticipated but not currently defined. Most programs usually wait until work is almost completed before making a judgment that management reserve can be applied to cover cost variances.

[17]See OMB Circular No. A-11, Part 7, "Planning, Budgeting, Acquisition, and Management of Capital Assets," June 2005.

[18]American National Standards Institute (ANSI) / Electronic Industries Alliance (EIA) EVM System Standard (ANSI/EIA-748-98), Chapter 2 (May 19, 1998).

monitor program represents all work to be completed, and adequate resources are available.

However, although the EVM data have not been independently validated, we examined the EVM data and found that they did not show any anomalies and were very detailed. Therefore, we used them to analyze the portal monitor program status and to make independent projections of the program's final costs at completion.

CBP Officers Have Made Progress in Using Radiation Detection Equipment Correctly and Adhering to Inspection Guidelines, but There Are Potential Issues with Agency Procedures

CBP officers we observed conducting primary and secondary inspections appeared to use radiation detection equipment correctly and to follow the agency's inspection procedures. In fact, in some cases, CBP officers exceeded standard inspection procedure requirements by opening and entering containers to better identify radiation sources. In contrast, in 2003, when we issued our last report on domestic radiation detection, CBP officers sometimes deviated from standard inspection procedures and, at times, used detection equipment incorrectly. However, the agency's inspection procedures could be strengthened.

CBP Officers Appeared to Use Equipment Correctly and Follow Procedures

During this review, at the 10 ports-of-entry that we visited, the CBP officers we observed conducting primary and secondary inspections appeared to follow inspection procedures and to use radiation detection equipment correctly. The officers' current proficiency in these areas follows increases in training and in CBP's experience using the detection equipment. In contrast, in 2003 we reported that CBP officers sometimes used radiation detection equipment in ways that reduced its effectiveness.

CBP has increased the number of its officers trained to use radiation detection equipment; in fact, the agency now requires that officers receive training before they operate radiation detection equipment. As of February 2006, CBP had trained 6,410 officers to use radiation isotope identification devices, 8,461 to use portal monitors, and 22,180 to use pagers. Many CBP officers received training on more than one piece of equipment and about 900 have since left the agency. Generally, today CBP officers receive radiation detection training from 4 sources: the CBP Academy in Glynco, Georgia; the Border Patrol Academy in Artesia, New Mexico; a DOE-sponsored 3-day training course for interdicting weapons of mass destruction, in Washington state; and on-the-job training at ports-of-entry. Training at the Academies in Georgia and New Mexico includes formal classroom instruction, as well as hands-on exercises on how to use portal monitors, isotope identifiers, and pagers. This training includes simulated scenarios in which officers use radiation detection equipment to conduct searches for nuclear and radiological materials. On-the-job instruction continues at field locations as senior CBP officers, as well as PNNL and other DHS contractor staff, work closely with inexperienced officers to provide them with practical training on how the radiation detection equipment works and how to respond to alarms. According to senior CBP officials, all of the instructors that offer training on using radiation detection equipment are certified in its use. Trainees must demonstrate proficiency in the use of each system prior to assuming full responsibility for radiation detection inspections. About 1,600 CBP officers have participated in DOE's 3-day training course designed to acquaint CBP officers with detection equipment. CBP is currently developing refresher training courses on the use of radiation detection equipment. To further enhance officers' ability to effectively respond to real or potential threats, several of the field locations that we visited conduct "table-top exercises" that simulate scenarios in which the equipment detects an illicit radiological source.

According to several of the CBP field supervisors we contacted, many officers have gained proficiency in following procedures and using radiation detection equipment through substantial field experience responding to alarms. The number of alarms officers typically handle varies according to the size of the site, its location, and type. For example, an isolated land border site would probably experience fewer alarms than a major seaport because of the differences in the volume of traffic. However, it was common for several of the locations we visited to experience 15 to 60 alarms per day. One seaport we visited had 9 terminals, usually with 2 primary and 1 secondary portal monitors. According to CBP officials, each terminal recorded about 8 to 12 alarms per day. The director of port security for a major eastern seaport we visited estimated that her facility records roughly 150 portal monitor alarms each day. Virtually all have been nuisance alarms, but CBP officials still believe they gained valuable experience in using the equipment and following procedures.

All of the primary and secondary inspections we witnessed were nuisance alarms. In all of these cases except one, officers followed CBP's guidance—as well as local variations meant to address issues unique to the area—and correctly used detection equipment. The lone exception occurred at a site whose primary inspection station was staffed by a state port police officer. After the station's portal monitor registered an alarm for a truck departing the site, the police officer did not follow CBP's procedures.[19] For example, he did not collect any documentation from the driver. At all other sites we visited, when a primary portal monitor sounded, CBP officers gathered the cargo's manifest, the vehicle registration, and the driver's license prior to sending the vehicle through secondary inspection. Officers use these documents to check the driver and vehicle cargo. The port police officer told us that he recognized the driver in this case, and so the officer did not believe it was necessary to collect such information. A CBP officer performed the secondary inspection in line with agency guidance. In fact, after using a radiation isotope identification device to conduct an external inspection and determine the source of the alarm—potassium hydroxide—the officer required that the driver open the back of the truck so she could make a visual check of the cargo. From the time of the initial alarm, until the truck departed the site boundary, about 35 minutes elapsed. According to port and CBP officials, this particular alarm, its resolution, and the amount of time it took to resolve are typical of the site. We also discussed the site's radiation detection efforts with the truck driver, in particular the delay associated with this alarm. He noted that he considers the delays experienced at this site to be relatively minor, and that the delays have not had any adverse effects on his business.

