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NUCLEAR NONPROLIFERATION

U.S. Agencies Have Limited Ability to Account for, Monitor, and Evaluate the Security of U.S. Nuclear Material Overseas

U.S. Government Accountability Office

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ACCOUNTABILITY ★ INTEGRITY ★ RELIABILITY



Highlights of [GAO-11-920](#), a report to the Committee on Foreign Affairs, House of Representatives

Why GAO Did This Study

The United States has exported special nuclear material, including enriched uranium, and source material such as natural uranium under nuclear cooperation agreements. The United States has 27 nuclear cooperation agreements for peaceful civilian cooperation. Under the U.S. Atomic Energy Act of 1954 (AEA), as amended, partners are required to guarantee the physical protection of U.S. nuclear material. GAO was asked to (1) assess U.S. agency efforts to account for U.S. nuclear material overseas, (2) assess the Department of Energy's (DOE) and U.S. agencies' efforts to evaluate the security of U.S. material overseas, and (3) describe DOE's activities to secure or remove potentially vulnerable U.S. nuclear material at partner facilities. GAO analyzed agency records and interviewed DOE, Nuclear Regulatory Commission (NRC), Department of State (State), and partner country officials. This report summarizes GAO's classified report issued in June 2011.

What GAO Recommends

GAO suggests, among other things, that Congress consider directing DOE and NRC to compile an inventory of U.S. nuclear material overseas. DOE, NRC, and State generally disagreed with GAO's recommendations, including that they conduct annual inventory reconciliations with all partners, stating they were unnecessary. GAO continues to believe that its recommendations could help improve the accountability of U.S. nuclear material in foreign countries.

View [GAO-11-920](#). For more information, contact Gene Aloise at (202) 512-3841 or aloisee@gao.gov.

NUCLEAR NONPROLIFERATION

U.S. Agencies Have Limited Ability to Account for, Monitor, and Evaluate the Security of U.S. Nuclear Material Overseas

What GAO Found

DOE, NRC, and State are not able to fully account for U.S. nuclear material overseas that is subject to nuclear cooperation agreement terms because the agreements do not stipulate systematic reporting of such information, and there is no U.S. policy to pursue or obtain such information. U.S. nuclear cooperation agreements generally require that partners report inventory information upon request, however, DOE and NRC have not systematically sought such data. DOE and NRC do not have a comprehensive, detailed, current inventory of U.S. nuclear material—including weapon-usable material such as highly enriched uranium (HEU) and separated plutonium—overseas that includes the country, facility, and quantity of material. In addition, NRC and DOE could not fully account for the current location and disposition of U.S. HEU overseas in response to a 1992 congressional mandate. U.S. agencies, in a 1993 report produced in response to the mandate, were able to verify the location of 1,160 kilograms out of 17,500 kilograms of U.S. HEU estimated to have been exported. DOE, NRC, and State have established annual inventory reconciliations with five U.S. partners, but not the others it has transferred material to or trades with.

Nuclear cooperation agreements do not contain specific access rights that enable DOE, NRC, or State to monitor and evaluate the physical security of U.S. nuclear material overseas, and the United States relies on its partners to maintain adequate security. In the absence of access rights, DOE's Office of Nonproliferation and International Security, NRC, and State have conducted physical protection visits to monitor and evaluate the physical security of U.S. nuclear material at facilities overseas when permitted. However, the agencies have not systematically visited countries believed to be holding the highest proliferation risk quantities of U.S. nuclear material, or systematically revisited facilities not meeting international physical security guidelines in a timely manner. Of the 55 visits made from 1994 through 2010, U.S. teams found that countries met international security guidelines approximately 50 percent of the time.

DOE has taken steps to improve security at a number of facilities overseas that hold U.S. nuclear material but faces constraints. DOE's Global Threat Reduction Initiative (GTRI) removes U.S. nuclear material from vulnerable facilities overseas but can only bring back materials that have an approved disposition pathway and meet the program's eligibility criteria. GTRI officials told GAO that, of the approximately 17,500 kilograms of HEU exported from the United States, 12,400 kilograms are currently not eligible for return to the United States. Specifically, GTRI reported that over 10,000 kilograms of U.S. HEU are believed to be in fuels from reactors in Germany, France, and Japan that have no disposition pathways in the United States and are adequately protected. In addition, according to GTRI, 2,000 kilograms of transferred U.S. HEU are located primarily in European Atomic Energy Community countries and are currently in use or adequately protected.

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Abbreviations

AEA	Atomic Energy Act
DOE	Department of Energy
EURATOM	European Atomic Energy Community
GTRI	Global Threat Reduction Initiative
HEU	highly enriched uranium
IAEA	International Atomic Energy Agency
IPPAS	International Physical Protection Advisory Service
LEU	low enriched uranium
NMMSS	Nuclear Materials Management and Safeguards System
NNPA	Nuclear Non-Proliferation Act of 1978
NNSA	National Nuclear Security Administration
NPT	Nuclear Nonproliferation Treaty
NRC	Nuclear Regulatory Commission
NSC	National Security Council
NSG	Nuclear Suppliers Group
SILEX	Separation of Isotopes by Laser Excitation
TRIGA	Training Research Isotope General Atomics

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G A O

Accountability * Integrity * Reliability

United States Government Accountability Office
Washington, DC 20548

September 8, 2011

The Honorable Ileana Ros-Lehtinen
Chairman
The Honorable Howard L. Berman
Ranking Member
Committee on Foreign Affairs
House of Representatives

The United States has 27 nuclear cooperation agreements in force for peaceful civilian cooperation with partners including foreign countries, the European Atomic Energy Community (EURATOM), the International Atomic Energy Agency (IAEA), and Taiwan.¹ A nuclear cooperation agreement is a bilateral agreement that establishes the legal framework for significant civilian nuclear cooperation between the United States and other parties, including the transfer of certain nuclear material, including special nuclear material such as enriched uranium,² and source material such as natural uranium, nuclear reactors, and certain components of nuclear reactors.³ The agreements are reciprocal, with both parties generally agreeing to all conditions specified in them. Under the U.S. Atomic Energy Act of 1954 (AEA), as amended, these agreements must contain certain obligations that govern, among other things, the U.S.

¹For the purposes of this report, we refer to all countries, EURATOM, IAEA, and Taiwan as partners. EURATOM is composed of the 27 countries of the European Union. IAEA, an independent international organization based in Vienna, Austria, is affiliated with the United Nations and has the dual mission of promoting the peaceful uses of nuclear energy and verifying that nuclear materials intended for peaceful purposes are not diverted to military purposes. IAEA had 151 member states as of November 2010. Governmental relations between the United States and Taiwan were terminated on January 1, 1979. All agreements concluded with the authorities on Taiwan prior to January 1, 1979, are administered for the United States by the American Institute in Taiwan, a nonprofit corporation based in Washington, D.C. The United States has two nuclear cooperation agreements with Australia, including one for Separation of Uranium Isotopes by Laser Excitation (SILEX) technology, bringing the number of agreements to 27.

²Special nuclear material includes uranium enriched in the isotope of uranium-235, uranium-233, and plutonium.

³U.S. companies can obtain a license from the Nuclear Regulatory Commission (NRC) to export certain small quantities of nuclear material and minor reactor components to foreign countries without a nuclear cooperation agreement in place. Dual-use items—items that can be used for both civilian and military applications—can be exported without a nuclear cooperation agreement.

rights of approval over the transfer, retransfer, enrichment, and reprocessing of certain kinds of nuclear material transferred from the United States and, in some cases produced overseas. A list of current and former U.S. nuclear cooperation agreement partners can be found in appendix II.

Thousands of kilograms of U.S. highly enriched uranium (HEU) and tens of thousands of kilograms of U.S. plutonium in spent fuel have accumulated overseas, as a result of foreign nuclear research and commercial nuclear power activities, which are subject to the terms in U.S. nuclear cooperation agreements. Inventories of U.S. nuclear material overseas could continue to grow as the result of reprocessing or recovery activities. As we have previously reported,⁴ tracking and accounting for nuclear materials are important to (1) ensure that nuclear materials are used only for peaceful purposes, (2) comply with international treaty obligations, and (3) provide data to policymakers and other government officials. According to DOE and NRC officials, the United States obtains written assurances from partners in advance of each transfer of U.S.-obligated nuclear material that commits the partner to treat the transferred nuclear material according to the terms of its nuclear cooperation agreement with the United States. Nuclear material transferred from the United States, as well as special nuclear material produced overseas through the use of U.S.-supplied nuclear material or reactors, is known as “U.S.-obligated” material.

As the technology to design and create nuclear weapons has spread, one of the most serious threats facing the United States and other countries is the possibility that a nation or terrorist organization could steal weapon-usable nuclear materials from poorly secured stockpiles in various locations around the world.⁵ In April 2009, President Obama made securing all vulnerable nuclear material worldwide within the next 4 years

⁴GAO, *Nuclear Nonproliferation: Concerns With the U.S. International Nuclear Materials Tracking System*, [GAO/T-RCED/AIMD-96-91](#) (Washington, D.C.: Feb. 28, 1996).

⁵Weapon-usable nuclear materials are HEU—uranium enriched in the isotope uranium-235 to 20 percent or greater; uranium-233; and any plutonium containing less than 80 percent of the isotope plutonium-238. Such materials are also often referred to as fissile materials or strategic special nuclear materials. In addition, weapon-grade HEU is generally defined as HEU enriched in the isotope of uranium-235 at 90 percent or greater.

a key U.S. nonproliferation goal,⁶ and the Department of Energy (DOE) has stated that doing so will require greater security cooperation with key countries; pursuing new partnerships to secure nuclear material; and strengthening nuclear security standards, practices, and international safeguards.

Securing nuclear material worldwide is a priority for DOE, through its National Nuclear Security Administration (NNSA),⁷ which, as one of its core mission areas, aims to keep dangerous nuclear materials out of the hands of terrorists by securing nuclear weapons and nuclear materials at their source and by improving security practices around the world. In particular, two key DOE NNSA offices work with U.S. nuclear cooperation agreement partners to strengthen nuclear security practices and identify and secure vulnerable nuclear materials. First, DOE's Office of Nonproliferation and International Security works with countries to ensure that provisions in the agreements are met by, among other things, providing physical protection training, assessment, and guidance on a bilateral basis, and leading U.S. interagency physical protection visits to countries with U.S. nuclear material. Second, DOE's Office of Global Threat Reduction implements the Global Threat Reduction Initiative (GTRI) and, among other things, identifies, secures, removes, and/or facilitates the disposition of high-risk, vulnerable nuclear and radiological material at civilian sites around the world that pose a threat.

In November 2010, we reported on the export benefits facilitated by U.S. nuclear cooperation agreements.⁸ In light of the quantities of nuclear material exported overseas under the framework of U.S. nuclear cooperation agreements, you asked us to also report on how U.S. agencies account for nuclear material overseas and monitor and evaluate the materials' physical security. Specifically, our objectives were to:

⁶GAO, *Nuclear Nonproliferation: Comprehensive U.S. Planning and Better Foreign Cooperation Needed to Secure Vulnerable Nuclear Materials Worldwide*, [GAO-11-227](#) (Washington, D.C.: Dec. 15, 2010).

⁷NNSA was created by the National Defense Authorization Act for Fiscal Year 2000, Pub. L. No. 106-65 (1999). It is a separate semiautonomous agency within DOE, with responsibility for the nation's nuclear weapons, nonproliferation, and naval reactors programs.

⁸GAO, *Nuclear Commerce: Governmentwide Strategy Could Help Increase Commercial Benefits from U.S. Nuclear Cooperation Agreements with Other Countries*, [GAO-11-36](#) (Washington, D.C.: Nov. 4, 2010).

(1) assess U.S. agency efforts to account for U.S. nuclear material overseas, (2) assess DOE's and other U.S. agencies' efforts to monitor and evaluate the physical security conditions of U.S. nuclear material subject to the terms of nuclear cooperation agreements, and (3) describe DOE's activities to secure or remove potentially vulnerable U.S. nuclear material at partner facilities. In June 2011, we reported to you on the results of our work in a classified report. This report summarizes certain aspects of our classified report.

