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October 17, 2006

The Honorable Thad Cochran
Chairman

The Honorable Robert C. Byrd
Ranking Minority Member
Committee on Appropriations
United States Senate

The Honorable Jerry Lewis
Chairman

The Honorable David R. Obey
Ranking Minority Member
Committee on Appropriations
House of Representatives

Subject: Combating Nuclear Smuggling: DHS's Cost-Benefit Analysis to Support the Purchase of New Radiation Detection Portal Monitors Was Not Based on Available Performance Data and Did Not Fully Evaluate All the Monitors' Costs and Benefits

Since the attacks of September 11, 2001, combating terrorism has been one of the nation's highest priorities. As part of that effort, preventing nuclear and 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) under DHS 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 interdict dangerous nuclear and radiological materials through the use of radiation detection equipment, including portal

¹The 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.

²National Security Presidential Directive 43/Homeland Security Presidential Directive 14, Domestic Nuclear Detection (April 15, 2005). Congress recently passed a bill that would provide permanent statutory authority for DNDO and its activities. See *Security and Accountability for Every Port Act of 2006*, H.R. 4954, §§ 501-502 (2006) (“SAFE Port Act”). As of October 12, 2006, the President had not yet signed the bill.

monitors. The Pacific Northwest National Laboratory (PNNL), one of the Department of Energy's (DOE) national laboratories, manages the deployment of radiation portal monitors for DHS.³

Current portal monitors, which cost about \$55,000 per monitor, detect the presence of radiation, but cannot distinguish between harmless radiological materials, such as naturally occurring radiological material in some ceramic tile, and dangerous nuclear materials, such as highly enriched uranium (HEU). CBP officers also use radioactive isotope identification devices (RIIDs), which are handheld devices designed to identify different types of radioactive material, such as radioactive material used in medicine or industry, a naturally occurring source of radiation, or weapons-grade material. These devices have limitations in their ability to detect and identify nuclear material. DHS would like to improve the capabilities of its radiation detection equipment in order to better distinguish between different types of nuclear and radiological materials. As a result, DHS sponsored research, development, and testing activities in 2005 that were designed to produce portal monitors that, in addition to detecting, would also identify the type of nuclear or radiological material. Portal monitors with this new identification technology currently cost about \$377,000 or more per monitor. In these same tests, DHS also tested the performance of currently deployed portal monitors.

In July 2006, DHS announced that it had awarded contracts to three vendors to further develop and purchase \$1.2 billion worth of new portal monitors over 5 years. DHS plans to deploy these monitors at U.S. ports of entry. For fiscal year 2007, DNDO plans to acquire the first installment of 104 new portal monitors that use new identification technology at a cost of \$80.2 million. Congress, however, has curtailed DNDO's ability to do so by restricting the availability of funding for full scale procurement of new radiation detection portal monitors until DHS certifies that a significant increase in operational effectiveness will be achieved.⁴

In a March 2006 report, 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 recommended that once the costs and capabilities of these new portal monitors were well understood, and before any of the new equipment was purchased, the Secretary of DHS work with the Director of DNDO to analyze the benefits and costs of deploying new portal monitors.⁵ Further, we recommended that this analysis focus on determining whether any additional detection capability provided by the new portal monitors were worth the additional costs.

³DOE 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.

⁴Homeland Security Appropriations Act for Fiscal Year 2007, Pub. L. No. 109-295, tit. IV (2006). At the same time, Congress has directed that all containers entering the 22 busiest U.S. ports be scanned for radiation by December 31, 2007, and specified that to the extent practicable, DHS is to deploy "next generation radiation detection technology." See SAFE Port Act, § 121.

⁵GAO, *Combating Nuclear Smuggling: DHS Has Made Progress Deploying Radiation Detection Equipment at U.S. Ports of Entry, but Concerns Remain*, [GAO-06-389](#) (Washington, D.C.: Mar. 22, 2006).

In response to our recommendation, in May 2006, DNDO issued a cost-benefit analysis for the acquisition and deployment of new portal monitors.⁶ In this document, DNDO stated that the purpose of its analysis was to help provide a “robust” defense against nuclear smuggling, to limit the negative impacts to legitimate trade and travel between nations, and to provide a sound financial investment for the United States government. In this context, by agreement with your staff, we reviewed DNDO’s cost-benefit analysis to determine the extent to which it provides a sound analytical basis for acquiring and deploying new portal monitors. We briefed your staff on the results of our evaluation on August 21, 2006, and this report presents the details of that briefing. The briefing focused mainly on the use of performance and cost data for current and newer portal monitors (see Enclosure 1).