We also visited a seaport that experienced a legitimate alarm in which CBP officers used the detection equipment correctly and responded according to procedures. Uranium hexafluoride, a potentially hazardous chemical containing low levels of radioactivity, caused this alarm. A primary portal monitor at the seaport sounded as a truck carrying one container attempted to exit a terminal. Following standard operating procedures, the truck was diverted to a secondary inspection station, where a secondary portal monitor also alarmed. A CBP officer then scanned the container and cab of the truck with an isotope identifier, which indicated that the radiation source was located in the cab within several metal pails. The isotope identifier identified two radiation sources, one of which was uranium-235—potentially a weapons-usable material. The other source was uranium-238. Again following procedures, CBP officers isolated the

[19]Since the officer is an employee of the state, he was not required to follow CBP procedures. According to the port police supervisor present at the scene, the officer acted within the scope of port police guidance.

sources of radiation and provided LSS scientists with information collected by the isotope identifier. Officers also reviewed the driver's delivery papers; used various CBP databases to check the driver, importer, and consignee's history of transporting goods; and contacted the driver's dispatcher and the U.S. consignee to gather information on and assess the legitimacy of the shipment. The consignee explained that the pails contained trace amounts of uranium hexafluoride that had been sent to the company's laboratory for testing. Following additional investigation, which included an X-ray of the pails and a review of DOT requirements regarding radiation-warning placard requirements, CBP determined that the event was not a security threat and released the driver and conveyance. Senior officials at this seaport told us that CBP's radiation detection guidance served as an effective and successful guide to resolving this alarm.

Potential Issues in CBP's Inspection Procedures Could Be Mitigated to Improve Detection Capabilities

We identified two potential issues in CBP's national inspection procedures that could increase the nation's vulnerability to nuclear smuggling. The first potential issue involves NRC documentation. Generally, NRC requires that importers obtain an NRC license for their legitimate shipments of radiological materials into the United States.[20] However, NRC regulations do not require that the license accompany the shipment, although in some cases importers choose to voluntarily include the license. According to CBP officials, CBP lacks access to NRC license data that could be used to verify that importers actually acquired the necessary licenses or to authenticate a license at the border. At present, CBP officers employ a variety of investigative techniques to try to determine if individuals or organizations are authorized to transport a radiological shipment. For example, CBP officers review their entry paperwork, such as shipping papers. Officers also often interview drivers about the details of the delivery and observe their behavior for any suspicious or unusual signs. At one land border crossing we visited, officers told us that frequent and legitimate shippers of radiological material provide advance notice that a radiological shipment will be transported. This can lead to law enforcement personnel being called in to escort the shipment through the port-of-entry.

The second potential issue pertains to CBP's secondary inspection guidelines. Generally, CBP's guidelines require that CBP officers locate,

[20]See 10 C.F.R. § 110.5.

isolate, and identify the radiation source(s) identified during primary inspections. Customarily, officers use a radiation isotope identification device to perform an external examination of cargo containers in these situations. (See fig. 3.) However, the effectiveness of a radiation isotope identification device is diminished as its distance from the radioactive source increases, and by the thickness of the metal container housing the radioactive source. As a result, secondary inspections that rely solely on external examinations may not always be able to locate, isolate, and identify an illicit shipment of nuclear material.

Figure 3: CBP Officers Conducting an External Secondary Inspection at a Seaport

Source: GAO.

The local procedures at some ports-of-entry we visited go beyond the requirements established by CBP's guidelines by having CBP officers open and, if necessary, enter containers when conducting secondary inspections. (See fig. 4.) For example, at one high-volume seaport we visited, the local inspection procedures require officers to open and, if necessary, enter a container to locate and identify a radiological source if an external examination with an isotope identifier is unable to do so. Under such circumstances, the port's procedures require the officer to open the container doors, locate the source, and obtain another reading as close to the source as possible. By entering the container, an officer may be able to reduce the isotope identifier's distance from the radioactive source, and thus obtain a more accurate reading. If the isotope identifier is unable to detect and identify the source after two readings within the container, officers must contact LSS for further guidance. Officers at this seaport have opened containers in the past when the isotope identifier had been unable to detect naturally occurring radioactive material, such as granite or ceramic tile, which is low in radioactive emissions. CBP supervisors at this seaport said that this occurs infrequently and that it adds a very minimal amount of time to the inspection process. In addition, at a land border crossing we visited, the local standard operating procedures instruct CBP officers to conduct a physical examination on vehicles that alarm for the presence of radiation. Officials at this particular port-of-entry said that they have entered vehicles with an isotope identifier when the device has been unable to detect or identify the radioactive source from vehicles' exterior. During a physical examination, officers are supposed to open the vehicle and look for high-density materials, such as lead or steel, which can be used to shield gamma radiation and solid objects with large quantities of liquid that could be used to shield neutron radiation. Because the majority of alarms at this land border crossing are caused by medical isotopes in people, CBP officers physically inspect vehicles on an infrequent basis.

Figure 4: A CBP Officer Entering a Cargo Container During a Secondary Inspection at a Seaport

Source: GAO.

Finally, we also visited a land border crossing where CBP officers routinely open and enter commercial trucks to conduct secondary inspections, even though the site's local procedures do not require this additional examination. Officials at this crossing said that they open up containers to verify that the container's manifest and reading from the isotope identifier are consistent with the container's load. If they are not consistent, CBP officers are supposed to contact LSS for further guidance. During our visit, we observed a truck that alarmed at primary and secondary portal monitors. CBP officers then required the driver to park at a loading dock, where officers first used an isotope identifier to screen the truck from the outside; the reading from the isotope identifier was inconclusive, however. Officers then opened and entered the container with an isotope identifier, conducted a second reading of the radioactive source, and determined that the material inside the container was a non-threatening radioactive source that matched the manifest. A CBP supervisor released the truck. This inspection, from the time of the original alarm to the truck's release took about 25 minutes—slightly greater than the 20-minute average for this site. According to CBP supervisors, officers at this port-of-entry follow this practice routinely, even during the site's peak hours. This approach enables the officers to get closer to the source and obtain a more accurate reading. Furthermore, since this practice enables officers to conduct a more thorough examination of the containers' contents, it may increase the likelihood that CBP officers will find any illicit radioactive material. According to senior CBP officials at this port-of-entry, despite being implemented at one of the busiest commercial ports-of-entry in the nation, this additional procedure has had little negative impact on the flow of commerce and has not increased the cost of CBP inspections.