To conduct this work, we reviewed relevant statutes, including the AEA, as amended, and the texts of all current U.S. nuclear cooperation agreements. We obtained data from the Nuclear Materials Management and Safeguards System (NMMSS), a database jointly operated by DOE and the Nuclear Regulatory Commission (NRC). This database, among other things, maintains data on U.S. peaceful use exports and retransfers of enriched uranium and plutonium that have occurred since 1950. To assess the reliability of data in NMMSS, we interviewed officials from DOE and NRC and a former DOE contractor to identify any limitations in NMMSS's data on the location and status of U.S. material overseas and found these data to be sufficiently reliable for the purposes of accounting for U.S. exports of nuclear material. We also compared NMMSS data with other sources of information regarding U.S. nuclear material transfers, including DOE data on nuclear material returns. We reviewed DOE, NRC, and Department of State (State) records and interviewed officials at those agencies to determine the extent to which DOE, NRC, and State are able to identify where U.S. nuclear material was exported, retransferred, and is currently held. We selected a non-probability sample of partners based on, among other considerations, quantities of U.S. special nuclear material transferred to them.⁹ We conducted site visits in four countries that currently hold U.S.-obligated nuclear material and interviewed governmental officials and nuclear facility operators in these countries to discuss material accounting procedures and observe physical protection measures. Further, we interviewed officials from several other partners regarding their observations about working with the U.S. government to account for material subject to the terms of nuclear cooperation

⁹Results of interviews of non-probability samples are not generalizable to all partners but provide an understanding of those partners' views of the U.S. government's efforts to account for its nuclear material inventories and monitor and evaluate the physical security conditions of U.S. nuclear material overseas subject to nuclear cooperation agreement terms.

agreements. We reviewed IAEA's security guidelines, "The Physical Protection of Nuclear Material and Nuclear Facilities," INFCIRC/225/Rev.4,¹⁰ and relevant international treaties. We also obtained and analyzed available records of U.S. physical protection visits to partner facilities from 1974 through 2010. We reviewed agency documents and interviewed officials from DOE, NRC, and State to determine the process used for conducting physical protection visits at partner facilities. We obtained information from GTRI regarding its program's activities. We interviewed IAEA officials and reviewed relevant documents to better understand IAEA's role in maintaining safeguards and evaluating physical security measures. Additional details on our scope and methodology can be found in appendix I.

We conducted this performance audit from September 2010 to June 2011 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

The AEA, as amended, sets forth the procedures and requirements for the U.S. government's negotiating, proposing, and entering into nuclear cooperation agreements with foreign partners. The AEA, as amended, requires that U.S. peaceful nuclear cooperation agreements contain the following nine provisions:¹¹

1. *Safeguards*: Safeguards, as agreed to by the parties, are to be maintained over all nuclear material and equipment transferred, and all special nuclear material used in or produced through the use of such nuclear material and equipment, as long as the material or equipment remains under the jurisdiction or control of the cooperating

¹⁰In January 2011, IAEA issued an updated revision of its security guideline document, IAEA, "Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities" (IAEA INFCIRC/225/Rev.5 (2011)).

¹¹The President may exempt proposed agreements for peaceful nuclear cooperation from any of these requirements if he determines that the requirement would be seriously prejudicial to the achievement of U.S. nonproliferation objectives or otherwise jeopardize the common defense and security.

party, irrespective of the duration of other provisions in the agreement or whether the agreement is terminated or suspended for any reason. Such safeguards are known as “safeguards in perpetuity.”

2. *Full-scope IAEA safeguards as a condition of supply:* In the case of non-nuclear weapons states, continued U.S. nuclear supply is to be conditioned on the maintenance of IAEA “full-scope” safeguards over all nuclear materials in all peaceful nuclear activities within the territory, under the jurisdiction, or subject to the control of the cooperating party.¹²
3. *Peaceful use guaranty:* The cooperating party must guarantee that it will not use the transferred nuclear materials, equipment, or sensitive nuclear technology, or any special nuclear material produced through the use of such, for any nuclear explosive device, for research on or development of any nuclear explosive device, or for any other military purpose.
4. *Right to require return:* An agreement with a non-nuclear weapon state must stipulate that the United States has the right to require the return of any transferred nuclear materials and equipment, and any special nuclear material produced through the use thereof, if the cooperating party detonates a nuclear device, or terminates or abrogates an agreement providing for IAEA safeguards.

¹²Section 104 of the Henry J. Hyde United States-India Peaceful Atomic Energy Cooperation Act of 2006 authorized the President to exempt India from the full-scope safeguards requirement if the President made a determination that India had taken certain specified actions and that the Nuclear Suppliers Group (NSG) had decided by consensus to permit the supply to India of nuclear items covered by the NSG Guidelines. On September 10, 2008, the President made the requisite determination, the agreement was approved by legislation enacted on October 8, 2008, and that agreement with India entered into force on December 6, 2008.

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5. *Physical security:* The cooperating party must guarantee that it will maintain adequate physical security for transferred nuclear material and any special nuclear material used in or produced through the use of any material, or production or utilization facilities transferred pursuant to the agreement.¹³
 6. *Retransfer rights:* The cooperating party must guarantee that it will not transfer any material, Restricted Data, or any production or utilization facility transferred pursuant to the agreement, or any special nuclear material subsequently produced through the use of any such transferred material, or facilities, to unauthorized persons or beyond its jurisdiction or control, without the consent of the United States.
 7. *Restrictions on enrichment or reprocessing of U.S.-obligated material:* The cooperating party must guarantee that no material transferred, or used in, or produced through the use of transferred material or production or utilization facilities, will be reprocessed or enriched, or with respect to plutonium, uranium-233, HEU, or irradiated nuclear materials, otherwise altered in form or content without the prior approval of the United States.
 8. *Storage facility approval:* The cooperating party must guarantee not to store any plutonium, uranium-233, or HEU that was transferred pursuant to a cooperation agreement, or recovered from any source or special nuclear material transferred, or from any source or special nuclear material used in a production facility or utilization facility transferred pursuant to the cooperation agreement, in a facility that has not been approved in advance by the United States.
 9. *Additional restrictions:* The cooperating party must guarantee that any special nuclear material, production facility, or utilization facility produced or constructed under the jurisdiction of the cooperating party by or through the use of transferred sensitive nuclear technology, will be subject to all the requirements listed above.

¹³A production facility is any equipment or device, or any important component of such equipment or device, capable of the production of special nuclear material in such quantity as to be of significance to the common defense and security or in such a manner as to affect the health and safety of the public. A utilization facility is any equipment or device, or any important component of such equipment or device, other than an atomic weapon, capable of using such material.

In addition, the United States is a party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). The NPT binds each of the treaty's signatory states that had not manufactured and exploded a nuclear weapon or other nuclear explosive device prior to January 1, 1967 (referred to as non-nuclear weapon states) to accept safeguards as set forth in an agreement to be concluded with IAEA. Under the safeguards system, IAEA, among other things, inspects facilities and locations containing nuclear material, as declared by each country, to verify its peaceful use. IAEA standards for safeguards agreements provide that the agreements should commit parties to establish and maintain a system of accounting for nuclear material, with a view to preventing diversion of nuclear energy from peaceful uses, and reporting certain data to IAEA.

IAEA's security guidelines provide the basis by which the United States and other countries generally classify the categories of protection that should be afforded nuclear material, based on the type, quantity, and enrichment of the nuclear material. For example, Category I material is defined as 2 kilograms or more of unirradiated or "separated" plutonium or 5 kilograms of uranium-235 contained in unirradiated or "fresh" HEU and has the most stringent set of recommended physical protection measures. The recommended physical protection measures for Category II and Category III nuclear materials are less stringent. Appendix III contains further details on the categorization of nuclear material.

DOE, NRC, and State Are Not Able to Fully Account for U.S. Nuclear Material Located at Foreign Facilities

DOE, NRC, and State are not able to fully account for U.S. nuclear material overseas that is subject to nuclear cooperation agreement terms because the agreements do not stipulate systematic reporting of such information, and there is no U.S. policy to pursue or obtain such information. Section 123 of the AEA, as amended, does not require nuclear cooperation agreements to contain provisions stipulating that partners report information on the amount, status, or location (facility) of special nuclear material subject to the agreement terms. However, U.S. nuclear cooperation agreements generally require that partners report inventory information upon request, although DOE and NRC have not systematically sought such data. We requested from multiple offices at DOE and NRC a current and comprehensive inventory of U.S. nuclear material overseas, to include country, site, or facility, and whether the quantity of material was rated as Category I or Category II material. However, neither agency has provided such an inventory. NMMSS does not contain the data necessary to maintain an inventory of U.S. special nuclear material overseas. DOE, NRC, and State have not pursued

annual inventory reconciliations of nuclear material subject to U.S. cooperation agreement terms with all foreign partners that would provide the U.S. government with better information about where such material is held. Furthermore, according to DOE, NRC, and State officials, no U.S. law or policy directs U.S. agencies to obtain information regarding the location and disposition of U.S. nuclear material at foreign facilities.

U.S. Nuclear Cooperation Agreements Generally Require That Partners Report Inventory Information upon Request, but DOE and NRC Have Not Systematically Sought Such Data

Section 123 of the AEA, as amended, does not require nuclear cooperation agreements to contain provisions stipulating that partners report information on the amount, status, or location (facility) of special nuclear material subject to the agreement terms. However, the texts of most U.S. nuclear cooperation agreements contain a provision calling for each partner to maintain a system of material accounting and control and to do so consistent with IAEA safeguards standards or agreements.¹⁴ In addition, we found that all agreements, except three negotiated prior to 1978 and the U.S.-China agreement, contain a provision that the other party shall report, or shall authorize the IAEA to report, inventory information upon request. However, according to DOE and NRC officials, with the exception of the administrative arrangements with five partners, the United States has not requested such information from all partners on an annual or systematic basis.

Nonetheless, the AEA requires U.S. nuclear cooperation agreements to include terms that, among other things, obligate partners to obtain U.S. approval for the transfer, retransfer, enrichment and reprocessing, and the storage of U.S.-obligated uranium-233, HEU, or other nuclear materials that have been irradiated. In addition, according to DOE and NRC officials, the United States obtains written assurances from partners in advance of each transfer of U.S. nuclear material that commits them to maintain the transferred nuclear material according to the terms of its nuclear cooperation agreement with the United States. DOE and NRC officials told us these assurances help the United States ensure that partner countries comply with the terms of the nuclear cooperation agreement.

¹⁴The U.S.-China agreement states that parties shall exchange views on their national material accounting systems.

In addition, IAEA, DOE, NRC, and State officials told us that IAEA's safeguards activities provide a level of assurance that nuclear material is accounted for at partner facilities. The safeguards system, which has been a cornerstone of U.S. efforts to prevent nuclear proliferation, allows IAEA to independently verify that non-nuclear weapons states that signed the NPT are complying with its requirements. Under the safeguards system, IAEA, among other things, inspects facilities and locations containing nuclear material declared by countries to verify its peaceful use. Inspectors from IAEA's Department of Safeguards verify that the quantities of nuclear material that these non-nuclear weapons states declared to IAEA are not diverted for other uses. IAEA considers such information confidential and does not share it with its member states, including the United States, unless the parties have agreed that IAEA can share the information.

IAEA's inspectors do not verify nuclear material by country of origin or associated obligation. DOE, State, and IAEA officials told us that, because IAEA does not track the obligation of the material under safeguards, IAEA may notice discrepancies in nuclear material balances through periodic reviews of countries' shipping records. However, these officials said that IAEA does not have the ability to identify whether and what volume of nuclear material at partner country facilities is U.S.-obligated and therefore subject to the terms of U.S. nuclear cooperation agreements.

DOE and NRC Do Not Have a Current Comprehensive Inventory of U.S. Material Overseas

DOE and NRC do not have a comprehensive, detailed, current inventory of U.S. nuclear material overseas that would enable the United States to identify material subject to U.S. nuclear cooperation agreement terms. We requested from multiple offices at DOE and NRC a current and comprehensive inventory of U.S. nuclear material overseas, to include country, site, or facility, and whether the quantity of material was Category I or Category II. However, the agencies have not provided such a list. DOE officials from the Office of Nonproliferation and International Security told us that they have multiple mechanisms to account for the amount of U.S.-obligated nuclear material at foreign facilities. They stated that they use NMMSS records to obtain information regarding U.S. nuclear material inventories held in other countries. However, NMMSS officials told us that NMMSS was an accurate record of material exports from the United States, but that it should not be used to estimate current inventories. In addition, NMMSS officials stated that DOE's GTRI program has good data regarding the location of U.S. nuclear material overseas and that this information should be reconciled with NMMSS data.

However, when we requested information regarding the amount of U.S. material at partner facilities, GTRI stated that they could not report on the amount of U.S. nuclear material remaining at facilities unless it was scheduled for GTRI to return. In addition, in February 2011 written comments to us, GTRI stated it was not responsible for acquiring or maintaining inventory information regarding U.S. nuclear material overseas. A long-time contract employee for DOE's Office of Nonproliferation and International Security stated he has tried to collect information regarding U.S. nuclear material overseas from various sources including a list of countries eligible for GTRI's fuel return program, NMMSS, and other sources, but it is not possible to reconcile information from the various lists and sources and consequently there is no list of U.S. inventories overseas.