To conduct our review of DNDO’s cost-benefit analysis we analyzed documentation supporting the costs used for both currently deployed and new equipment. As provided by federal regulations, DHS developed what is called an Independent Government Cost Estimate.⁷ We obtained and evaluated this estimate to determine its reasonableness. We also reviewed test reports for new portal monitors and currently deployed monitors produced by National Institutes of Standards and Technology (NIST) and PNNL to assess the validity of performance assumptions DNDO used in its analysis. In addition, we had discussions with officials from DNDO, CBP, NIST, and several of DOE’s national laboratories, including Oak Ridge, Sandia, Brookhaven, and PNNL, as well as representatives of the trucking and shipping industries. We conducted our review from May 2006 to September 2006 in accordance with generally accepted government auditing standards.

Summary

DNDO’s cost-benefit analysis does not provide a sound analytical basis for DNDO’s decision to purchase and deploy new portal monitor technology. DNDO did not use the results of its own performance tests in its cost-benefit analysis and instead relied on assumptions of the new technology’s anticipated performance level. Performance tests also showed that the ability of new radiation detection portal monitors to correctly identify masked HEU (placed next to or within another, usually more benign, radiological substance) was even more limited.⁸ According to the cost-benefit analysis and radiation detection experts to whom we spoke, masked HEU is a significant concern because it is difficult to detect. DNDO also focused the analysis exclusively on identifying HEU and did not consider in the analysis how well (either as a goal or in testing) new portal monitor technology can correctly detect or identify other dangerous radiological or nuclear materials. Furthermore, the analysis did not include the results from side-by-side tests that DNDO conducted of the advanced portal monitors and current portal monitors.

⁶DNDO also issued a revised analysis in June 2006.

⁷Federal Acquisition Regulation, 48 C.F.R. § 15.404-1(b)(2)(v).

⁸These test results involved identifying both HEU and depleted uranium.

The cost-benefit analysis for acquiring and deploying portal monitors is also incomplete because it does not include all of the major costs and benefits required by DHS guidelines. In particular, DNDO did not assess the likelihood that radiation detection equipment would either misidentify or fail to detect nuclear or radiological material. Rather, it focused its analysis on reducing the time necessary to screen traffic at border check points and reduce the impact of any delays on commerce. DNDO also used questionable assumptions about the procurement costs of portal monitor technology. DNDO assumed a purchase price for current portal monitor technology that is more than twice what CBP typically pays.

We provided DHS with a draft of this report for its review and comment. Its written comments are presented in Enclosure 2. The Department neither agreed nor disagreed with our recommendation, but continues to stand behind the basic conclusions of its cost-benefit analysis that new radiation detection portal monitors are a sound investment for the U.S. Government. We continue to believe, however, that significant weaknesses in DNDO's cost-benefit analysis precludes it from providing a reliable basis for making major procurement decisions, such as whether to invest heavily in deploying a new portal monitor technology.

Background

DHS's program to deploy radiation detection equipment at U.S. ports-of-entry has two goals.⁹ The first is to use this equipment to screen all cargo, vehicles, and individuals coming into the United States. Each day, DHS processes about 64,000 containers arriving in the United States via ships, trucks, and rail cars; 365,000 vehicles; and more than 1.1 million people. The United States has over 380 border sites at which DHS plans to deploy radiation detection equipment. 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 detection 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 portal monitors 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 radiation detection equipment includes radiation portal monitors, which can detect gamma radiation (emitted by radiological materials that can be used in a dirty bomb as well as naturally occurring radiological material in some ceramic tile) and neutron radiation (emitted by only a limited number of materials, such as plutonium—a material that can be used to make a nuclear weapon).

⁹These goals are now subject to the new requirements established by Congress in section 121 of the SAFE Ports Act.