DHS Is Working to Improve the Capabilities of Currently-fielded and New Radiation Detection Equipment, but Much Work Remains to Achieve Better Equipment Performance

DHS has managed research, development, and testing activities that attempt to address the inherent limitations of currently-fielded radiation detection equipment and to produce new, advanced technologies with even greater detection capabilities. DHS is enhancing its ability to test detection equipment by building a new test facility at DOE's Nevada Test Site. In addition, DHS tests radiation detection equipment under real-life conditions at S&T's CMTB in New York and New Jersey. However, much work remains for the agency to achieve consistently better detection capabilities, as the efforts undertaken so far have achieved only mixed results.

Currently-fielded Radiation Detection Equipment Has Inherent Limitations

Currently-fielded radiation portal monitors have two main limitations. First, they are limited by the physical properties of the radiation they are designed to detect, specifically with regard to the range of detection (some radioactive material emits more radiation than others). Further, this limitation can be exacerbated because sufficient amounts of high-density materials, such as lead or steel, can shield radiation emissions to prevent their detection. Second, currently-fielded portal monitors cannot distinguish between different types of radioactive materials, i.e., they cannot differentiate naturally occurring radioactive material from radiological threat materials. CBP officers are required to conduct secondary inspections on all portal monitor alarms, including nuisance alarms. According to the CBP field supervisors with whom we spoke, nuisance alarms comprise almost all of the radiation alerts at their ports-of-entry. Port operators noted a concern that nuisance alarms might become so numerous that commerce could be impeded, but thus far these alarms have not greatly slowed the flow of commerce through their ports-of-entry.

CBP's currently-fielded radiation isotope identification devices also have inherent limitations. For example, during some secondary inspections, radiation isotope identification devices are unable to identify radiological material. In these cases, CBP standard procedures require that officers consult LSS to conclusively identify the source. According to CBP officers at two of the ports we visited, this usually lengthens secondary inspections by 20 to 30 minutes, although in some cases an hour or more was needed to resolve the alarm. Furthermore, a 2003 Los Alamos National Laboratory evaluation of seven isotope identifiers, including the one deployed by CBP, concluded that all devices had difficulty recognizing radioactive material and correctly identifying the material they did recognize. The Los Alamos finding is consistent with our field observations, as CBP officers at several of the ports-of-entry we visited reported similar trouble with their radiation isotope identification devices.

Laboratory testing of currently-fielded radiation detection equipment has further demonstrated their limitations in effectively detecting and identifying nuclear material. For example, in February 2005, DHS sponsored testing of commercially available portal monitors, isotope identifiers, and pagers against criteria set out in American National Standards Institute (ANSI) standards. The ANSI standards provide performance specifications and test methods for testing radiation detection equipment, including portal monitors and handheld devices. The actual testing was performed by four DOE laboratories, with coordination, technical management, and data evaluation provided by the Department of Commerce's National Institute for Standards and Technology (NIST). The laboratories tested a total of 14 portal monitors from 8 manufacturers against 29 performance requirements in the ANSI standards. Overall, none of the radiation detection equipment, including the portal monitors and handheld devices deployed by CBP, met all of the performance requirements in this first round of testing. However, according to S&T officials, many of the limitations noted in CBP's equipment were related to withstanding environmental conditions—not radiation detection or isotope identification. However, in some tests, the portal monitors that CBP employs, along with many others, exhibited poor results. For example, in tests conducted to evaluate the portal monitors' response to neutron radiation, of which plutonium is a primary source, almost all monitors, including a portal monitor fielded by CBP, failed to meet the ANSI requirement. However, according to S&T officials, the test was conducted using the manufacturer's standard configuration, rather than the configuration CBP uses in its field operations. In another test, one that used CBP's typical field parameters rather than the manufacturer's, the portal monitor passed all the radiation detection performance requirements. S&T believes that the portals used by CBP would meet all the radiation performance requirements if set up with the parameters and configuration as used in the field. In addition, isotope identifiers displayed weaknesses. For example, the isotope identifier currently in use by CBP was not able to simultaneously identify two different isotopes, as required by the ANSI standards. When tested with barium-133 and plutonium-239, the isotope identifier was able to recognize the barium but failed to recognize the plutonium—a weapons-grade nuclear material. As this was a first round of testing and modifications were made to both the standards and testing protocols after the procedures were completed, NIST plans to manage testing of the equipment again in early 2006. The results from both rounds of testing are intended to provide guidance for federal, state, and local officials in evaluating and purchasing radiation detection equipment, and to enable manufacturers to improve their equipment's performance.

DHS Has Sponsored Research and Development to Improve the Capabilities of Current Technology and to Develop New Technology but Much Work Remains

DHS has sponsored research efforts designed to improve the detection capabilities of the currently-fielded portal monitors and to provide them with the ability to distinguish radiological sources. For example, PNNL researched, developed, and tested a new software—known as "energy windowing"—to address the currently-fielded portal monitors' inability to distinguish between radiological materials. Energy-windowing is supposed to identify and screen out material, such as fertilizer or kitty litter, that cause nuisance alarms and thereby reduce the number of such alarms at cargo screening facilities, while also improving the portal monitor's sensitivity to identify nuclear material of concern. PNNL has activated energy-windowing on the 556 portal monitors it has deployed at land border crossings and seaports. At a few ports-of-entry that we visited, CBP officials said that the software has been effective in significantly reducing the number of nuisance alarms. However, tests of the software have shown that its effectiveness in reducing nuisance alarms largely depends on the types of radiation sources it has been programmed to detect and differentiate. In tests involving some common, unshielded radiation sources, such as cobalt-57 and barium-153, the new software has shown improved detection and discrimination capabilities. However, during scenarios that target other common, shielded threat sources—such as those that might be used in a shielded radiological dispersal device or nuclear weapon—the software has been less able to detect and discriminate. Experts have recommended further testing to fully explore the software's capabilities.