According to public information, the United States has additional measures known as administrative arrangements with five of its trading partners to conduct annual reconciliations of nuclear material amounts. In addition, for all partners, DOE and NRC officials told us that an exchange of diplomatic notes is sent prior to any transfer to ensure that U.S. nuclear material is not diverted for non-peaceful purposes, and which binds the partner to comply with the terms of the nuclear cooperation agreement. However, the measures cited by DOE are not comprehensive or sufficiently detailed to provide the specific location of U.S. nuclear material overseas.

NRC and DOE could not fully account for U.S. exports of HEU in response to a congressional mandate that the agencies report on the current location and disposition of U.S. HEU overseas. In 1992, Congress mandated that NRC,¹⁵ in consultation with other relevant agencies, submit to Congress a report detailing the current status of previous U.S. exports of HEU, including its location, disposition (status), and how it had been used. The January 1993 report that NRC produced in response to the mandate stated it was not possible to reconcile this information from available U.S. sources of data with all foreign holders of U.S. HEU within the 90-day period specified in the act.¹⁶ The report further states that a

¹⁵Energy Policy Act of 1992, Pub. L. No. 102-486, § 903(b), 106 Stat. 2776, 2945-46.

¹⁶NRC, *The United States Nuclear Regulatory Commission's Report to Congress on the Disposition of Highly Enriched Uranium Previously Exported from the United States*, Washington, D.C. (January 1993).

thorough reconciliation of U.S and foreign records with respect to end use could require several months of additional effort, assuming that EURATOM would agree to participate. According to DOE and NRC officials, no further update to the report was issued, and the U.S. government has not subsequently attempted to develop such a comprehensive estimate of the location and status of U.S. HEU overseas.

The 1993 report provided estimated material balances based on the transfer, receipt, or other adjustments reported to the NMMSS and other U.S. agencies. The report stated that the estimated material balances should match partners' reported inventories. However, the report did not compare the balances or explain the differences.

Our analysis of other documentation associated with the report shows that NRC, in consultation with U.S. agencies, was able to verify the location of 1,160 kilograms out of an estimated 17,500 kilograms of U.S. HEU remaining overseas as of January 1993. NRC's estimates matched partner estimates in 22 cases; did not match partner estimates in 6 cases; and, in 8 cases, partners did not respond in time to NRC's request.

The 1993 report noted that, in cases where U.S. estimates did not match partners' inventory reports, "reconciliation efforts are underway." However, DOE, NRC, and NMMSS officials told us that no further report was issued. In addition, NMMSS officials told us that they were unaware of any subsequent efforts to reconcile U.S. estimates with partners' reports, or update the January 1993 report. In addition, we found no indication that DOE, NMMSS, or NRC officials have updated the January 1993 report, or undertaken a comprehensive accounting of U.S. nuclear material overseas.

NMMSS Does Not Contain Data Necessary to Identify Where U.S. Material Is Located Overseas

We found that NMMSS does not contain the data necessary to maintain an inventory of U.S. nuclear material overseas subject to U.S. nuclear cooperation agreements. According to NRC documents, NMMSS is part of an overall program to help satisfy the United States' accounting, controlling, and reporting obligations to IAEA and its nuclear trading partners. NMMSS, the official central repository of information on domestic inventories and exports of U.S. nuclear material, contains current and historic data on the possession, use, and shipment of nuclear material. It includes data on U.S.-supplied nuclear material transactions with other countries and international organizations, foreign contracts, import/export licenses, government-to-government approvals, and other DOE authorizations such as authorizations to retransfer U.S. nuclear

material between foreign countries.¹⁷ DOE and NRC officials told us that NMMSS contains the best available information regarding U.S. exports and retransfers of special nuclear material.

DOE and NRC do not collect data necessary for NMMSS to keep an accurate inventory of U.S. nuclear material overseas. According to NRC officials, NMMSS cannot track U.S. nuclear material overseas because data regarding the current location and status of U.S. nuclear material, such as irradiation, decay, burn up, or production, are not collected. NMMSS only contains data on domestic inventories and transaction receipts from imports and exports reported by domestic nuclear facilities and some retransfers reported by partners to the United States and added to the system by DOE. Therefore, while the 1995 Nuclear Proliferation Assessment Statement accompanying the U.S.-EURATOM agreement estimated 250 tons of U.S.-obligated plutonium are planned to be separated from spent power reactor fuel in Europe and Japan for use in civilian energy programs in the next 10 to 20 years, our review indicates that the United States would not be able to identify the European countries or facilities where such U.S.-obligated material is located.

DOE, NRC, and State Have Not Pursued Annual Reconciliations of Inventories of Nuclear Material Subject to U.S. Nuclear Cooperation Agreement Terms with All Partners

DOE, NRC, and State have not pursued annual inventory reconciliations of nuclear material subject to U.S. nuclear cooperation agreement terms with all partners that would provide the U.S. government with better information about where such material is held overseas. Specifically, once a nuclear cooperation agreement is concluded, U.S. government officials—generally led by DOE—and partner country officials may negotiate an administrative arrangement for an annual inventory reconciliation to exchange information regarding each country’s nuclear material accounting balances. Inventory reconciliations typically compare the countries’ data and material transfer and retransfer records, and can help account for material consumed or irradiated by reactors.

Government officials from several leading nuclear material exporting and importing countries told us that they have negotiated with all their other partners to exchange annual inventory reconciliations to provide a

¹⁷NMMSS has been used to account for U.S. imports and exports of nuclear material since 1967 and has been upgraded several times, most recently in 2009, though some of its information dates to 1950.

common understanding of the amount of their special material held by another country or within their country. For example, Australia, which exports about 13 percent of the world's uranium each year, conducts annual reconciliations with each of its partners, and reports annually to the Australian Parliament regarding the location and disposition of all Australian nuclear material. NRC officials told us that Australia has some of the strictest reporting requirements for its nuclear material.

The United States conducts annual inventory reconciliations with five partners but does not conduct inventory reconciliations with the other partners it has transferred material to or trades with.¹⁸ According to DOE officials, for the five reconciliations currently conducted, NMMSS data are compared with the partner's records and, if warranted, each country's records are adjusted, where necessary, to reflect the current status of U.S. special nuclear material. As of February 2011, the United States conducted bilateral annual exchanges of total material balances for special nuclear materials with five partners. Of these partners, the United States exchanges detailed information regarding inventories at each specific facility only with one partner. DOE officials noted that they exchange information with particular trading partners on a transactional basis during the reporting year and work with the partners at that time to resolve any potential discrepancies that may arise. In the case of EURATOM, material information is reported as the cumulative total of all 27 EURATOM members. For the purposes of nuclear cooperation with the United States, EURATOM is treated as one entity rather than its 27 constituent parts. None of the 27 EURATOM member states have bilateral nuclear cooperation agreements in force with the United States.

According to a 2010 DOE presentation for NMMSS users, the difference in reporting requirements results in a 69-page report for Japan and a 1-page report for EURATOM. In addition, information exchanged with other trading partners also is not reported by facility. DOE and NRC officials told us that the United States may not have accurate information regarding the inventories of U.S. nuclear material held by its 21 other partners.

¹⁸The United States has two agreements with Australia. One agreement concerns broad-based nuclear cooperation; the second is limited to collaboration in SILEX technology.

DOE officials told us that, in addition to benefits, there were costs to pursuing facility-by-facility reconciliations and reporting. In particular, DOE officials told us they have not pursued facility-by-facility accounting in annual reconciliations with other partners because it would be difficult for the United States to supply such detailed information regarding partner material held in U.S. facilities. DOE and NRC officials told us this would also create an administrative burden for the United States. According to DOE officials, the relative burden with which the United States can perform facility-by-facility accounting by foreign trading partner varies greatly based on the amount of material in the United States that is obligated to such partners. For example, the United States can perform facility-by-facility accounting with one country, because U.S. officials told us there is not much of that country's nuclear material in the United States. However, if the United States were to conduct facility-by-facility accounting with Australia, it would create burdensome reporting requirements. Specifically, according to DOE officials, Australia would have to report to the United States on the status of a few facilities holding U.S. nuclear material, but the United States would be required to report on hundreds of U.S. facilities holding Australian nuclear material. Without information on foreign facilities, however, it may be difficult to track U.S. nuclear materials for accounting and control purposes.

No U.S. Law or Policy Directs U.S. Agencies to Obtain Information Regarding the Location and Disposition of U.S. Nuclear Material at Foreign Facilities

DOE, NRC, and State officials told us neither U.S. law nor U.S. policy explicitly requires the United States to track U.S. special nuclear material overseas. Moreover, U.S. law does not require peaceful nuclear cooperation agreements to require cooperating parties to provide reports to the United States of nuclear material on a facility-by-facility basis. A March 2002 DOE Inspector General's audit raised concerns about the U.S. government's ability to track sealed sources, which could contain nuclear or radioactive material.¹⁹ In response to the audit's findings, NNSA's Associate Administrator for Management and Administration wrote that "While it is a good idea to be aware of the locations and conditions of any [U.S.] material, it is not the current policy of the U.S. government." Furthermore, the Associate Administrator asserted that various U.S. government agencies, including State, DOE, and NRC, would need to be involved should DOE change its policy and undertake

¹⁹According to DOE, a sealed source may contain nuclear or radiological material, and is packaged to be environmentally safe and are generally used for calibration of radiation measuring and monitoring instruments in nuclear research and development.

an initiative to track the location and condition of U.S. sealed sources in foreign countries. Similarly, DOE, NRC, and State officials told us that if it became the policy of the U.S. government to track nuclear material overseas—and in particular, by facility—then requirements would have to be negotiated into the nuclear cooperation agreements or the associated administrative arrangements.

NMMSS officials told us that NMMSS is currently capable of maintaining information regarding inventories of U.S. nuclear material overseas. However, as we reported in 1982,²⁰ NMMSS information is not designed to track the location (facility) or the status—such as whether the material is irradiated or unirradiated, fabricated into fuel, burned up, or reprocessed. As a result, NMMSS neither identifies where U.S. material is located overseas nor maintains a comprehensive inventory of U.S.-obligated material. In addition, NMMSS officials emphasized that this information would need to be systematically reported. According to these officials, such reporting is not done on a regular basis by other DOE offices and State. In some instances, State receives a written notice of a material transfer at its embassies and then transmits this notice to DOE. Officials from DOE’s Office of Nonproliferation and International Security told us that, while they could attempt to account for U.S. material overseas on a case-by-case basis, obtaining the information to systematically track this material would require renegotiating the terms of nuclear cooperation agreements.

DOE has recently issued proposed guidance clarifying the role of DOE offices for maintaining and controlling U.S. nuclear material. An October 2010 draft DOE order states that DOE “Manages the development and maintenance of NMMSS by: (a) collecting data relative to nuclear materials including those for which the United States has a safeguards interest both domestically and abroad; (b) processing the data; and (c) issuing reports to support the safeguards and management needs of DOE and NRC, and other government organizations, including those associated with international treaties and organizations.”²¹ However, we did not find any evidence that DOE will be able to meet those

²⁰See GAO, *Obstacles To U.S. Ability to Control And Track Weapons-Grade Uranium Supplied Abroad*, [GAO/ID-82-91](#) (Washington, D.C. Aug. 2, 1982).

²¹DOE Draft Order O 470.6 Nuclear Material Control and Accountability, issued Oct. 6, 2010.

responsibilities in the current configuration of NMMSS without obtaining additional information from partners and additional and systematic data sharing among DOE offices.

DOE, NRC, and State Do Not Have Access Rights to Monitor and Evaluate That U.S. Nuclear Material Located at Foreign Facilities Is Adequately Protected

Nuclear cooperation agreements do not contain specific access rights that enable DOE, NRC, or State to monitor and evaluate the physical security of U.S. nuclear material overseas, and the United States relies on partners to maintain adequate security. In the absence of specific access rights, DOE, NRC, and State have jointly conducted interagency physical protection visits to monitor and evaluate the physical security of nuclear material when given permission by the partner country. However, the interagency physical protection teams have neither systematically visited countries believed to be holding Category I quantities of U.S. nuclear material, nor have they systematically revisited facilities determined to not be meeting IAEA security guidelines in a timely manner.

U.S. Agencies' Ability to Evaluate the Security of U.S. Nuclear Material Overseas Is Limited by Lack of Access Rights, and the United States Relies on Partners to Maintain Adequate Security

DOE's, NRC's, and State's ability to monitor and evaluate whether material subject to U.S. nuclear cooperation agreement terms is physically secure is contingent on partners granting access to facilities where such material is stored. Countries, including the United States, believe that the physical protection of nuclear materials is a national responsibility. This principle is reflected both in IAEA's guidelines on the "Physical Protection of Nuclear Material and Nuclear Facilities" and in pending amendments to the Convention on the Physical Protection of Nuclear Material. Our review of section 123 of the AEA and all U.S. nuclear cooperation agreements currently in force found that they do not explicitly include a provision granting the United States access to verify the physical protection of facilities or sites holding material subject to U.S. nuclear cooperation agreement terms. However, in accordance with the AEA, as amended, all nuclear cooperation agreements, excepting three negotiated prior to 1978, contain provisions requiring both partners to maintain adequate physical security over transferred material.