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. Because current portal monitors using detection technology—known as "plastic scintillators" (PVT)—detect the presence of radiation but cannot distinguish between harmless and dangerous nuclear or radiological materials, "secondary inspections" are required. To confirm and identify the presence of radiation, this secondary inspection includes CBP officers using RIIDs to determine whether the radiation being emitted is from a harmless source, such as kitty litter, or a dangerous source, such as weapons-grade nuclear material. Typically, completing a secondary inspection takes about 15 minutes. DHS would like to improve the capabilities of its radiation detection equipment in order to distinguish among different types of nuclear and radiological materials and, in so doing, reduce the number of secondary inspections on non-threatening nuclear and radiological material.¹⁰

DNDO Relied on the Potential Performance of New Portal Monitors Rather Than Its Own Test Results of Current Equipment Performance in Its Cost-Benefit Analysis

DHS is developing new portal monitors, known as "advanced spectroscopic portal monitors" (ASP) that, in addition to detecting nuclear or radiological material, can also identify the type of material. In 2005, DNDO conducted side-by-side testing at the Nevada Test Site (NTS)¹¹ on 10 ASP systems and 3 PVT systems developed by private sector companies, including the PVT systems currently deployed. DHS requested that NIST provide assistance by conducting an independent analysis of data acquired during the last phase of developmental testing of ASPs to help DHS determine the performance of ASP portal monitors being proposed by private sector companies. NIST compared the 10 ASP systems, and in June 2006 submitted a report to DHS on the results of that testing.¹²

Performance tests of ASPs showed that they did not meet DNDO's main performance assumption in the cost-benefit analysis of correctly identifying HEU 95 percent of the time it passes through portal monitors. The 95 percent performance assumption included ASPs' ability to both detect bare, or unmasked, HEU in a container and HEU masked in a container with a more benign radiological material.¹³ Based on NIST's assessment of the performance data, the ASP prototypes (manufactured by the three companies that won DNDO's recent ASP procurement contract) tested at NTS identified

¹⁰Section 121 of the SAFE Ports Act reinforces this goal by requiring that DHS utilize next generation radiation technology "to the extent practicable", with conference report language noting that "such technology can reduce nuisance alarms" and "speed effective alarm resolution." See H.R. Conf. Rep. No. 109-711 (2006).

¹¹DHS and DOE are collaborating in building a new Radiological and Nuclear Countermeasures Test and Evaluation Complex at the Nevada Test Site to support the development, testing, acquisition, and deployment of radiation detection equipment. The facility is expected to become fully operational in early 2007. Currently, an interim facility at NTS is being used to test radiation detection equipment.

¹²NIST did not evaluate the PVTs or compare their performance to the performance of the ASPs.

¹³The ability to detect masked HEU is based on DOE guidance on performing the evaluation.

bare HEU only 70 to 88 percent of time. Performance tests also showed that ASPs' ability to identify masked HEU fell far short of meeting the 95 percent level of performance assumed in the cost-benefit analysis. According to DNDO's cost-benefit analysis, identifying masked HEU is the most difficult case to address. DOE officials told us that benign radiological materials could be used to hide the presence of HEU. NIST reported that the best ASP prototype DNDO tested last year in Nevada that won a procurement contract was able to correctly identify masked HEU and depleted uranium (DU) only 53 percent of the time. Similarly, the ASP prototypes submitted by the other two companies that won DNDO's ASP procurement were able to identify masked HEU and DU only 45 percent and 17 percent of the time.

Despite these results, DNDO did not use the information from these tests in its cost-benefit analysis. Instead, DNDO officials told us that since new portal monitors cannot meet the 95 percent level of performance, they relied on the assumption that they will reach that level of performance sometime in the future. DNDO officials asserted that the current performance levels of the ASPs will improve, but they provided no additional information as to how the 95 percent performance goal will be achieved or an estimate of when the technology will attain this level.

Moreover, DNDO's cost-benefit analysis only considered the benefits of ASPs' ability to detect and identify HEU and did not consider ASPs ability to detect and identify other nuclear and radiological materials. The ability of an ASP to identify specific nuclear or radiological materials depends on whether the ASP contains software that is specific to those materials. In our view, a complete cost-benefit analysis would include an assessment of ASPs' ability to detect and identify a variety of nuclear and radiological material, not just HEU. By excluding radiological and nuclear materials other than HEU, DNDO's analysis did not consider the number of secondary inspections that would be related to these materials and hence it likely underestimated the costs of ASP use. Further, DNDO told us the assumptions for the ability of ASP systems to detect and identify HEU 95 percent came from the ASP performance specifications. However, we examined the performance specifications and found no specific requirement for detecting or identifying HEU with a 95 percent probability.¹⁴ While there is a requirement in the performance specification for the identification for HEU and other special nuclear material, we found no associated probability of success in performing this function.