DHS is also sponsoring the development of three new technologies that are designed to address the main inherent limitations of currently-fielded portal monitors. CBP's deployment plan currently calls for the widespread installation of the first of these technologies, "advanced spectroscopic portal monitors." According to DNDO, the advanced spectroscopic technology uses different detection materials that are capable of both detecting the presence of radiation and identifying the isotope causing the alarm. It is hoped that the spectroscopic portal monitor can more quickly identify the sources of alarms, thereby reducing the number of nuisance alarms. This increased operational effectiveness may allow the portal monitors to be set at a lower detection threshold, thus allowing for greater sensitivity to materials of concern. DHS commissioned PNNL to determine whether spectroscopic portal monitors provide improved performance capabilities over the currently-fielded monitors. In July 2004 and July 2005, PNNL conducted two small-scale preliminary studies to compare the two types of portal monitors in side-by-side tests using shielded and unshielded radioactive materials. In the first test, PNNL concluded that the relative performance of spectroscopic and currently-fielded portal monitors is highly dependent on variables such as the radioactive sources being targeted and the analytic methods being used. The results of these tests were mixed. In some situations, spectroscopic portal monitors outperformed the current technology; in other cases, they performed equally well. In the second test, PNNL concluded that the spectroscopic monitor's ability to detect the shielded threat sources was equal to, but no better than, those of the 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. PNNL noted that because the studies were limited in scope, more testing is needed.

In October 2005, DNDO completed the first round of comprehensive testing of spectroscopic portal monitors at its testbed at the Nevada Test Site. DNDO tested 10 spectroscopic portal monitors against 3 currently-fielded monitors in 7,000 test runs involving the portal monitors' ability to detect a variety of radiological materials under many different cargo configurations. According to senior DNDO officials who supervised these tests, preliminary analysis of test data indicates that the spectroscopic portal monitors' performance demonstrated somewhat mixed results. 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. Because the data produced by the test runs is voluminous and complex, NIST and another contractor are still in the process of analyzing the test data and plan to produce a report summarizing the results of the testing in 2006. DNDO received responses to the Advanced Spectroscopic Portal Request for Proposal in February 2006, and intends to use the data from the Nevada Test Site to help evaluate these responses. In fiscal year

2006, DNDO also intends to award contracts to two or three manufacturers for further engineering development and production.

The second new technology is “high-Z detection,” which is designed to better detect high atomic number (high-Z) materials—such as Special Nuclear Material (SNM)—and shielding materials—such as lead—that could be used to shield gamma radiation from portal monitors. The Cargo Advanced Automated Radiography System (CAARS) program within DNDO is intended to develop the technologies necessary for automated detection of high-Z material. DNDO envisions using the advanced portal monitor technology for the detection of lightly shielded nuclear threats and radiological dispersal devices, and using CAARS technology for the detection of high-Z materials.

The third new technology is “active interrogation,” which is designed to better detect nuclear material, especially shielded sources, and DNDO expects it to play a role further in the future than advanced portal monitors and CAARS. DHS and DOE are supporting research at DOE national laboratories, such as Los Alamos and Lawrence Livermore, to develop these systems. Active interrogation systems probe or “interrogate” containers with neutron or gamma rays to induce additional radiation emissions from radioactive material within the container. According to DNDO, these systems are too large and costly to consider for current use. In addition, because these systems emit radiation, care will have to be taken to ensure personnel safety before any deployments are made.

In addition to these relatively near-term research and development efforts, DNDO intends to solicit proposals from private, public, academic, and federally funded research centers to pursue radiation detection projects with a more long-term orientation. The solicitation identifies five areas of research:

- mobile detection systems that can be used to detect potential radiological threats that are in transit, at fixed locations, and at special events;
- detection systems that can be integrated into ships, trucks, planes, or into containers;
- active detection technologies, including portal monitors and handheld devices that can detect and verify the presence of shielded nuclear materials;

- innovative detector materials that provide improved detection and isotope identification capabilities over existing materials, in addition to technologies that lead to reductions in the costs to manufacture detector materials, increasing the size and choice of the shapes of detector materials without a loss in performance; and

- alternate means to detect and identify nuclear material other than through radiation detection such as mass, density, or temperature.

DHS Sponsors Test Facilities in Nevada, New York, and New Jersey to Support Efforts to Improve Detection Capabilities

DHS is testing commercially available portal monitors, advanced portal monitors, and handheld devices at its new Radiological and Nuclear Countermeasures Test and Evaluation Complex at the Nevada Test Site (NTS). DNDO, with assistance from DOE's National Nuclear Security Administration, began construction of the complex in 2005.[21] While construction work is under way, an Interim Test Track was built nearby. The complex is to support the DNDO's development, testing, acquisition, and support of the deployment of radiation detection technologies. When completed, the complex will be comprised of several operating areas where testing and evaluation of detection systems will be conducted, such as a testing facility to evaluate active interrogation technologies; and a large, instrumented outdoor testing area to test mobile detection systems. The complex will also have a vehicle choke point where detection systems for land border crossings, toll plazas, and entrances to tunnels and bridges can be evaluated. According to DNDO officials, an important advantage of using NTS is that it provides the necessary facilities to test detection system capabilities with special nuclear materials in threat-representative configurations. The complex will be open to other organizations within DHS, including CBP, S&T, the Transportation Security Administration, and the U.S. Coast Guard. It will also be open to DOE national laboratories, universities, and private companies conducting radiation detection development and production for DHS. The facility is expected to become fully operational in January 2007.