The AEA, as amended, requires that the cooperating party must guarantee that it will maintain adequate physical security for transferred nuclear material and any special nuclear material used in or produced through the use of any material, or production, or utilization facility transferred pursuant to the agreement. However, it does not specify that State, in cooperation with other U.S. agencies, negotiates agreement terms that must include rights of access or other measures for the United

States to verify whether a partner is maintaining adequate physical security over U.S. material. Our review of the texts of all 27 U.S. nuclear cooperation agreements in force found that most of them contain a provision providing that the adequacy of physical protection measures shall be subject to review and consultations by the parties. However, none of the agreements include specific provisions stipulating that the United States has the right to verify whether a partner is adequately securing U.S. nuclear material.²² As a result, several DOE and State officials told us the United States' ability to monitor and evaluate the physical security of U.S. nuclear material overseas is contingent on partners' cooperation and access to facilities where U.S. material is stored.

State, DOE, and NRC officials told us that they rely on partners to comply with IAEA's security guidelines for physical protection. However, the guidelines, which are voluntary, do not provide for access rights for other states to verify whether physical protection measures for nuclear material are adequate. IAEA's security guideline document states that the "responsibility for establishing and operating a comprehensive physical protection system for nuclear materials and facilities within a State rests entirely with the Government of that State." In addition, according to the guidelines, member states should ensure that their national laws provide for the proper implementation of physical protection and verify continued compliance with physical protection regulations. For example, according to IAEA's security guidelines, a comprehensive physical protection system to secure nuclear material should include, among other things,

- technical measures such as vaults, perimeter barriers, intrusion sensors, and alarms;

²²An arrangements and procedures document negotiated pursuant to the 2008 U.S.-India nuclear cooperation agreement contains a provision providing for consultation visits at two reprocessing facilities established to reprocess material including U.S.-obligated material. In addition, the 1988 U.S.-Japan nuclear cooperation agreement provides for what is known as "advance consent rights" by the United States to Japan to reprocess its U.S.-obligated spent nuclear fuel. Specifically, a provision in the nuclear cooperation agreement allows for either party to "have access to all places and data, and any equipment or facility...necessary to account for the nuclear material...and to make such independent measurements as may be deemed necessary by the safeguarded party to account for such nuclear material" if either party becomes aware that the IAEA is not applying safeguards as required by the agreement.

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- material control procedures; and
 - adequately equipped and appropriately trained guard and emergency response forces.

In addition, according to DOE and State officials, key international treaties, including the Convention on the Physical Protection of Nuclear Material—which calls for signatory states to provide adequate physical protection of nuclear material while in international transit—do not provide states the right to verify the adequacy of physical protection measures. A senior official from IAEA’s Office of Nuclear Security told us that physical security is a national responsibility and that governments may choose to organize their various physical security components differently, as long as the components add up to an effective regime.

Despite these constraints on access, the U.S. government can take certain actions to protect U.S. nuclear material located at foreign facilities. For example, NRC licensing for the export of nuclear equipment and material is conditioned on partner maintenance of adequate physical security. NRC officials stated that, when an export license application for nuclear materials or equipment is submitted, the U.S. government seeks confirmation, in the form of peaceful use assurances, from the foreign government that the material and equipment, if exported, will be subject to the terms and conditions of that government’s nuclear cooperation agreement with the United States. In addition, NRC officials stated that this government-to-government reconfirmation of the terms and conditions of the agreement meets the “letter and spirit” of the AEA and Nuclear Non-Proliferation Act of 1978 (NNPA) and underscores that the partner is aware of and accepts the terms and conditions of the agreement.

NRC officials also noted that the NNPA amendments to the AEA were designed and intended to encourage foreign governments to agree to U.S. nonproliferation criteria in exchange for nuclear commodities. However, the AEA does not empower the U.S. government through inspections or other means to enforce foreign government compliance with nuclear cooperation agreements once U.S. nuclear commodities are in a foreign country. Importantly, according to NRC, the onus is on the receiving country as a sovereign right and responsibility and consistent with its national laws and international commitments, to adequately secure the nuclear material.

According to DOE and State, as well as foreign government officials, the United States and the partner share a strong common interest in deterring and preventing the misuse of nuclear material, as well as an interest in maintaining the rights afforded to sovereign countries. The partner's interest in applying adequate security measures, for instance, is particularly strong because the nuclear material is located within its territory. Moreover, specific physical security needs may often depend on unique circumstances and sensitive intelligence information known only to the partner.

In addition, the AEA requires that U.S. nuclear cooperation agreements with non-nuclear weapon states contain a stipulation that the United States shall have the right to require the return of certain nuclear material, as well as equipment, should the partner detonate a nuclear device or terminate or abrogate its safeguards agreements with IAEA. However, DOE, NRC, and State officials told us that the U.S. government has never exercised the "right to require return" provisions in its nuclear cooperation agreements. In addition, the United States typically includes "fall-back safeguards"—contingency plans for the application of alternative safeguards should IAEA safeguards become inapplicable for any other reason. DOE and State officials told us, however, that the United States has not exercised its fall-back safeguards provisions, because the United States has not identified a situation where IAEA was unable to perform its safeguards duties.

U.S. Agencies Have Visited Foreign Sites to Monitor and Evaluate the Physical Security of U.S. Nuclear Material

U.S. agencies have, over time, made arrangements with partners to visit certain facilities where U.S. nuclear material is stored. As we reported in August 1982 and in December 1994,²³ U.S. interagency physical protection teams visit partner country facilities to monitor and evaluate whether the physical protection provided to U.S. nuclear material meets IAEA physical security guidelines. In 1974, DOE's predecessor, the Energy Research and Development Administration, began leading teams composed of State, NRC, and DOE national laboratory officials to review the partner's legal and regulatory basis for physical protection and to ensure that U.S. nuclear material was adequately protected. In 1988, the Department of Defense's Defense Threat Reduction Agency began to participate in these visits, and officials from other agencies and offices, such as GTRI, have participated. The visits have generally focused on research reactors containing HEU but have also included assessments, when partners voluntarily grant access, of other facilities' physical security, including nuclear power plants, reprocessing facilities, and research and development facilities containing U.S. nuclear material.

According to DOE documents and DOE, NRC, and State officials, the primary factors for selecting countries for visits are the type, quantity, and form of nuclear material, with priority given to countries with U.S. HEU or plutonium in Category I amounts. In addition, in 1987, NRC recommended that countries possessing U.S. Category I nuclear material be revisited at least every 5 years. DOE and NRC officials told us this has become an official goal for prioritizing visits. According to DOE, interagency physical protection visits are also made whenever the country has had or expects to have a significant change in its U.S. nuclear material inventory, along with other factors, such as previous findings that physical protection was not adequate. These criteria and other factors are used to help U.S. agencies prioritize visits on a countrywide basis and also supplement other information that is known about a partner's

²³We reported in August 1982 and December 1994 that the United States evaluates foreign countries physical protection systems under what was then known as the U.S. Bilateral Physical Protection Program. For a list of countries visited, number of facilities visited, and date of visits from 1974 through 1981, see [GAO/ID-82-81](#). In 1994, we reported that the United States had conducted bilateral physical security consultations with approximately 46 nations, including site visits to review the physical protection at fixed sites and during transport. For a list of the countries visited by U.S. physical protection teams from 1974 through 1994, including country, number of visits, and date of last visit, see appendix II of that report, GAO, *Nuclear Nonproliferation: U.S. International Nuclear Materials Tracking Capabilities Are Limited*, [GAO/RCED/AIMD-95-5](#) (Washington, D.C.: Dec. 27, 1994).

physical protection system and the current threat environment. Moreover, while the U.S. physical protection program assesses physical security conditions on a site-specific basis, NRC's regulations permit the determination of adequacy of foreign physical protection systems on a countrywide basis.²⁴ Therefore, DOE, NRC, and State officials told us that the results of the interagency physical protection visits, combined with other sources of information such as country threat assessments, are used as a measure of the physical security system countrywide.

The U.S. teams visit certain facilities where U.S. nuclear material is used or stored to observe physical protection measures after discussing the relevant nuclear security regulatory framework with the partner government. DOE and State officials told us these physical protection visits help U.S. officials develop relationships with partner officials, share best practices and, in some cases, recommend physical security improvements.

We visited four facilities that hold U.S.-obligated nuclear material. The partner officials and facility operators we met shared their observations regarding the U.S. physical protection visits. Representatives from one site characterized a recent interagency physical protection visit as a "tour." These officials told us the U.S. government officials had shared some high-level observations regarding their visit with government officials and nuclear reactor site operators but did not provide the government or site operators with written observations or recommendations. On the other hand, government officials from another country we visited told us that a recent interagency physical protection visit had resulted in a useful and detailed exchange of information about physical security procedures. These government officials told us they had learned "quite a lot" from the interagency physical protection visit and that they hoped the dialogue would continue, since security could always be improved. In February 2011, DOE officials told us they had begun to distribute the briefing slides they use at the conclusion of a physical protection visit to foreign officials. State officials told us that the briefings are considered government-to-government activities, and it is the partner

²⁴NRC's regulations pertaining to the review of license applications for exports of nuclear equipment, material including exports of material subject to nuclear cooperation agreements, permit the determination of adequacy of foreign protection systems on a countrywide basis. See 10 C.F.R. §110.44 (2011).

government's choice on whether to include facility operators in the briefings.

In addition, we reviewed U.S. agencies' records of these and other physical protection visits and found that, over the 17-year period from 1994 through 2010, U.S. interagency physical protection teams made 55 visits. Of the 55 visits, interagency physical protection teams found the sites met IAEA security guidelines on 27 visits, did not meet IAEA security guidelines on 21 visits, and the results of 7 visits are unknown because the physical protection team was unable to assess the sites, or agency documentation was missing.

According to DOE, State, and NRC officials, the visits are used to encourage security improvements by the partner. For example, based on the circumstances of one particular facility visited in the last 5 years, the physical protection team made several recommendations to improve security, including installing (1) fences around the site's perimeter, (2) sensors between fences, (3) video assessment systems for those sensors, and (4) vehicle barriers. According to DOE officials, these observations were taken seriously by the country, which subsequently made the improvements.

When we visited the site as part of our review, government officials from that country told us the U.S. interagency team had provided useful advice and, as a result, the government had approved a new physical protection plan. These government officials characterized their interactions with DOE and other U.S. agency officials as positive and told us that the government's new physical protection plan had been partly implemented. Moreover, although we were not granted access to the building, we observed several physical protection upgrades already implemented or in progress, including: (1) the stationing of an armed guard outside the facility holding U.S. Category I material; (2) ongoing construction of a 12-foot perimeter fence around the facility; and (3) construction of a fence equipped with barbed wire and motion detectors around the entire research complex. We were also told that, among other things, remote monitoring equipment had been installed in key areas in response to the interagency visit. The Central Alarm Station was hardened, and the entrance to the complex was controlled by turnstiles and a specially issued badge, which entrants received after supplying a passport or other government-issued identification. Private automobiles were not allowed in the facility.

Not all U.S. physical protection visits proceed smoothly. In some cases, U.S. agencies have attempted repeatedly to convince partner officials of the seriousness of meeting IAEA security guidelines and to fund improvements. For example, a U.S. interagency physical protection team in the early 2000s found numerous security problems at a certain country's research reactor. The site supervisor objected to the interagency team's assessment because physical security was a matter of national sovereignty, and IAEA security guidelines were subject to interpretation. The site supervisor also objected to some of the U.S. team's recommendations. In some instances, under U.S. pressure, countries have agreed to make necessary improvements with DOE technical and material assistance.

Our review of agency records indicates that, in recent years, as the number of countries relying on U.S. HEU to fuel research reactors has continued to decline, U.S. agencies have succeeded in using a partner's pending export license for U.S. HEU or expected change in inventory of U.S. special nuclear material as leverage for a U.S. interagency physical protection visit. For example, we identified two cases since 2000 where a partner country applied for a license to transfer U.S. HEU, and a U.S. interagency team subsequently visited those two sites. In addition, we identified a recent situation where a partner country's inventory of U.S. plutonium at a certain site was expected to significantly increase, and a U.S. interagency team visited the site to determine whether the site could adequately protect these additional inventories.