DNDO's cost-benefit analysis also may not accurately reflect the capabilities of PVTs to detect nuclear or radiological material. DNDO officials acknowledged that DNDO tested the performance of PVTs along with the ASPs in 2005, but did not use the results of these tests in its cost-benefit analysis. Instead, in a June 2006 written response to our questions, DNDO told us it based its analysis on the performance of PVT monitors that PNNL tested during 2004 in New York. However, the results from these field tests are not definitive because, as PNNL noted in its final report, the tests did not use HEU and, therefore, the results from the tests did not indicate how well PVT portal monitors would

¹⁴The performance specifications contain a requirement for detecting, not identifying, californium-252 with a 95 percent probability. Californium-252 has similar radiological properties to HEU. In addition, the performance specifications contain a requirement for detecting, but not identifying, other radiological materials such as cobalt-57, cobalt-60, barium-133, cesium-137, and americium-241.

be able to detect HEU in the field.¹⁵ Moreover, the PVT portal monitors that PNNL used had only one radiation detection panel as opposed to the four-panel PVT monitors that DHS currently deploys at U.S. ports-of-entry. An expert at a national laboratory told us that larger surface areas are more likely to detect radiological or nuclear material. DNDO also stated that due to the nature of the testing at the Nevada Test Site, the tests did not provide the data needed for the cost-benefit analysis. According to DNDO officials, this data would come from analysis of the performance of fielded systems at U.S. ports-of-entry where the probability to detect threats could be compared to false alarm rates.

DNDO's Cost-Benefit Analysis was Incomplete and Used Inflated Cost Estimates for PVT Equipment

DNDO officials told us they did not follow the DHS guidelines for performing cost-benefit analyses in conducting their own cost-benefit analysis.¹⁶ DNDO officials said their analysis was intended to be an easy-to-understand assessment of the best investment for the U.S. government. However, DNDO's simplified approach to the cost-benefit analysis omitted many factors that could affect the cost of new radiation portal monitors. For example, DNDO officials told us that there are over 12 different types of ASP monitors, yet they only estimated the cost of cargo portal monitors that would be used at land border crossings. In reality, DNDO and CBP plan to deploy different types of ASPs that would have varying costs, such as portal monitors at seaports which would have higher costs. Additionally, DNDO did not capture all the costs related to developing the different types of ASP monitors.

DNDO has also underestimated the life-cycle costs for operations and maintenance for both PVT and ASP equipment over time. DNDO analysis assumed a 5-year life-cycle for both PVT and ASP equipment. However, DNDO officials told us that a 10-year life-cycle was a more reasonable expectation for PVT and ASP equipment. The analysis assumes that the annual maintenance costs for PVT and ASP monitors will each equal 10 percent of their respective procurement costs. This means that maintenance costs for PVTs would be about \$5,500 per year per unit based on a \$55,000 purchase price and ASP maintenance costs would be about \$38,000 per year per unit based on a \$377,000 purchase price. With the much higher maintenance costs for ASPs and doubling the life-cycle to 10 years, the long-term implications for these cost differences would be magnified. As a result of this, DNDO's analysis has not accounted for about \$181 million in potential maintenance costs for ASPs alone.

Furthermore, DNDO did not assess the likelihood that radiation detection equipment would either misidentify or fail to detect nuclear and radiological materials. Rather, DNDO's cost-benefit analysis focuses on the ability of ASPs to reduce false alarms—alarms that indicate nuclear or radiological material is in a container when, in fact, the material is actually non-threatening, such as ceramic tile. Reducing false alarms would

¹⁵Pacific Northwest National Laboratory, *A Sensitivity Comparison of NaI and PVT Portal Monitors at a Land-Border Port-of-Entry*, p. iii, November 2004. For Official Use Only

¹⁶DHS, Capital Planning and Investment Control, *Cost-Benefit Analysis (CBA) Guidebook 2006, Version 2.0*, February 2006. Traditional rules of performing cost-benefit analyses include assessing the full life-cycle costs for operation and maintenance, and determining the level of confidence in cost data.

reduce the number of secondary inspections of non-threatening nuclear and radiological materials and therefore the costs of those inspections. However, as required by DHS's guide to performing cost-benefit analyses, DNDO's analysis does not include all costs. In particular, the analysis does not include the potentially much bigger cost of "false negatives." False negatives are instances in which a container possesses a threatening nuclear or radiological material, but the portal monitor either misidentifies the material as non-threatening or does not detect the material at all, thus allowing the material to enter the country. During the 2005 Nevada tests, the incidence of false negatives among the three vendors who received contracts ranged from about 45 percent to slightly more than 80 percent. This raises concerns because, as explained to us by a scientist at a national laboratory, at this level of performance, ASPs could conceivably misidentify HEU as a benign nuclear or radiological material or not detect it at all, particularly if the HEU is placed side by side with a non-threatening material such as kitty litter.