In addition to the Nevada complex, DHS manages CMTB to test radiation detection equipment in an operational environment. The CMTB originated

[21]The National Nuclear Security Administration is a separately organized agency within DOE that was created by the National Defense Authorization Act for fiscal year 2000 with responsibility for the nation's nuclear weapons, nonproliferation, and naval reactors programs. Pub. L. No. 106-65 (1999).

as a DOE funded demonstration project in fiscal year 2003, but transferred to DHS in August 2003. The scientific, engineering, and technical staff of the CMTB are drawn predominantly from the national laboratories. The test bed encompasses various operational settings, such as major seaports, airports, roadways, and railways. The CMTB deploys commercially available and advanced radiation detection equipment at these venues to test and evaluate their performance in real-world situations, to develop better standard operating procedures, and to assess the impact the equipment has on the flow of commerce. At present, CMTB is testing portal monitors at toll crossings of two tunnels and one bridge, two seaport terminals, and two air cargo facilities. In addition, CMTB is developing several advanced secondary inspection mobile technologies. (See fig. 5.) The advanced spectroscopic portal monitors that DNDO is developing will likely be evaluated at the CMTB, once testing is completed at the Nevada Test Site.

Figure 5: The “SMARTCART,” a Mobile Portal Monitor Using Advanced Detection Technology, Being Tested at the CMTB in New York

Source: GAO.

The Newly Created Domestic Nuclear Detection Office Is Structured to Improve Coordination of Executive Branch Radiation Detection Programs

DHS works with DOE, DOD, and other federal, state, and local agencies, as well as the private sector to carry out radiation detection programs. The newly established DNDO was set up to serve as DHS’s main instrument for coordinating these efforts. Since its creation in April 2005, DNDO has entered into working relationships with other agencies and is taking the lead in developing what it calls a “global architecture,” an integrated approach to detecting and stopping nuclear smuggling. However, because DNDO was created so recently, these efforts are in their early stages of development and implementation.

DNDO Attempts to Improve Cooperation Among Other DHS Offices, DOE, DOD, and Other Agencies in Deploying and Operating Equipment

Historically, cooperation among agencies engaged in domestic radiation detection has been limited. In April 2005, however, the president signed a joint presidential directive that directed the establishment of DNDO to, among other things, improve such cooperation by creating a single accountable organization with the responsibility for establishing strong linkages across the federal government and with other entities. As currently envisioned under the directive, DNDO's mission covers a broad spectrum of radiological and nuclear protective measures, but focuses mainly on nuclear detection. The directive includes several provisions directing DNDO to coordinate its activities with other entities. For example, DNDO is to work with DOE, DOD, the Departments of State and Justice, state and local agencies, and the private sector to develop programs to thwart illicit movements of nuclear materials. In addition, provisions of the directive require consultation between DNDO, law enforcement and nonproliferation centers, as well as other related federal and state agencies. Table 2 provides a summary of the cooperation brought about by the presidential directive.

Table 2: Cooperation with DNDO Brought about by Presidential Directive

Agency	Responsibilities
Department of Homeland Security	
S&T	All radiological/nuclear detection programs and staff subsumed by DNDO.
U.S. Coast Guard (USCG)	USCG and DNDO coordinate on detection and reporting resources, and protocols to ensure that USCG equipment is state-of-the-art and that detection events are properly reported.
Office of State & Local Government Coordination and Preparedness (SLGCP)	DNDO works to ensure good communication, coordination, and takes other actions with state and local governments. SLGCP personnel help staff DNDO.
Interagency Components	
Department of Energy	Provide staffing to, and coordinates with, DNDO in equipping National Incident Response Teams. DOE also provides DNDO with information from overseas programs. Makes the NTS and special nuclear materials available for DNDO testing.
Department of Defense	Provide staffing to DNDO. Facilitate coordination between DOD detection programs and domestic programs. Coordinate on technical "reachback capabilities." Integrate any domestic detection systems in communities near military bases with DNDO assets.
Department of Justice	Provide staffing to DNDO. FBI will coordinate on establishing and executing "reachback capabilities." FBI remains the lead law enforcement agency in terrorist events.
Department of State	Provide links and overall coordination between DNDO and non-U.S. organizations responsible for radiation detection.

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Agency	Responsibilities
Central Intelligence Agency	Primary responsibility for gathering, analyzing, and disseminating intelligence information relevant to DNDO operations. The agency will accept collection requirements through channels from DNDO.
Nuclear Regulatory Commission	Coordinate detection requirements with DNDO. DNDO shares detection event data with NRC, and NRC shares information with DNDO on legal shipments of radiological materials.

Source: DNDO.

According to senior DNDO officials, although the close cooperation called for in DNDO's mandate has been difficult to achieve, there are two factors that may help DNDO succeed in this effort. First, the presidential directive is explicit in directing other federal agencies to support DNDO's efforts. The directive transfers primary responsibility for radiation and nuclear detection activities in the United States to DNDO, and requires DNDO to include personnel from other agencies in its organization. For example, under the directive, DOE will provide DNDO with information received from overseas programs, including the Megaports Initiative and others, as well as information from DOE's international partners involved with radiological and nuclear detection systems. Second, all of the radiological and nuclear detection programs and staff of S&T became part of DNDO.