According to DOE officials, requests for U.S. low enriched uranium (LEU) export licenses have increased in recent years.²⁵ In response, DOE officials told us that U.S. agencies have begun to prioritize visits to countries making such requests, and our review of agency documentation corroborates this. For example, physical protection visit records we reviewed state that recent interagency physical protection visits were made to two sites to evaluate the facilities' physical security in advance of pending U.S. LEU license applications. In addition, a DOE contractor and State official told us that a U.S. team planned to visit another partner country site in late 2011 in order to verify the adequacy of physical protection for U.S.-obligated LEU.

²⁵LEU is uranium that contains less than 20 percent of the isotope uranium-235.

U.S. Agencies Do Not Have a Formal Process for Coordinating and Prioritizing U.S. Physical Protection Visits

DOE, NRC, and State do not have a formal process for coordinating and prioritizing U.S. interagency physical protection visits. In particular, DOE, which has the technical lead and is the agency lead on most visits has neither (1) worked with NRC and State to establish a plan and prioritize interagency physical protection visits, nor (2) measured performance in a systematic way. Specifically:

- *Establishing a plan and prioritizing and coordinating efforts.* A U.S. agency formal plan for which countries or facilities to visit has not been established, nor have goals for the monitoring and evaluation activities been formalized. In October 2009, DOE reported to us that it had formulated a list of countries that contained U.S. nuclear material and were priorities for U.S. teams to visit. However, in a subsequent written communication to us, a senior DOE official stated that DOE had not yet discussed this list with State, NRC, or other agency officials.²⁶ As a result, the list of countries had not been properly vetted at that time and did not represent an interagency agreed-upon list. In February 2011, DOE officials told us that U.S. agencies will be considering a revised methodology for prioritizing physical protection visits. NRC officials told us they thought the interagency coordination and prioritization of the visit process could be improved. A State official, who regularly participates in the U.S. physical protection visits, told us that interagency coordination had improved in the past 6 months, in response to a recognized need by U.S. agencies to be prepared for an expected increase in requests for exports of U.S. LEU.
- *Measuring performance.* The agencies have not developed performance metrics to gauge progress in achieving stated goals related to physical protection visits. Specifically, DOE, NRC, and State have not performed an analysis to determine whether the stated interagency goal of visiting countries containing U.S. Category I nuclear material within 5 years has been met. In addition, although DOE has stated U.S. physical protection teams revisit sites whenever there is an indication that security does not meet IAEA security guidelines, DOE has not quantified its efforts in a meaningful way. In response to our questions about metrics, DOE officials stated that

²⁶Our analysis shows three countries were visited between October 2009 and April 2010, one more in early 2011, and DOE and State officials reported they expect to visit one other in late 2011.

there is no U.S. law regarding the frequency of visits or revisits and that the agency's internal goals are not requirements. These officials told us that DOE, NRC, and State recognize that the "number one goal" is to ensure the physical security of U.S. nuclear material abroad. DOE officials stated that the best measure of the U.S. physical protection visits' effectiveness is that there has not been a theft of U.S. nuclear material from a foreign facility since the 1970s, when two LEU fuel rods were stolen from a certain country. However, officials reported to us that, in 1990, the facility was determined to be well below IAEA security guidelines. Our review of DOE documentation shows that other U.S. LEU transferred to the facility remains at the site.

In July 2011, in conjunction with the classification review for this report, DOE officials stated that while DOE, NRC, and State work together on coordinating U.S. government positions regarding priorities and procedures for the interagency physical protection program, no updated document exists that formalizes the process for planning, coordinating, and prioritizing U.S. interagency physical protection visits. We note that the documents that DOE refers to are internal DOE documents presented to us in 2008 and 2009 in response to questions regarding nuclear cooperation agreements. These documents are not an interagency agreed-upon document, but reflect DOE's views on determining which countries and facilities interagency physical protection teams should visit. Further, DOE officials in July 2011 stated that DOE, NRC, and State do not have an agreed-upon way to measure performance in a systematic way, and that while the goals for the monitoring and evaluation activities have not yet been formalized through necessary updated documents, a prioritized list of countries to visit does exist. These officials noted that the U.S. government is working to update its planning documents and is examining its methodology for prioritizing physical protection visits. Any changes will be included in these updated documents.

DOE and U.S. agencies' activities for prioritizing and coordinating U.S. interagency physical protection visits and measuring performance do not meet our best practices for agency performance or DOE's standards for internal control. We have reported that defining the mission and desired outcomes, measuring performance, and using performance information to identify performance gaps are critical if agencies are to be accountable

for achieving intended results.²⁷ In addition, DOE's own standards for internal control call for "processes for planning, organizing, directing, and controlling operations designed to reasonably assure that programs achieve intended results... and decisions are based on reliable data."²⁸ However, DOE, NRC, and State have neither established a plan nor measured performance to determine whether they are meeting internal goals and whether U.S. agencies' activities are systematic.

DOE and U.S. Agencies Do Not Systematically Visit Countries with Category I U.S. Nuclear Material or Revisit Foreign Facilities Not Meeting Security Guidelines

U.S. agencies have not systematically evaluated the security of foreign facilities holding U.S. nuclear material in two key ways. First, U.S. interagency physical protection teams have not systematically visited countries holding Category I quantities of U.S. nuclear material. Second, interagency teams have not revisited sites that did not meet IAEA security guidelines in a timely manner.

U.S. Physical Protection Teams Have Not Systematically Visited Countries Holding Category I Quantities of Nuclear Material

U.S. interagency physical protection teams have not systematically visited countries believed to be holding Category I quantities of U.S. special nuclear material at least once every 5 years—a key programmatic goal. In a December 2008 document, DOE officials noted that, in 1987, NRC recommended that countries possessing Category I nuclear material be revisited at least once every 5 years. This recommendation was adopted as a goal for determining the frequency of follow-on visits. In addition, DOE, NRC, and State officials told us that they aim to conduct physical protection visits at each country holding Category I quantities of U.S. nuclear material at least once every 5 years. We evaluated U.S. agencies' performance at meeting this goal by reviewing records of U.S.

²⁷GAO, *Executive Guide: Effectively Implementing the Government Performance and Results Act*, GAO/GGD-96-118 (Washington, D.C.: June 1996).

²⁸DOE Order O 413.1B.

physical protection visits and other information.²⁹ We found that the United States had met this goal with respect to two countries by conducting physical protection visits at least once every 5 years since 1987 while they held Category I quantities of U.S. nuclear material. However, we estimated that 21 countries held Category I amounts of U.S. nuclear material during the period from 1987 through 2010 but were not visited once every 5 years while they held such quantities of U.S. nuclear material.

In addition, U.S. interagency physical protection teams have not visited all partner facilities believed to contain Category I quantities of U.S. special nuclear material to determine whether the security measures in place meet IAEA security guidelines. Specifically, we reviewed physical protection visit records and NMMSS data and identified 12 facilities that NMMSS records indicate received Category I quantities of U.S. HEU that interagency physical protection teams have never visited.

We identified four additional facilities that GTRI officials told us currently hold, and will continue to hold, Category I quantities of U.S. special nuclear material for which there is no acceptable disposition path in the United States. In addition, these facilities have not been visited by a U.S. interagency physical protection team, according to our review of available documentation.³⁰

Moreover, U.S. interagency physical protection teams have not systematically visited partner storage facilities for U.S. nuclear material. The AEA, as amended, requires that U.S. nuclear cooperation agreements contain a stipulation giving the United States approval rights

²⁹Because DOE and NRC did not have a comprehensive inventory of U.S. material located overseas or any comprehensive analyses of the U.S. interagency physical protection visits' results—as described elsewhere in this report—we obtained and analyzed NMMSS records of U.S. nuclear material exports and retransfers, GTRI records of fuel returns and, where available, information from U.S. physical protection visits records indicating the volumes and disposition of U.S. nuclear material overseas at the time of the U.S. interagency visit. We developed an estimate of which partner countries held Category I quantities of U.S. nuclear material during the review period, and for how long. We used the IAEA security document INFCIRC/225/Rev.4 to categorize material. We shared the results of this analysis with DOE and NRC officials and made adjustments based on agency officials' comments on where they believe nuclear material subject to U.S. nuclear cooperation agreement terms resides.

³⁰GTRI reported to us that these sites are not a physical security priority as, compared with other facilities around the world, their physical protection is adequate.

U.S. Teams Have Not Revisited Facilities That Did Not Meet IAEA Security Guidelines in a Timely Manner

over any storage facility containing U.S. unirradiated or “separated” plutonium or HEU. DOE and NRC officials told us there is no list of such storage facilities besides those listed in a U.S. nuclear cooperation agreement with a certain partner. They stated—and our review of available documents corroborated—that a number of the U.S. physical protection visits have included assessments of overseas storage sites for U.S. nuclear material, since such sites are often collocated with research reactors. However, our review also found two instances where partner storage areas containing U.S. HEU or separated plutonium did not meet IAEA guidelines or were identified as potentially vulnerable.

DOE and U.S. agencies do not have a systematic process to revisit or monitor security improvements at facilities that do not meet IAEA security guidelines. Based on our analysis of available documentation, we found that, since 1994, U.S. interagency physical protection teams determined that partner country sites did not meet IAEA security guidelines on 21 visits. We then examined how long it took for a U.S. team to revisit the sites that did not meet IAEA security guidelines and found that, in 13 of 21 cases, U.S. interagency teams took 5 years or longer to revisit the facilities.³¹

According to DOE, NRC, and State officials, the interagency physical protection visits are not the only way to determine whether partner facilities are meeting IAEA security guidelines. For example, the United States is able to rely on information provided by other visits and U.S. embassy staff to monitor physical security practices. These visits include DOE-only trips and trips by DOE national laboratory staff and NRC physical protection experts who worked with the host country to improve physical security at the sites. NRC officials also stated that, in some cases, the partner’s corrective actions at the site are verified by U.S. officials stationed in the country, and a repeat physical protection visit is not always required.

³¹In three cases, GTRI, or its predecessor organization, returned the material determined to be vulnerable within 5 years from the date of assessment by the U.S. interagency physical protection team. In two cases, a U.S. physical protection team made a revisit in less than 5 years. In the most recent two cases, 5 years have not elapsed to make a determination on whether the team visited within 5 years or not. We chose 5 years to evaluate because U.S. agencies have a goal of visiting countries with Category I nuclear material at least once every 5 years.

IAEA officials told us that U.S. technical experts often participate in voluntary IAEA physical security assessments at IAEA member states' facilities. Specifically, IAEA created the International Physical Protection Advisory Service (IPPAS) to assist IAEA member states in strengthening their national security regime. At the request of a member state, IAEA assembles a team of international experts who assess the member state's system of physical protection in accordance with IAEA security guidelines. As of December 2010, 49 IPPAS missions spanning about 30 countries had been completed.

DOE Seeks to Increase Security or Remove Vulnerable U.S. Nuclear Material at Partner Facilities but Faces Challenges

DOE has taken steps to improve security at a number of facilities overseas that hold U.S. nuclear material. DOE's GTRI program removes nuclear material from vulnerable facilities overseas and has achieved a number of successes. However, DOE faces a number of constraints. Specifically, GTRI can only bring certain types of nuclear material back to the United States that have an approved disposition pathway and meet the program's eligibility criteria. In addition, obtaining access to the partner facilities to make physical security improvements may be difficult. There are a few countries that are special cases where the likelihood of returning the U.S. nuclear material to the United States is considered doubtful.

DOE's Office of Nonproliferation and International Security and GTRI officials told us that when a foreign facility with U.S.-obligated nuclear material does not meet IAEA security guidelines, the U.S. government's first response is to work with the partner country to encourage physical security improvements. In addition, the GTRI program was established in 2004 to identify, secure, and remove vulnerable nuclear material at civilian sites around the world and to provide physical protection upgrades at nuclear facilities that are (1) outside the former Soviet Union, (2) in non-weapon states, and (3) not in high-income countries. According to GTRI officials, the U.S. government's strategy for working with partner countries to improve physical security includes: (1) encouraging high-income countries to fund their own physical protection upgrades with recommendations by the U.S. government and (2) working with other-than-high-income countries to provide technical expertise and funding to implement physical protection upgrades. If the material is excess to the country's needs and can be returned to the United States under an approved disposition pathway, GTRI will work with the country to repatriate the material.

According to GTRI officials, GTRI was originally authorized to remove to the United States, under its U.S. fuel return program, only U.S.-obligated fresh and spent HEU in Material Test Reactor fuel, and Training Research Isotope General Atomics (TRIGA) fuel rod form. According to GTRI officials, GTRI has also obtained the authorization to return additional forms of U.S. fresh and spent HEU, as well as U.S. plutonium from foreign countries, so long as there is no alternative disposition path. The material must (1) pose a threat to national security, (2) be usable for an improvised nuclear device, (3) present a high-risk of terrorist theft, and (4) meet U.S. acceptance criteria.