In addition, in recent testimonies before Congress, DNDO's Director has cited the primary benefit of deploying ASP monitors as reducing unnecessary secondary inspections.¹⁷ However, DNDO's analysis does not fully estimate today's baseline costs for secondary inspections, which makes it impossible to determine whether the use of ASPs, as currently planned, will result in significant cost savings for these inspections. Finally, the ASP contract award has exceeded DNDO's estimate for total cost by about \$200 million. The cost-benefit analysis shows the total cost for deploying PVT and ASP monitors to be about \$1 billion, which covers all costs related to acquisition (for both PVT and ASP), design, maintenance and physical inspection over 5 years. However, in July 2006, DHS announced that it had awarded contracts to develop and purchase up to \$1.2 billion worth of ASP portal monitors over 5 years. Furthermore, the cost-benefit analysis underestimates total deployment costs and does not account for other major costs, such as physical inspections of cargo containers, an additional procurement of 442 new PVT monitors, installation and integration, and maintenance.

DNDO's Cost-Benefit Analysis Used Inflated Cost Estimates for PVT Equipment

DNDO overstated the purchase price of PVT monitors. Although DHS is currently paying an average of about \$55,000 per monitor, DNDO's cost-benefit analysis assumed the PVT would cost \$130,959—the highest published manufacturers' price for the government.¹⁸ According to DNDO's Director, DNDO chose the highest published price because the current contract for portal monitors is going to expire, and the portal monitors will probably cost more in the future. However, the information DNDO provided us does not explain why DNDO assumes that this future price will be more than double what DHS is currently paying, as assumed in DNDO's analysis. PNNL officials told us that the future price will almost certainly be lower than the price used in DNDO's analysis.

¹⁷*Enlisting Foreign Cooperation in U.S. Efforts to Prevent Nuclear Smuggling: Hearing Before the House Committee on Homeland Security, Subcommittee on Prevention of Nuclear and Biological Attack*, 109th Cong. (May 25, 2006) (statement of Mr. Vayl S. Oxford, Director, DNDO); *Detecting Smuggled Nuclear Weapons, Hearing Before the Senate Judiciary Committee, Subcommittee on Terrorism, Technology, and Homeland Security*, 109th Cong. (July 27, 2006) (statement of Mr. Vayl S. Oxford, Director, DNDO).

¹⁸DNDO, *Cost Benefit Analysis for Next Generation Passive Radiation Detection of Cargo at the Nation's Border Crossings*, May 30, 2006.

Conclusions

DNDO's cost-benefit analysis does not justify its recent decision to spend \$1.2 billion to purchase and deploy ASP technology. In particular, DNDO used incomplete and unreliable data to evaluate the costs and benefits of ASPs. For example, DNDO did not use its own test results that showed that the new portal monitor technology could not meet the cost-benefit analysis' main performance assumption of correctly identifying HEU 95 percent of the time. In addition, the ability of ASPs to correctly identify masked HEU falls far short of the 95 percent level of performance. Instead of relying on performance data, DNDO relied on potential future performance to justify the purchase of ASPs. While DNDO officials asserted that the current performance levels of the ASPs will improve, they provided no additional information as to how or when the 95 percent performance goal will be achieved. Furthermore, DNDO's simplified approach to the cost-benefit analysis omitted many factors that could affect the cost of new radiation portal monitors, such as underestimating the life-cycle costs for operating and maintaining the equipment over time by about \$181 million. For these reasons, DNDO's cost-benefit analysis does not meet the intent of our March 2006 report recommendation to fully assess the costs and benefits before purchasing any new equipment.

Recommendations for Executive Action

We recommend that DHS and DNDO conduct a new cost-benefit analysis to justify the purchase of new radiation detection portal monitors by using sound analytical methods, including actual performance data and a complete accounting of all major costs and benefits as required by DHS guidelines. We also recommend that DNDO conduct realistic testing for both ASPs and PVTs in order to meet the Congressional requirement outlined in the Homeland Security Appropriations Act for Fiscal Year 2007 that DHS certify that a "significant increase in operational effectiveness" will be achieved by ASPs before spending additional funds to purchase ASPs for deployment.