DOE's Second Line of Defense program supports DNDO efforts by working with the agency to exchange information, data, and lessons learned from overseas deployments. According to senior officials at DNDO, the data from overseas deployments are needed to help DNDO efforts to develop profiles of potential risks to the United States. In addition, the performance of these systems, as evidenced by these data, can help improve domestic portal monitors' ability to detect radiation. In addition, DOE provides equipment training opportunities for DHS personnel. In April 2005, DOE and DHS formalized certain aspects of this cooperation in a memorandum of understanding. Specifically, the areas of cooperation include, among other things: discussing procedures for the rapid analysis of cargo and for operational/emergency responses, training CBP officers, exchanging technical and lessons learned information, and providing updates on their respective programs' implementation.

DHS has also entered into formal agreements with state and local governments to coordinate their radiation detection efforts. For example, in April 2005, just prior to DNDO's creation, DHS and the Port Authority of New York and New Jersey finalized a memorandum of understanding to provide services, personnel, and equipment to run the CMTB program.

Specifically, the program is designed to evaluate and assess the role of threat detection technologies, develop and exercise various concepts of operation and response tools, integrate lessons learned from field experiences, and provide detection and monitoring capabilities for testing and evaluation purposes. The agreement spells out each partner's responsibilities, including coordination with other agencies. According to a senior DNDO official, DNDO now has responsibility for this and other similar agreements under its authority to develop and evaluate new radiation detection equipment.

Finally, DNDO officials also believe that the way the agency has been staffed and organized will aid its cooperation efforts. For example, staff from DHS, DOD, DOE, the Departments of State and Justice, and other agencies, have been detailed to DNDO. All of DNDO's major organizational units are staffed with personnel from multiple agencies. For example, the strategic planning staff within the Office of the Director has employees from DOE, DOD, CBP, Federal Bureau of Investigation (FBI), and DHS's Office of State and Local Government Coordination and Preparedness. Significantly, DNDO's Office of Operations Support, which is designed to provide real-time situational data as well as technical support to field units, is headed by an FBI executive with senior staff from CBP, DOE, and DHS's Transportation Security Administration providing direct management support. According to a senior DNDO official, having this broad range of agencies represented in DNDO decision making helps ensure that agencies' views are heard and fully considered, thereby helping to achieve the greatest possible consensus even for difficult decisions. Further, agency personnel detailed to DNDO have the authority to "bind" their respective agencies, i.e., whatever decisions or agreements are reached under the auspices of DNDO will bind their agency to comply to the extent permitted by law. Finally, according to senior officials in DOE and CBP, the current organizational arrangement appears to be working. Officials noted that early in DNDO's history, communication was difficult, but has recently improved. For example, CBP and DOE officials told us they had hoped to have greater input into DNDO's early efforts to develop integrated radiation detection systems. However, these officials noted that by October 2005, DNDO seemed to have heard and acted upon their recommendations. However, although these officials were optimistic about future collaborations with DNDO, they also noted that DNDO has not yet completed a large enough body of work to conclude firmly that its coordination efforts will always be similarly successful.

DNDO Is Cooperating with Other Agencies to Develop a Global Nuclear Detection System

Among the main purposes in creating the DNDO, according to its Director, is to develop a global nuclear detection system that he characterized as a "global architecture." DNDO's intention in developing such an approach is to coordinate other agencies' efforts, such as the Second Line of Defense and Container Security Initiative, with the domestic deployment program to create an integrated, worldwide system. The resulting "global architecture" would be a multi-layered defense strategy that includes programs that attempt to secure nuclear materials and detect their movements overseas; to develop intelligence information on nuclear materials' trans-shipments and possible movement to the United States; and to integrate these elements with domestic efforts undertaken by governments—federal, state, local, and tribal—and the private sector. Much of DNDO's work in terms of acquiring and supporting the deployment of radiation detection equipment, as well as in supporting research, development, and testing of new detection equipment supports the office's mission to develop the U.S. domestic portion this global architecture.

In addition, DHS, in conjunction with selected state and local organizations, as well as other federal agencies and the private sector, began two pilot projects in fiscal year 2003 to demonstrate a layered defense system designed to protect the United States against radiological and nuclear threats. DHS's Radiological Pilot Programs Office coordinated the projects' initial efforts, and DNDO assumed responsibility in October 2005. Field work began in fiscal year 2004 and will be completed in fiscal year 2007. The project leaders expect the final report and lessons learned to be issued in fiscal year 2007. Both pilot projects featured a broad selection of federal, state, and local agencies, including state law enforcement, counter-terrorism, emergency management, transportation, and port authorities.

Conclusions

DHS has made progress deploying radiation detection equipment at U.S. ports-of-entry; notably, the department achieved these gains without greatly impeding the flow of commerce (i.e., the movement of cargo containers out of ports-of-entry). However, we believe that DHS will find it difficult under current plans and assumptions to meet its current portal monitor deployment schedule at U.S. borders because it would have to increase its current rate of deployment by 230 percent to meet its September 2009 deadline. Our analysis of CBP's and PNNL's earned value data suggests that millions of dollars worth of work is being deferred each month and that the work that is completed is costing millions more than planned. Currently, we estimate that CBP is facing a likely cost overrun of about $340 million, and that the last portal monitor may not be installed until late 2014. Unless CBP and PNNL make immediate improvements in the schedule performance, then additional slippage in the deployment schedule is likely.

A key overriding cause for these delays is the late disbursal of funds to DHS contractors. This late dispersal disrupts and delays some ongoing installation projects. In this regard, DHS approval processes for documentation requested by the House Appropriations Committee are lengthy and cumbersome. In one case, for example, funds for fiscal year 2005 were not made available to the DHS contractor until September 2005, the last month of the fiscal year. This process is taking too long and needs to be shortened.

Further, 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 monitors, taking into account their differences in cost, will DHS be able to answer this question.