To date, GTRI has removed more than 1,240 kilograms of U.S. HEU from Australia, Argentina, Austria, Belgium, Brazil, Canada, Chile, Colombia, Denmark, Germany, Greece, Japan, the Netherlands, Philippines, Portugal, Romania, Slovenia, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, and Turkey.³² It has also performed security upgrades at reactors containing U.S. nuclear material that were not meeting IAEA security guidelines in 10 partner countries. As we reported in September 2009,³³ GTRI has improved the security of research reactors, and GTRI officials told us in April 2011 that they plan to continue to engage other countries to upgrade security.

In a separate report published in December 2010, we noted that GTRI has assisted in the conversion from the use of HEU to LEU or verified the shutdown of 72 HEU research reactors around the world,³⁴ 52 of which previously used U.S. HEU. GTRI prioritizes its schedule for upgrading the security of research reactors and removing nuclear material based on the amount and type of nuclear material at the reactor and other threat factors, such as the vulnerability of facilities, country-level threat, and proximity to strategic assets. Our review identified several situations where GTRI or its predecessor program removed vulnerable U.S. nuclear material.

³²GTRI has removed all U.S.-obligated HEU from Brazil, Chile, Colombia, Denmark, Greece, Philippines, Portugal, Romania, Slovenia, South Korea, Spain, Sweden, Taiwan, Thailand, and Turkey.

³³GAO, *Nuclear Nonproliferation: National Security Administration Has Improved the Security of Reactors in its Global Research Reactor Program, but Action is Needed to Address Remaining Concerns*, [GAO-09-949](#) (Washington, D.C.: Sept. 17, 2009).

³⁴See [GAO-11-227](#).

Notwithstanding these successes, the GTRI program has some limitations. GTRI cannot remove all potentially vulnerable nuclear material worldwide because the program's scope is limited to only certain types of material that meet the eligibility criteria. GTRI officials told us that, of the approximately 17,500 kilograms of HEU it estimates was exported from the United States, the majority—12,400 kilograms—is currently not eligible for return to the United States. According to GTRI officials, over 10,000 kilograms is contained in fuels from "special purpose" reactors that are not included in GTRI's nuclear material return program because they were not traditional aluminum-based fuels, TRIGA fuels, or target material. As a result, this material does not have an acceptable disposition pathway in the United States, according to GTRI officials. GTRI officials stated that these reactors are in Germany, France, and Japan, and that the material has been deemed to be adequately protected. GTRI reported that the other approximately 2,000 kilograms of transferred U.S. nuclear material is located primarily in EURATOM member countries and is either currently in use or adequately protected.

In addition, the potential vulnerability of nuclear material at certain high-income facilities was raised to us by officials at the National Security Council (NSC)—the President's principal forum for considering national security and foreign policy matters—and included in a prior report. Specifically, we reported that, there may be security vulnerabilities in certain high-income countries, including three specific high-income countries named by the NSC officials. For sites in these countries, GTRI officials told us the U.S. government's strategy is to work bilaterally with the countries and to provide recommendations to improve physical protection, and follow up as needed.

Our analysis of available agency physical protection visit documents also raises concerns regarding the physical security conditions in these countries, including facilities that did not meet IAEA security guidelines and interagency physical protection teams' lack of access issues.

DOE also works with countries to remove material if it is in excess of the country's needs and meets DOE acceptance criteria. The ability of DOE to return U.S. nuclear material depends, however, on the willingness of the foreign country to cooperate. As we reported in September 2009,³⁵

³⁵See [GAO-09-949](#).

because GTRI's program for physical security upgrades and nuclear material returns is voluntary, DOE faces some challenges in obtaining consistent and timely cooperation from other countries to address security weaknesses. Our report further noted that DOE has experienced situations where a foreign government has refused its assistance to make security upgrades. For example, we reported that one country had refused offers of DOE physical security upgrades at a research reactor for 9 years. However, this situation was subsequently resolved when all HEU was removed from this country, according to GTRI officials. In addition, we reported that DOE had experienced two other situations where the partner country would not accept security assistance until agreements with the United States were reached on other issues related to nuclear energy and security.

There are several countries that have U.S. nuclear material that are particularly problematic and represent special cases. Specifically, U.S. nuclear material has remained at sites in three countries where physical protection measures are unknown or have not been visited by an interagency physical protection team in decades. GTRI removed a large quantity of U.S. spent HEU recently from one of these countries.

According to NRC and State officials, U.S. transfers to these three countries were made prior to 1978, when the physical protection requirements were added to the AEA. Therefore, these countries have not made the same commitments regarding physical security of U.S.-transferred material. Finally, we identified another country that poses special challenges. All U.S.-obligated HEU has been removed from this country, which was one of the GTRI program's highest priorities. Previous U.S. interagency physical protection visits found a site in this country did not meet IAEA security guidelines.

Conclusions

The world today is dramatically different than when most U.S. nuclear cooperation agreements were negotiated. Many new threats have emerged, and nuclear proliferation risks have increased significantly. We recognize that the United States and its partners share a strong common interest in deterring and preventing the misuse of U.S. nuclear material—or any nuclear material—and that flexibility in the agreements is necessary to forge strong and cooperative working relationships with our partners. The fundamental question, in our view, is whether nuclear cooperation agreements and their underlying legislative underpinnings need to be reassessed given the weaknesses in inventory management and physical security that we identified.

Specifically, we found these agreements may not be sufficiently robust in two areas—inventories and physical security. Without an accurate inventory of U.S. nuclear materials—in particular, weapon-usable HEU and separated plutonium—the United States does not have sufficient assurances regarding the location of materials. As a result, the United States may not be able to monitor whether the partner country is appropriately notifying the United States and whether the United States is appropriately and fully exercising its rights of approval regarding the transfer, retransfer, enrichment and reprocessing and, in some cases, storage of nuclear materials subject to the agreement terms. NRC and multiple offices within DOE could not provide us with an authoritative list of the amount, location, and disposition of U.S. HEU or separated plutonium overseas. We are particularly concerned that NRC and DOE could not account, in response to a 1992 mandate by Congress, on the location and disposition of U.S. nuclear material overseas—and that they have not developed such an inventory in the almost two decades since that mandate.

We recognize that physical security is a national responsibility. We also recognize that neither the AEA, as amended, nor the U.S. nuclear cooperation agreements in force require that State negotiate new or renewed nuclear cooperation agreement terms that include specific access rights for the United States to verify whether a partner is maintaining adequate physical security of U.S. nuclear material. Without such rights, it may be difficult for the United States to have access to critical facilities overseas—especially those believed to be holding weapon-usable materials—to better ensure that U.S. material is in fact adequately protected while the material remains in the partner’s custody. We note the agreements are reciprocal, with both parties generally agreeing to all conditions specified in them. We acknowledge that any change to the nuclear cooperation framework or authorizing legislation will be very sensitive. Careful consideration should be given to the impact of any reciprocity clauses on U.S. national security when negotiating or reviewing these agreements. However, it may be possible to do so in a way that includes greater access to critical facilities where weapon-usable U.S. nuclear material is stored, without infringing on the sovereign rights of our partners or hampering the ability of the U.S. nuclear industry to remain competitive.

In the course of our work, we identified several weaknesses in DOE, NRC, and State’s efforts to develop and manage activities that ensure that U.S. nuclear cooperation agreements are properly implemented. Specifically, the lack of a baseline inventory of U.S. nuclear materials—in

particular, weapon-usable materials—and annual inventory reconciliations with all partners limits the ability of the U.S. government to identify where the material is located. Currently, annual reconciliations with five partners are undertaken. However, the information, with the exception of one country, is aggregated and not provided on a facility-by-facility basis. Without such information on facilities, it may be difficult to track U.S. material for accounting and control purposes. No annual reconciliations currently exist for the United States' other partners that it has transferred material to or trades with. The NMMSS database could be the official central repository of data regarding U.S. inventories of nuclear material overseas if DOE and NRC are able to collect better data.

We are concerned that DOE has not worked with NRC and State to develop a systematic process for monitoring and evaluating the physical security of U.S. nuclear material overseas, including which foreign facilities to visit for future physical protection visits. In particular, U.S. interagency physical protection teams have neither met a key programmatic goal for visiting countries containing Category I quantities of U.S. special nuclear material every 5 years, nor have they visited all partner facilities believed to be holding Category I quantities of U.S. nuclear material, nor revisited facilities that were found to not meet IAEA security guidelines in a timely manner. Moreover, relying on reported thefts of U.S. nuclear material as a gauge of security is not the best measure of program effectiveness when accounting processes for inventory of U.S. material at foreign facilities are limited. Improving the U.S. government's management of nuclear cooperation agreements could contribute to the administration achieving its goal of securing all vulnerable nuclear material worldwide in 4 years.

Matters for Congressional Consideration

- Congress may wish to consider directing DOE and NRC to complete a full accounting of U.S. weapon-usable nuclear materials—in particular, HEU and separated plutonium—with its nuclear cooperation agreement partners and other countries that may possess such U.S. nuclear material.
- In addition, Congress may wish to consider amending the AEA if State, working with other U.S. agencies, does not include enhanced measures regarding physical protection access rights in future agreements and renewed agreements, so that U.S. interagency physical protection teams may obtain access when necessary to verify that U.S. nuclear materials have adequate physical protection. The amendment could provide that the U.S. government may not

enter into nuclear cooperation agreements unless such agreements contain provisions allowing the United States to verify that adequate physical security is exercised over nuclear material subject to the terms of these agreements.

Recommendations for Executive Action

We are making seven recommendations to enable agencies to better account for, and ensure the physical protection of, U.S. nuclear material overseas.

To help federal agencies better understand where U.S. nuclear material is currently located overseas, we recommend that the Secretary of State, working with the Secretary of Energy and the Chairman of the Nuclear Regulatory Commission, take the following four actions to strengthen controls over U.S. nuclear material subject to these agreements:

- determine, for those partners with which the United States has transferred material but does not have annual inventory reconciliation, a baseline inventory of weapon-usable U.S. nuclear material, and establish a process for conducting annual reconciliations of inventories of nuclear material on a facility-by-facility basis;
- establish for those partners with which the United States has an annual inventory reconciliation, reporting on a facility-by-facility basis for weapon-usable material where possible;
- facilitate visits to sites that U.S. physical protection teams have not visited that are believed to be holding U.S. Category I nuclear material; and
- seek to include measures that provide for physical protection access rights in new or renewed nuclear cooperation agreements so that U.S. interagency physical protection teams may in the future obtain access when necessary to verify that U.S. nuclear materials are adequately protected. Careful consideration should be given to the impact of any reciprocity clauses on U.S. national security when negotiating or reviewing these agreements.

In addition, we recommend that the Secretary of Energy, working with the Secretary of State, and the Chairman of the Nuclear Regulatory Commission take the following three actions:

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- develop an official central repository to maintain data regarding U.S. inventories of nuclear material overseas. This repository could be the NMMSS database, or if the U.S. agencies so determine, some other official database;
 - develop formal goals for and a systematic process to determine which foreign facilities to visit for future interagency physical protection visits. The goals and process should be formalized and agreed to by all relevant agencies; and
 - periodically review performance in meeting key programmatic goals for the physical protection program, including determining which countries containing Category I U.S. nuclear material have been visited within the last 5 years, as well as determining whether partner facilities previously found to not meet IAEA security guidelines were revisited in a timely manner.

Agency Comments and Our Evaluation

We provided a draft of this report to the Secretaries of Energy and State, and the Chairman of the NRC for their review and comment. Each agency provided written comments on the draft report, which are presented in appendixes IV, VI, and V, respectively. All three agencies generally disagreed with our conclusions and recommendations. DOE, NRC, and State disagreed with GAO in three general areas of the report. Specifically, all the agencies (1) disagree with our recommendations to establish annual inventory reconciliations with all trading partners and establish a system to comprehensively track and account for U.S. nuclear material overseas, because the agencies believe this is impractical and unwarranted; (2) maintain that IAEA safeguards are sufficient or an important tool to account for U.S. nuclear material overseas; and (3) assert that any requirement in future nuclear cooperation agreements calling for enhanced physical protection access rights is unnecessary and could hamper sensitive relationships.