Agency Comments and Our Evaluation

We provided DHS with a draft of this report for its review and comment. Its written comments are presented in Enclosure 2. The Department neither agreed nor disagreed with our recommendation, but continues to stand behind the basic conclusions of its cost-benefit analysis that the ASP program is a sound investment for the U.S. Government. In our view, the cost-benefit analysis cannot be used as a reliable basis for making a major procurement decision.

In its written comments, the Department stated that there are three areas of disagreement and/or misunderstanding with GAO. In our view, however, there are no misunderstandings on any of these issues. First, although the Department agreed that performance tests of ASPs did not meet DNDO's main performance assumption of correctly identifying HEU 95 percent of the time it passes through the portal monitors, these tests were designed to determine which contractors would manufacture the equipment, not determine the absolute capabilities of ASPs. However, in our view, an

objective and complete cost-benefit analysis should have included empirical data on how well ASPs are currently performing. Instead of relying on performance data, DNDO relied on potential future performance to justify the purchase of ASPs.

Second, according to the Department, DNDO did not use performance data of PVTs in its cost-benefit analysis from tests conducted at the Nevada Test Site in 2005 because those tests were not designed to provide an objective side-by-side comparison of ASPs and PVTs. However, the purpose of the cost-benefit analysis was to determine the benefits, if any, of using ASPs instead of currently deployed radiation detection technology, including PVTs. The relative capabilities of the two competing detection systems—ASPs and PVTs—should have been critical to DNDO’s analysis. However, DNDO missed an opportunity to collect objective, empirical data on the relative capabilities of ASPs and PVTs because the agency failed to design its side-by-side tests to measure such differences. As a result, instead of having empirical data available for its cost-benefit analysis, DNDO relied on assumptions of future ASP performance and on limited, unreliable data drawn from tests conducted in 2004 to assess the performance of PVTs. DNDO will not be able to assess objectively whether ASPs offer any advantages over PVTs, much less whether any such potential advantages are worth the ASPs’ considerable additional cost, until DNDO conclusively determines the relative effectiveness of the two technologies.

Lastly, while the Department agreed that radiation detection portal monitors should also be able to detect and identify radiological materials in addition to HEU, it believes that HEU is the most difficult material to detect and it will continue use HEU as a reasonable threat baseline. We agree that HEU is the most difficult material to detect, but we disagree that HEU should be used as the only reasonable threat baseline to determine the performance of portal monitors. As we reported, a complete cost-benefit analysis would include an assessment of ASPs’ ability to detect and identify a variety of nuclear and radiological material, not just HEU. By excluding radiological and nuclear materials other than HEU, DNDO’s analysis did not consider the number of secondary inspections that would be related to these materials and hence it likely underestimated the costs of ASP use.

We are sending copies of this correspondence to interested congressional committees and members, the Secretary of Homeland Security, and other interested parties. We will also make copies available to others on request. In addition, this correspondence will be available at no charge on GAO’s Web site at <http://www.gao.gov>. Should you or your staff have any questions, please contact me at (202) 512-6870 or by e-mail at aloisee@gao.gov. Contact points for our Office of Congressional Relations and Public

Affairs may be found on the last page of this correspondence. Key contributions to this report include Leland Cogliani, Nancy Crothers, Jonathan Fremont, Jim Shafer, Daren Sweeney, and Eugene Wisnoski.

A handwritten signature in black ink that reads "Gene Aloise". The signature is written in a cursive style with a large, looped initial "G".

Gene Aloise
Director, Natural Resources
and Environment

Enclosures - 2

Briefing to House and Senate Committees on Appropriations, August 21, 2006



Briefing to House and Senate Committees on
Appropriations
August 21, 2006

Analysis of the Domestic Nuclear Detection Office/Department
of Homeland Security's Cost Benefit Analysis for Next
Generation Radiation Detection Equipment



- The Domestic Nuclear Detection Office (DNDO), within the Department of Homeland Security (DHS), is responsible for acquiring and supporting the deployment of radiation detection equipment at U.S. ports-of-entry.
- The purpose of the radiation detection equipment is to screen all cargo, vehicles, and individuals coming into the United States for radiological and nuclear materials, without delaying movement of this traffic into the nation.
- Current plastic portal monitors (PVT) are able to detect the presence of radiation. DNDO has sponsored research, development, and testing activities designed to produce portal monitors that can detect radiation *and* identify the type of material. These new portal monitors are known as “advanced spectroscopic portals” (ASP).