CBP has experienced difficulty deploying portal monitors at seaports, at least in part because it has been unable to reach agreements with many seaport operators, who are concerned that radiation detection efforts may delay the flow of commerce through their ports. As a result, the agency has fallen 2 years behind its seaport deployment schedule—and seaports continue to be vulnerable to nuclear smuggling. Significantly, there is no clear solution and no reason to be optimistic that progress can be made soon. CBP's policy of negotiating deployment agreements with seaport terminal operators has not yet yielded agreements at many seaports and this has caused significant delays in the deployment of portal monitors at some seaports. CBP has chosen not to attempt to force terminal operators to cooperate. A subset of this issue concerns screening rail traffic leaving seaports, which is a particularly difficult problem. The operational concerns of performing secondary rail inspections in seaports are daunting. Some port operators as well as a national study strongly suggest that rail transport will increase over the next 10 years. However, unless an effective and efficient means to screen rail traffic is developed and deployed, seaports will likely continue to either avoid installing detection equipment altogether, or simply turn it off when its operation might prove to be inconvenient. Without more progress on this front, we risk rail cargo becoming a burgeoning gap in our defenses against nuclear terrorism.

CBP appears to have made progress in using radiation detection equipment correctly and adhering to inspection procedures. At several ports-of-entry we visited, CBP officers physically opened and inspected cargo containers to confirm the nature of the radiological source under certain circumstances. They did this when they were unable to confirm the type of radiological material through current approved procedures. Since the currently deployed handheld equipment is limited in its ability to accurately identify sources of radiation, opening the container allows CBP officers to get closer to the source of the alarm and thereby improve their chances of accurately identifying the source. It also enables officers to verify that the container's contents are consistent with the isotope identifier's initial reading and the container's manifest. Furthermore, since DHS and DOE officials have expressed concerns that illicit radiological material could be shielded, this practice enables officers to conduct a more thorough examination of the containers' contents—thereby increasing the likelihood that CBP officers will find any illicit radioactive material. Importantly, this process, according to border security officials, did not impede the progress of commerce through any port-of-entry.

On the other hand, because CBP officers do not have access to NRC licensing data, it is difficult for them to verify that shippers have obtained necessary NRC licenses and to verify the authenticity of any NRC licenses that may accompany shipments of radioactive materials. As a result, unless nuclear smugglers in possession of faked license documents raised suspicions in some other way, CBP officers could follow agency guidelines yet unwittingly allow them to enter the country with their illegal nuclear cargo. As we see it, this is a significant gap in CBP's national procedures that should be closed.

Recommendations for Executive Action

Since DHS provides the Congress with information concerning the acquisition and deployment of portal monitors, and since DHS's procedures to obtain internal agreement on this information are lengthy and cumbersome—often resulting in delays—we recommend that the Secretary of Homeland Security, working with the Director of DNDO and the Commissioner of CBP, review these approval procedures and take actions necessary to ensure that DHS submits information to the Congress early in the fiscal year.

In order to complete the radiation portal monitor deployment program, as planned, we recommend that the Secretary of Homeland Security, working with the Director of DNDO, and in concert with CBP and PNNL, devise a plan to close the gap between the current deployment rate and the rate needed to complete deployments by September 2009.

To ensure that DHS's substantial investment in radiation detection technology yields the greatest possible level of detection capability at the lowest possible cost, we recommend that once the costs and capabilities of advanced technology portal monitors are well understood, and before any of the new equipment is purchased, the Secretary of Homeland Security work with the Director of DNDO to analyze the benefits and costs of deploying advanced portal monitors. This analysis should focus on determining whether any additional detection capability provided by the advanced equipment is worth its additional cost. After completing this cost-benefit analysis, the Secretary of Homeland Security, working with the Director of DNDO, should revise its total program cost estimates to reflect current decisions.

To help speed seaport deployments and to help ensure that future rail deployments proceed on time, we recommend that the Secretary of Homeland Security, in cooperation with the Commissioner of CBP, develop procedures for effectively screening rail containers and develop new technologies to facilitate inspections.

To increase the chances that CBP officers find illicit radiological material, we recommend that the Secretary of Homeland Security, working with the Commissioner of CBP, consider modifying the agency's standard operating procedures for secondary inspections to include physically opening cargo containers during secondary inspections at all ports-of-entry when the external inspection does not conclusively identify the radiological material inside.

To further increase the chances that CBP officers identify illicit radiological material, we recommend that the Secretary of Homeland Security, working with the Chairman of NRC, develop a way for CBP border officers to determine whether radiological shipments have the necessary NRC licenses and to verify the authenticity of NRC licenses that accompany such shipments.

To ensure that CBP is receiving reliable cost and schedule data, we recommend that the Secretary of Homeland Security direct PNNL to have its earned value management system validated so that it complies with guidance developed by the American National Standards Institute/ Electronic Industries Alliance. In addition, we recommend the Secretary of Homeland Security direct CBP and PNNL to conduct an Integrated Baseline Review to ensure its earned value management data is reliable for assessing risk and developing alternatives.

Agency Comments and Our Evaluation

We provided a draft of this report to DHS for comment. In response, we received written comments from DHS officials. DHS noted that the report is factually correct. Further, the Department agreed with our recommendations and committed to implementing them. DHS officials also commented that our review did not completely capture the enormity or complexity of the Radiation Portal Monitor program. We agree that this program is a massive undertaking, and our original draft reflected this perspective in several places. In commenting on our recommendation to develop a better means for CBP border officers to verify NRC license information, DHS stated that "NRC licenses are required to accompany certain legitimate shipments of radiological materials…" However, according to senior NRC officials, no requirement that the license accompany the shipment exists. Finally, DHS provided some clarifying comments that we incorporated into this report, as appropriate.