With regard to the three general areas of disagreement, our response is as follows:

- DOE, NRC, and State assert that it is not necessary to implement GAO's recommendation that agencies undertake an annual inventory reconciliation and report on a facility-by-facility basis for weapon-usable material where possible for all countries that hold U.S.-obligated nuclear material. We stand by this recommendation for numerous reasons. First, as stated in the report, we found—and none of the agencies refuted—that the U.S. government does not have an

inventory of U.S. nuclear material overseas and, in particular, is not able to identify where weapon-usable materials such as HEU and separated plutonium that can be used for a nuclear weapon may reside. In fact, NRC commented that “inventory knowledge is very important for high-consequence materials, e.g., high enriched uranium and separated plutonium.” Because DOE, NRC, and State do not have comprehensive knowledge of where U.S.-obligated material is located at foreign facilities, it is unknown whether the United States is appropriately and fully exercising its rights of approval regarding the transfer, retransfer, enrichment, and reprocessing and, in some cases, storage of nuclear materials subject to the agreements’ terms. In addition, the lack of inventory information hampers U.S. agencies in identifying priorities for interagency physical protection visits. We are particularly concerned that NRC and DOE, in response to a 1992 mandate by Congress, could only account for the location and disposition of about 1,160 kilograms out of an estimated 17,500 kilograms of U.S.-exported HEU. Furthermore, the agencies have not developed such an inventory or performed an additional comprehensive review in the almost two decades since that mandate. We believe it is important that DOE, NRC, and State pursue all means possible to better identify where U.S.-obligated material is located overseas—and for weapon-usable HEU and separated plutonium, seek to do so on a facility-by-facility basis. Annual inventory reconciliations with all partners provide one way to do that. The United States has demonstrated it has the ability to conduct such exchanges, which none of the agencies disputed. Our report notes that the United States conducts annual inventory reconciliations with five partners, including one where facility-level information is annually exchanged. We believe the recent signing of nuclear cooperation agreements with India and Russia, as well as the situation where current partners whose agreements are set to expire in coming years must be renegotiated—including Peru and South Korea—provide a convenient and timely opportunity for DOE, NRC, and State to pursue such enhanced material accountancy measures.

- DOE, NRC, and State commented that IAEA’s comprehensive safeguards program is another tool to maintain the knowledge of locations of nuclear material in a country, including U.S.-obligated material, and that IAEA inspection, surveillance, and reporting processes are effective tools for material tracking and accounting. We agree that IAEA safeguards are an important nuclear nonproliferation mechanism. However, our report found IAEA’s safeguards have a limited ability to identify, track, and account for U.S.-obligated material. Specifically, as our report notes, and as confirmed to us by

senior IAEA officials, IAEA does not track the obligation of the nuclear material under safeguards and, therefore, IAEA may not have the ability to identify whether and what volume of nuclear material at partner country facilities is U.S.-obligated and subject to the terms of U.S. nuclear cooperation agreements. In addition, our report notes that IAEA considers member country nuclear material inventory information confidential and does not share it with its member countries, including the United States. Therefore, IAEA has a limited ability to account for nuclear material subject to the terms of U.S. nuclear cooperation agreements. Importantly, safeguards are not a substitute for physical security and serve a different function. As our report notes, safeguards are primarily a way to detect diversion of nuclear material from peaceful to military purposes but do not ensure that facilities are physically secure to prevent theft or sabotage of such material.

- DOE, NRC, and State disagreed with our recommendation that State, working with DOE and NRC, should seek to negotiate terms that include enhanced measures regarding physical protection access rights in future and renewed agreements. They also raised concerns with our Matter for Congressional Consideration to amend the AEA should State not implement our recommendation. We do not agree with agencies' comments that our recommendation that agencies "seek to include" such measures is impractical. As we note in our report, an enhanced measure for access rights is in place in the recently negotiated U.S.-India arrangements and procedures document. Further, while partner countries pledge at the outset of an agreement that they will physically protect U.S.- obligated material, the results of our work show that they have not always adequately done so. Specifically, our report noted that, of the 55 interagency physical protection visits made from 1994 through 2010, interagency teams found that countries met IAEA security guidelines on only 27 visits; did not meet IAEA security guidelines on 21 visits, and the results of 7 visits are unknown because the U.S. team was unable to assess the sites or agency documentation of the physical protection visits was missing. In addition, we identified 12 facilities that are believed to have or previously had Category I U.S. nuclear material that have not been visited by an interagency physical protection team. We agree with the agencies' comments that the licensing process for U.S. nuclear material offers some assurances that physical security will be maintained and that an exchange of diplomatic notes at the time of a transfer is designed to ensure the partners maintain the material according to the terms of the agreements. However, these measures are implemented at the time of licensing or material

transfer, and insight into the physical security arrangements of the nuclear material over the longer-term, often 30-year duration of these agreements is by no means guaranteed. Ensuring that the United States has the tools it needs to visit facilities in the future—even after an initial transfer of material is made per a conditional export license—is important to supporting U.S. nuclear nonproliferation objectives. We continue to believe that our recommendation and Matter for Congressional Consideration are consistent with the report’s findings and would enhance the security of U.S.-obligated nuclear material in other countries.

In addition, DOE and NRC commented that (1) our report contained errors in fact and judgment, (2) our report’s recommendations could result in foreign partners requiring reciprocal access rights to U.S. facilities that contain nuclear material that they transferred to the United States, which could have national security implications, and (3) our recommendation that agencies establish a process for conducting annual reconciliations of inventories of nuclear material and develop a repository to maintain data regarding U.S. inventories of nuclear material overseas would be costly to implement. Our response to these comments is as follows:

- None of the agencies’ comments caused us to change any factual statement we made in the report. DOE provided a limited number of technical comments, which we incorporated as appropriate. Importantly, some of the facts that agencies did not dispute included: (1) our analysis that found U.S. agencies made only a single attempt to comprehensively account for transferred U.S. HEU almost 20 years ago and, at that time, were only able to verify the amount and location of less than one-tenth of transferred U.S. HEU; and (2) partner countries did not meet IAEA physical security guidelines for protecting U.S. nuclear material in about half of the cases we reviewed from 1994 through 2010. In our view, these security weaknesses place U.S.-obligated nuclear material at risk and raise potential proliferation concerns. These agreements for nuclear cooperation are long-term in scope and are often in force for 30 years or more. As we noted in our report, the world today is dramatically different than the time when most of the agreements were negotiated. New threats have emerged, and nuclear proliferation risks have increased significantly. NRC commented that countries may not want to change the “status quo” as it pertains to nuclear cooperation agreement terms, including those regarding the physical protection of U.S.-obligated nuclear material. In our view, the status quo, or business-as-usual approach should not apply to matters related to the security of U.S.-obligated nuclear material located at partner facilities throughout the world. Moreover,

implementing a more robust security regime is consistent with and complements the administration's goal of securing all vulnerable nuclear material worldwide within a 4-year period.

- DOE and NRC's comment that the United States may be asked to demonstrate reciprocity by nuclear cooperation agreement partners to verify that adequate physical protection is being provided to their nuclear material while in U.S. custody has merit and needs to be taken into consideration when developing or reviewing nuclear cooperation agreements. As a result, we added language to the conclusions and recommendation sections to additionally state that "careful consideration should be given to the impact of any reciprocity clauses on U.S. national security when negotiating or reviewing these agreements."
- In addition, DOE and NRC commented that we are suggesting a costly new effort in recommending that agencies account for and track U.S.-obligated nuclear material overseas. However, we noted in our report that NMMSS officials told us that NMMSS is currently capable of maintaining information regarding inventories of U.S. nuclear material overseas. Moreover, DOE and NRC did not conduct an analysis to support their assertion that such a system would be costly. Although we did not perform a cost-benefit analysis, based on our conversations with NMMSS staff and the lack of a DOE cost-benefit analysis, to the contrary, there is no evidence to suggest that adding additional information to the NMMSS database would necessarily entail significant incremental costs or administrative overhead. We are sensitive to suggesting or recommending new requirements on federal agencies that may impose additional costs. However, it is important to note that the U.S. government has already spent billions of dollars to secure nuclear materials overseas, as well as radiation detection equipment to detect possible smuggled nuclear material at our borders and the border crossings of other countries. The administration intends to spend hundreds of millions more to support the president's 4-year goal to secure all vulnerable nuclear material worldwide. If necessary, an expenditure of some resources to account for U.S. nuclear material overseas is worthy of consideration. We stand by our recommendations that State work with nuclear cooperation agreement partners that the United States has transferred material to, to develop a baseline inventory of U.S. nuclear material overseas, and that DOE work with other federal agencies to develop a central repository to maintain data regarding U.S. inventories of nuclear material overseas.

DOE disagreed with our findings that the U.S. interagency physical protection visit program (1) lacked formal goals, and that (2) U.S. agencies have not established a formal process for coordinating and prioritizing interagency physical protection visits, in addition to the three areas of general disagreement. During the course of our work, we found no evidence of an interagency agreed-upon list of program goals. In its comments, DOE stated that the formal goal of the program is to determine whether U.S.-obligated nuclear material at the partner country facility is being protected according to the intent of IAEA security guidelines. This is the first time the goal has been articulated to us as such. Moreover, we disagree with DOE's second assertion that it has established a formal process for coordinating and prioritizing visits. Our report notes that we found DOE has not (1) worked with NRC and State to establish a plan and prioritize U.S. physical protection visits or (2) measured performance in a systematic way. In particular, our report notes that, in October 2009, a DOE Office of Nonproliferation and International Security official reported to us that it had formulated a list of 10 countries that contained U.S. nuclear material and were priorities for physical protection teams to visit. However, a senior-level DOE nonproliferation official told us that DOE had not discussed this list with State or NRC, or other agency officials, and it could not be considered an interagency agreed-upon list. In addition, NRC Office of International Program officials told us they thought interagency coordination could be improved, and a State Bureau of International Security and Nonproliferation official told us that agency coordination has improved in the past 6 months. Moreover, as we further state in the report, in February 2011, DOE officials told us that the department is conducting a study of its methodology for prioritizing physical protection visits.

In addition, in July 2011, in conjunction with the classification review for this report, DOE officials stated that while DOE, NRC, and State work together on coordinating U.S. government positions regarding priorities and procedures for the interagency physical protection program, no updated document exists that formalizes the process for planning, coordinating, and prioritizing U.S. interagency physical protection visits. We note that the documents that DOE refers to are internal DOE documents presented to GAO in 2008 and 2009 in response to questions regarding nuclear cooperation agreements. These documents are not an interagency agreed upon document, but reflects DOE's views on determining which countries and facilities interagency physical protection teams should visit. Further, DOE officials in July 2011 stated that DOE, NRC, and State do not have an agreed-upon way to measure performance in a systematic way, and that while the goals for the

monitoring and evaluation activities have not yet been formalized through necessary updated documents, a prioritized list of countries to visit does exist. These officials noted that the U.S. government is working to update its planning documents and examining its methodology for prioritizing physical protection visits. Any changes will be included in these updated documents. Therefore, we continue to believe that DOE should work with the other agencies to develop formal goals for and a systematic process for determining which foreign facilities to visit for future physical protection visits, and that the process should be formalized and agreed to by all agencies.

NRC commented that in order to demonstrate that U.S. nuclear material located abroad is potentially insecure, GAO made an assessment based on U.S. agencies not conducting activities which are, according to NRC, neither authorized nor required by U.S. law or by agreements negotiated under Section 123 of the AEA. In fact, we acknowledge that U.S. agencies are not required to conduct certain activities or collect certain information. Moreover, we do not suggest that agencies undertake activities that are not authorized by law. We recommend that the agencies either expand upon and refine outreach they are already conducting, contingent on the willingness of our cooperation agreement partners, or negotiate new terms in nuclear cooperation agreements as necessary. If the agencies find that they are unable to negotiate new terms we recommend that Congress consider amending the AEA to require such terms.

State commented that determining annual inventories and reconciliations of nuclear material, as well as establishing enhanced facility-by-facility reporting for those partners with which the United States already has an annual inventory reconciliation is a DOE function, not a State function. We agree that DOE plays a vital role in carrying out these activities—once such bilaterally agreed upon measures are in place. However, we believe it is appropriate to recommend that the Department of State—as the agency with the lead role in any negotiation regarding the terms and conditions of U.S. nuclear cooperation agreements—work with DOE and NRC to secure these measures with all U.S. partners. State also commented that there is a cost to the U.S. nuclear industry in terms of lost competitiveness should the requirements in U.S. nuclear cooperation agreements be strengthened to include better access to critical facilities for U.S. interagency physical protection teams. State provided no further information to support this point. Our report acknowledges that any change to the nuclear cooperation framework or authorizing legislation will be very sensitive and that flexibility in the agreements is necessary.

We also stated that it may be possible to change the framework of agreements in a way that does not hamper the ability of the U.S. nuclear industry to remain competitive. While we would not want to alter these agreements in such a way that our nuclear industry is put at a competitive disadvantage, in our view, the security of U.S. nuclear material overseas should never be compromised to achieve a commercial goal.

Finally, State asserted that interagency physical protection teams have been granted access to every site they have requested under the consultation terms of U.S. nuclear cooperation agreements. As a result, State believes the provisions of the current agreements are adequate. As we note in our report, access to partner facilities is not explicitly spelled out in the agreements and, in our view, this is a limitation for the U.S. agencies in obtaining timely and systematic access to partner nuclear facilities. While State may be technically correct that access has been granted, our report clearly shows that many sites believed to contain Category I quantities of U.S. nuclear material have been visited only after lengthy periods of time, or have not been visited at all. We continue to believe that enhanced physical protection access measures could help interagency teams ensure that they are able to visit sites containing U.S. nuclear material in a timely, systematic, and comprehensive fashion.