- In our March 2006 report¹, we recommended that once the costs and capabilities of ASPs were well understood, and before any of the new equipment was purchased, the Secretary of DHS work with the Director of DNDO to analyze the benefits and costs of deploying ASPs.
- We further recommended that this analysis focus on determining whether any additional detection capability provided by the ASPs are worth the additional costs.
- In response to GAO's recommendation, in May 2006, DNDO issued a cost-benefit analysis to help guide its strategy for the acquisition and deployment of portal monitors.

¹ See GAO, *Combating Nuclear Smuggling: DHS Has Made Progress Deploying Radiation Detection Equipment at U.S. Ports of Entry, but Concerns Remain*, GAO-06-389 (Washington, D.C.: Mar 22, 2006).



DNDO's Cost-Benefit Analysis: Purpose and Goals

- The purpose of the analysis was to identify the best strategy that the DNDO-Customs and Border Protection could use to meet their deployment requirements for nuclear and radiological detection equipment at U.S. ports of entry.
- The analysis had three goals: to (1) provide a robust defense against nuclear and radiological threats, (2) limit impacts to commerce, and (3) provide a sound financial investment for the U.S government.



Objective

- The House and Senate Appropriations Committees asked us to review DNDO's cost-benefit analysis to determine the extent to which it provides a sound analytical basis for acquiring and deploying portal monitors.



- To conduct our review of DNDO's cost-benefit analysis, we:
 - Analyzed documentation supporting the costs used for both currently deployed and new equipment, such as the Independent Government Cost Estimate for ASPs.
 - Reviewed government test reports for ASP and PVT systems to assess the validity of assumptions DNDO used in its analysis.
 - Had discussions with officials from DNDO, Customs and Border Protection, Department of Energy laboratories, National Institutes of Standards and Technology, and representatives of the trucking and shipping industries.



- DNDO assumed in its cost-benefit analysis that ASPs can correctly detect and identify highly enriched uranium (HEU) 95 percent of the time it passes through portal monitors.
- In 2005, DNDO tested ASP capabilities to identify both bare, or unmasked, HEU and HEU masked in a container with radiological material, such as kitty litter.
- Performance tests showed that ASPs identified HEU much less than 95 percent of the time. At best, the tested ASPs correctly identified masked HEU only about half of the time.
- DNDO did not use the results of these tests in its cost-benefit analysis and instead assumed that the ASPs will reach that level of performance in the future.



- DNDO officials acknowledged that DNDO tested the performance of PVTs along with the ASPs in 2005, but did not use the results of these tests in its cost-benefit analysis.
- Instead, DNDO based its analysis on the performance of PVT monitors that PNNL tested during 2004 in New York
- The PVT monitors that DHS used in the tests had only one radiation detection panel as opposed to the four-panel PVT monitors that DHS currently deploys at ports-of-entry.
- Additionally, PNNL noted that the results from the tests did not indicate how well PVT portal monitors would be able to detect HEU in the field.



- DNDO officials told us they did not follow DHS guidelines for performing cost-benefit analyses.
- DNDO's cost-benefit analysis only considered the benefits of ASPs ability to detect and identify HEU and did not consider ASPs ability to detect and identify other nuclear and radiological materials.
- A complete analysis would include an assessment of an ASP's ability to identify a variety of radiological and nuclear sources, not just HEU.
- DNDO's analysis does not include the bigger cost of instances in which a container possesses a threatening radiological or nuclear material, but the portal monitor either misidentifies the material as non-threatening or does not detect the material at all, thus allowing the material to enter the country.



- DNDO analysis assumed a 5-year life-cycle for both PVT and ASP equipment. However, DNDO officials told us that a 10-year life-cycle was a more reasonable expectation for PVT and ASP equipment.
- Maintenance costs for PVTs would be about \$5,500 per year per unit based on a \$55,000 purchase price and ASP maintenance costs would be about \$38,000 per year per unit based on a \$377,000 purchase price.
- With the much higher maintenance costs for ASPs and doubling the life-cycle to 10 years, the long-term implications for these cost differences would be magnified. As a result of this, DNDO's analysis has not accounted for about \$181 million in maintenance costs for ASPs alone.