As agreed with your offices, 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 to the congressional committees with jurisdiction over DHS and its activities; the Secretary of Homeland Security; the Director of OMB; and interested congressional committees. We will also make copies of the report available to others upon request. This report will also be available at no charge on GAO's home page at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-3841. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix IV.

Gene Aloise
Director, Natural Resources and Environment

List of Requesters

The Honorable Norm Coleman
Chairman
Permanent Subcommittee on Investigations
Committee on Homeland Security and Governmental Affairs
United States Senate

The Honorable Susan M. Collins
Chairman
Committee on Homeland Security and Governmental Affairs
United States Senate

The Honorable Carl Levin
Ranking Minority Member
Permanent Subcommittee on Investigations
Committee on Homeland Security and Governmental Affairs
United States Senate

The Honorable John D. Dingell
Ranking Minority Member
Committee on Energy and Commerce
House of Representatives

Scope and Methodology

To assess the Department of Homeland Security's (DHS) progress in deploying radiation detection equipment, including radiation portal monitors, radiation isotope identification devices, and pagers at U.S. ports-of-entry and any problems associated with that deployment, we reviewed documents and interviewed officials from the U.S. Customs and Border Protection (CBP), Domestic Nuclear Detection Office (DNDO), and Pacific Northwest National Laboratory (PNNL). We focused primarily on the issues surrounding radiation portal monitors because they are a major tool in the federal government's efforts to thwart nuclear smuggling, and because the budget and other resources devoted to these machines far exceeds the handheld equipment also used at U.S. ports-of-entry. Further, we focused on the use of radiation detection equipment in primary and secondary inspections, but we did not examine their use as a part of CBP's targeted inspections. To assess CBP's current progress in deploying portal monitors, we compared PNNL's December 2004 project execution plan for deploying radiation portal monitors—including the project's schedule and estimated cost. We analyzed budget, cost, and deployment data on portal monitors to determine differences between PNNL's plan and its current progress. We also assessed PNNL's cost and schedule performance using earned value analysis techniques based on data captured in PNNL's contract performance reports. We also developed a forecast of future cost growth. We based the lower end of our forecast range on the sum of costs spent to date and the forecast cost of work remaining. The remaining work was forecast using an average of the current cost performance index efficiency factor. For the upper end of our cost range, we relied on the actual costs spent to date added to the forecast of remaining work with an average monthly cost and schedule performance index.

We also visited a nonprobability sample of CBP ports-of-entry, including two international mail and express courier facilities, five seaports, and three land border crossings.[1] We selected these ports-of-entry by using criteria such as the types of ports-of-entry where CBP plans to deploy equipment; ports-of-entry with wide geographic coverage; and ports-of-entry where portal monitors have been—or are planned to be—installed. During each visit, we spoke with CBP inspectors and local port authority officials on the progress made, and any problems experienced in deploying the equipment at their locations.

[1]Results from nonprobability samples cannot be used to make inferences about a population, because in a nonprobability sample, some elements of the population being studied have no chance or an unknown chance of being selected as part of the sample.

To assess CBP officers' use of radiation detection equipment, and how inspection procedures are implemented at U.S. ports-of-entry, and any problems associated with the use of the equipment, we reviewed CBP's standard operating procedures for radiation detection; documents on its training curriculum; and training materials on how to use the equipment. We participated in a 3-day hands-on training course for CBP officers at PNNL on how to use radiation detection equipment. We also interviewed officials from CBP field and headquarters to discuss problems associated with the use of the equipment. During our site visits, we toured the facilities, observed the equipment in use, and interviewed CBP officers about radiation detection policies and procedures and the deployment of equipment at their locations. We discussed with CBP officers how they determine the validity of Nuclear Regulatory Commission (NRC) licenses when legitimate shipments of radioactive material enter the nation.

To assess DHS's progress in improving and testing radiation detection equipment capabilities, we reviewed documents and interviewed officials from CBP, DNDO, Science and Technology Directorate (S&T), DOE, PNNL, and the National Institute for Standards and Technology (NIST). We reviewed S&T's April 2005 Program Execution Plan; DHS documentation on the development of advanced radiation detection technologies; and test results and assessments of the performance of both commercially available radiation detection equipment and advanced technologies. We visited four national laboratories—Lawrence Livermore, Los Alamos, Pacific Northwest, and Sandia—that are involved in the research, development, and testing of radiation detection technologies. In addition, we visited the Counter Measures Test Bed (CMTB) in New York and New Jersey, the Nevada Test Site, and the Department of Defense's (DOD) test site at a U.S. Air Force base to observe the testing of radiation detection equipment and discuss progress in improving and testing radiation detection equipment with onsite experts.

To assess the level of cooperation between DHS and other federal agencies in conducting radiation detection programs, we interviewed officials from CBP; S&T; the Transportation Security Administration; DOD's Defense Threat Reduction Agency; DOE's National Nuclear Security Administration; and Lawrence Livermore, Los Alamos, Pacific Northwest, and Sandia National Laboratories. We discussed the current extent of coordination and whether more coordination could result in improvements to DHS's deployment, development, and testing of radiation detection equipment and technologies. We reviewed agency agreements to cooperate, including a memorandum of understanding between DHS and DOE to exchange information on radiation detection technologies and deployments, and a memorandum of understanding between DHS and the Port Authority of New York and New Jersey to integrate lessons learned into domestic radiation detection efforts. In addition, we reviewed an organizational chart from DNDO as well as our past reports on coordination between federal agencies on deployment and testing.

We received training data from CBP, cost and budget data from CBP, and deployment data from CBP and PNNL. We obtained responses from key database officials to a number of questions focused on data reliability covering issues such as data entry access, internal control procedures, and the accuracy and completeness of the data. We determined these data were sufficiently reliable for the purposes of this report.

We conducted our review from March 2005 to February 2006 in accordance with generally accepted government auditing standards.

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Related GAO Products

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