- In calculating costs and benefits, DNDO overstated the acquisition costs of PVTs.
- DNDO assumed PVTs would cost about \$131,000 per unit—the highest published manufacturers' price for the government.
- However, DHS's actual procurement cost for a PVT monitor currently averages about \$55,000.



- DNDO's analysis shows the total cost for deploying PVT and ASP monitors to be about \$1 billion; which covers all costs related to acquisition (for both PVT and ASP), design, maintenance and physical inspection over 5 years.
- However, in July 2006, DHS announced that it had awarded contracts to develop and purchase \$1.2 billion worth of ASP portal monitors over 5 years.
- The ASP contract award has exceeded DNDO's estimate for total cost by about \$200 million. This is before accounting for major aspects of the total cost, such as the costs of physical inspections of cargo, an additional procurement of 442 new PVT monitors, installation and integration costs, and maintenance costs.



- DNDO's analysis is incomplete and unreliable.
 - DNDO did not use its own test results and instead assumed relied on potential performance of the new equipment.
 - DNDO used inaccurate or incomplete cost data.
 - The analysis does not include all costs and benefits for acquiring and deploying portal monitors
- Thus, DNDO's cost benefit analysis does not justify its recent decision to purchase and deploy ASP technology.
- DNDO should conduct a new cost-benefit analysis to justify the purchase of new radiation detection portal monitors by using sound analytical methods.
- DNDO should not spend any additional funds to purchase ASPs for deployment until it conducts realistic testing for both ASPs and PVTs that demonstrates that the new equipment provides superior detection and identification capabilities when compared to existing technology.

Comments from the Department of Homeland Security

Domestic Nuclear Detection Office
U.S. Department of Homeland Security
Washington, DC 20528



Homeland Security

October 11, 2006

MEMORANDUM FOR: Gene Aloise
Director, Natural Resources and Environment
Government Accountability Office

FROM: Vayl S. Oxford *VSO 10/11/06*
Director
Domestic Nuclear Detection Office

SUBJECT: Comments on GAO Report titled: Combating Nuclear Smuggling: DHS's Cost-Benefit Analysis to Support the Purchase of New Radiation Detection Portal Monitors Was Not Based on Available Performance Data and Did Not Fully Evaluate All the Monitors' Costs and Benefits, dated October 12, 2006

The Domestic Nuclear Detection Office (DNDO) has reviewed the subject report and the briefing presented to the House and Senate Committees on Appropriations dated August 21, 2006. Thank you very much for the opportunity to comment. While the DNDO has concerns with some of the report's findings, we remain committed to high fidelity testing prior to all full scale acquisition decisions, including the Advanced Spectroscopic Portal (ASP) program.

The DNDO met on multiple occasions with the GAO staff to discuss the Cost Benefit Analysis (CBA) methodology, assumptions, data sources, and results. In all instances, we agreed with GAO's suggestions and worked to further refine the CBA, or provided written responses documenting the technical rationale for the DNDO's approach. However, some misunderstandings and/or disagreements remain between the DNDO and the GAO, including:

- The GAO criticized the DNDO for assuming a probability of detection of 95%, even though initial test results did not show this same capability. However, the initial test results cited by the GAO were not intended to determine the absolute capabilities of deployed systems; rather, they were intended to support initial source selection decisions. Again, we remain committed to high fidelity testing prior to all full scale acquisition decisions. We plan to subject systems to additional testing prior to full scale production to evaluate their performance against stated specifications, including the requirement for 95% probability of detection.
- The GAO stated that the DNDO tested the performance of PVT and ASP systems side-by-side, but did not use these results in the CBA. Again, the test series referenced was not intended to provide an objective side-by-side comparison. Further testing at both the Nevada Test Site and the New York Container Terminal will evaluate the validity of these assumptions.

- The GAO stated that the CBA only evaluated systems' ability to detect highly enriched uranium (HEU) and did not consider other threats. DNDO agrees that threats other than HEU are equally important. However, we believe that HEU poses the greatest challenge from a detection standpoint, and serves as a reasonable threat baseline for the purpose of this analysis.

The DNDO stands behind the basic conclusions of the CBA--that the Advanced Spectroscopic Portal (ASP) program is a sound investment for the USG and that the Joint DNDO-CBP Deployment Strategy, employing a mix of PVT and ASP systems for primary inspection and ASP systems for all secondary inspections is the optimal approach.

DNDO believes that this report requires further collaboration and we look forward to continuing to work together on this important national priority. Please let me know if you or your staff need additional information; (202) 254-5688.

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