We are sending copies of this report to the appropriate congressional committees, the Secretaries of Energy and State, the Chairman of the Nuclear Regulatory Commission, and other interested parties. In addition, this report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

If you or your staff members have any questions about this report, please contact me at (202) 512-3841 or aloise@gao.gov. 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 key contributions to this report are listed in appendix VII.

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

Appendix I: Objectives, Scope, and Methodology

We addressed the following questions during our review: (1) assess U.S. agency efforts to account for U.S. nuclear material overseas, (2) assess the Department of Energy's (DOE) and other U.S. agencies' efforts to monitor and evaluate the physical security conditions of U.S. nuclear material subject to the terms of nuclear cooperation agreements, and (3) describe DOE's activities to secure or remove potentially vulnerable U.S. nuclear material at partner facilities.

To assess U.S. agency efforts to account for U.S. nuclear material overseas, we reviewed relevant statutes, including the Atomic Energy Act of 1954 (AEA), as amended, as well as the texts of all current nuclear cooperation agreements. We obtained data from the Nuclear Materials Management and Safeguards System (NMMSS), a database jointly run by DOE and the Nuclear Regulatory Commission (NRC), which, among other things, maintains data on U.S. peaceful use exports and retransfers of enriched uranium and plutonium that have occurred since 1950, and reviewed DOE and GAO reviews of the NMMSS database. To assess the reliability of data in the NMMSS database, we interviewed officials from DOE and NRC and a former DOE contractor to identify any limitations in NMMSS's data on the location and status of U.S. material overseas and found these data to be sufficiently reliable for the purposes of accounting for U.S. exports of nuclear material. We compared NMMSS data with other official and unofficial DOE sources of information regarding U.S. nuclear material transfers, including DOE data on nuclear material returns, to determine the reliability of DOE's inventory data for U.S. nuclear material transferred overseas. We reviewed DOE, NRC, and other U.S. agency records and interviewed officials at those agencies to determine the extent to which DOE, NRC, and State are able to identify where U.S. nuclear material was exported, retransferred, and is currently held. We selected a non-probability sample of partners based on, among other considerations, quantities of U.S. special nuclear material transferred to them. Results of interviews of non-probability samples are not generalizable to all partners but provide an understanding of those partners' views of the U.S. government's efforts to account for its nuclear material inventories overseas subject to nuclear cooperation agreement terms. We conducted site visits in four countries holding U.S.-obligated material and interviewed governmental officials and nuclear facility operators in these countries to discuss material accounting procedures. Further, we interviewed officials from five partners regarding their observations about working with the U.S. government to account for material subject to the terms of nuclear cooperation agreements. We analyzed the texts of administrative arrangements with key countries to

determine the extent to which DOE conducts inventory reconciliations of inventory transferred between the United States and a partner country.

To assess DOE's and other U.S. agencies' efforts to monitor and evaluate the physical security conditions of U.S. nuclear material overseas subject to nuclear cooperation agreement terms and describe DOE's activities to secure or remove potentially vulnerable U.S. nuclear material at partner facilities, we reviewed all U.S. nuclear cooperation agreements in force, as well as other U.S. statutes, and IAEA's security guidelines, "The Physical Protection of Nuclear Material and Nuclear Facilities," INFCIRC/225/Rev.4,¹ and other relevant international conventions to determine the extent to which such laws and international conventions provide for DOE and U.S. agencies to monitor and evaluate the physical security of transferred U.S. nuclear material subject to U.S. nuclear cooperation agreement terms. We interviewed officials from DOE, NRC, and the Department of State (State) to gain insights into how effective their efforts are, and how their efforts might be improved. We selected a nonprobability sample of partners based on, among other considerations, quantities of U.S. special nuclear material transferred to them and interviewed officials to determine how DOE and other U.S. agencies work with partner countries to exchange views on physical security and the process by which U.S. nuclear material is returned to the United States. Results of interviews of non-probability samples are not generalizable to all partners but provide an understanding of those partners' views of the U.S. government's efforts to monitor and evaluate the physical security conditions of U.S. nuclear material overseas subject to nuclear cooperation agreement terms. We also obtained and analyzed the records of all available U.S. physical protection visits to partner facilities from 1974 through 2010. We reviewed agency documents and interviewed officials from DOE, NRC, and State regarding the policies and procedures for determining which partners to visit, how they conducted physical protection visits at partner facilities, and mechanisms for following up on the results of these visits. In particular, we compared the sites visited with NMMSS records of U.S. material exported and retransferred, and other information to evaluate the extent to which U.S. physical protection visits were made to all sites overseas containing U.S. special nuclear material. We obtained written responses from Global

¹In January 2011, IAEA issued an updated revision of its security guideline document, IAEA, "Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities" (IAEA INFCIRC/225/Rev.5 (2011)).

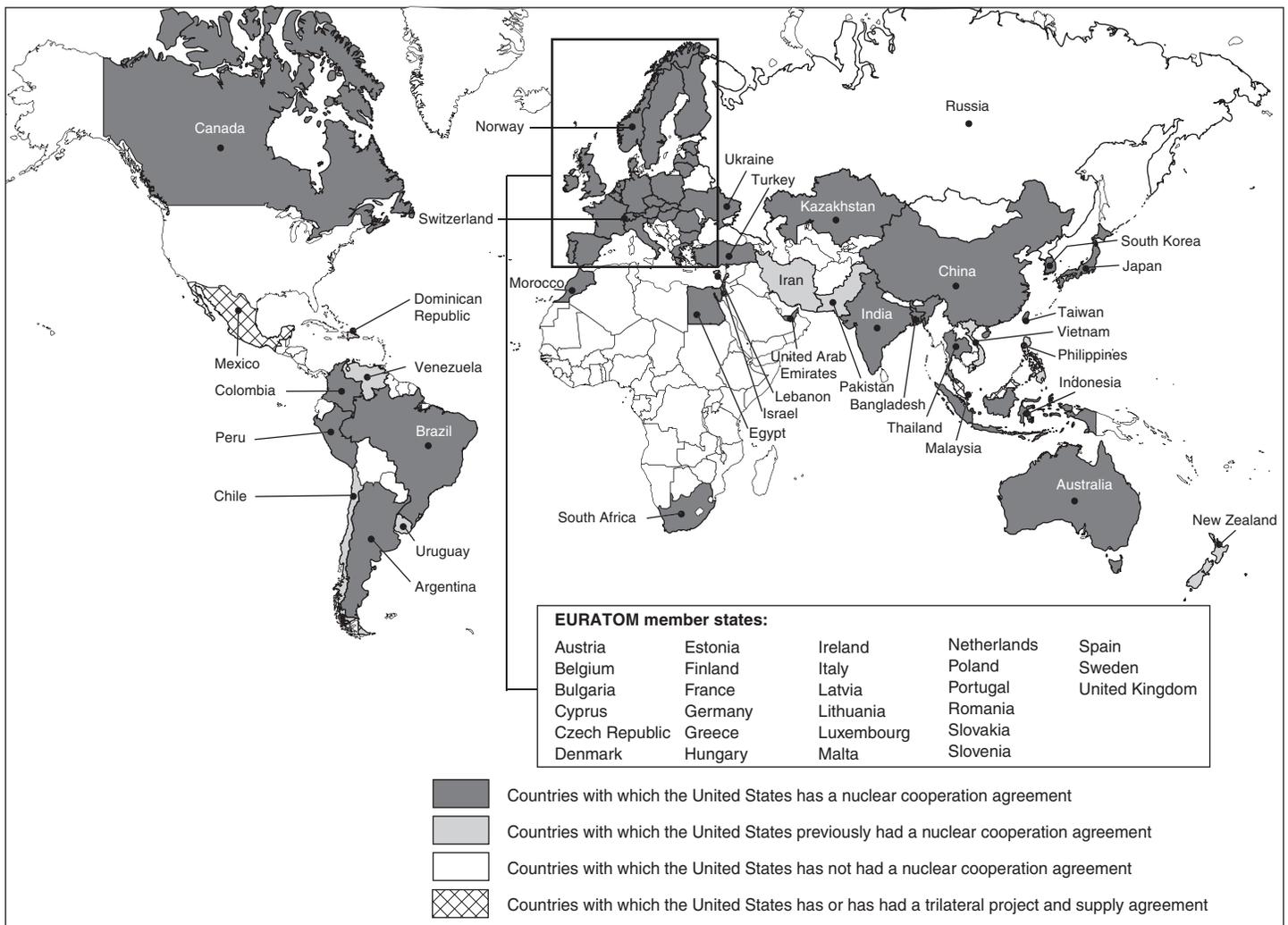
Threat Reduction Initiative (GTRI), and reviewed other information regarding their program activities. To better understand IAEA's role in maintaining safeguards and evaluating physical security measures, we interviewed IAEA officials and reviewed relevant documents.

We conducted this performance audit from September 2010 to June 2011 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: Current and Previous U.S. Nuclear Cooperation Agreement Partners

The United States currently has 27 agreements in force for peaceful nuclear cooperation with foreign countries, the European Atomic Energy Community (EURATOM), the International Atomic Energy Agency (IAEA), and Taiwan. Figure 1 shows the partner countries with which the United States currently has or previously had a nuclear cooperation agreement with.

Figure 1: Cooperating Partners with Which the United States Currently Has or Previously Had a Nuclear Cooperation Agreement



Sources: GAO analysis of Department of State data; Map Resources (map).

As indicated in figure 1, the United States has nuclear cooperation agreements in force with Argentina, Australia, Bangladesh, Brazil, Canada, China, Colombia, EURATOM, Egypt, India, Indonesia, IAEA, Japan, Kazakhstan, Morocco, Norway, Peru, Russia, South Africa, South Korea, Switzerland, Taiwan, Thailand, Turkey, Ukraine, and United Arab Emirates.¹ In addition, the United States previously had nuclear cooperation agreements with Chile, Dominican Republic, Iran, Israel, Lebanon, New Zealand, Pakistan, Philippines, Uruguay, Venezuela, and Vietnam.²

¹The United States has a set of trilateral project and supply agreements with Mexico and IAEA. We included these agreements because they were entered into pursuant to the United State's nuclear cooperation agreement with IAEA. The United States has two nuclear cooperation agreements with Australia, including one for Separation of Uranium Isotopes by Laser Excitation (SILEX) technology, bringing the number of agreements to 27.

²The United States also previously had trilateral project and supply agreements with Malaysia, Yugoslavia, and IAEA.

Appendix III: International Guidelines for the Categorization of Nuclear Material

IAEA's INFCIRC/225/Rev.4 security guideline document establishes the standard by which the United States and other countries generally classify the categories of physical protection that should be afforded nuclear material, based on the type, volume, and disposition of the nuclear material. Table 1 lists the material category according to IAEA's security guidelines, INFCIRC/225/Rev4. Specifically:

Table 1: Categorization of Nuclear Material According to IAEA Security Guidelines

Material	Form	Category I	Category II	Category III ^c
1. Plutonium ^a	Unirradiated ^b	2 kilograms or more	Less than 2 kilograms but more than 500 g	500 g or less but more than 15 g
2. Uranium-235	Unirradiated ^b -uranium enriched to 20% ²³⁵ U or more -uranium enriched to 10% ²³⁵ U but less than 20% ²³⁵ U -uranium enriched above natural, but less than 10% ²³⁵ U	5 kilograms or more	Less than 5 kilograms but more than 1 kilogram 10 kilograms or more	1 kilogram or less but more than 15g Less than 10 kilograms but more than 1 kilogram 10 kilograms or more
3. Uranium-233	Unirradiated ^b	2 kilograms or more	Less than 2 kilograms but more than 500 g	500 g or less but more than 15 g
4. Irradiated fuel (The categorization of irradiated fuel in the table is based on international transport considerations. The State may assign a different category for domestic use, storage, and transport taking all relevant factors into account.)			Depleted or natural uranium, thorium, or low-enriched fuel (less than 10% fissile content) ^{d,e}	

Source: IAEA INFCIRC225r4.

^aAll plutonium except that with isotopic concentration exceeding 80 % in plutonium-238.

^bMaterial not irradiated in a reactor or material irradiated in a reactor but with a radiation level equal to or less than 1 Gy/hr (100 rad/hr) at 1 meter unshielded.

^cQuantities not falling in Category III and natural uranium, depleted uranium and thorium should be protected at least in accordance with prudent management practice.

^dAlthough this level of protection is recommended, it would be open to States, upon evaluation of the specific circumstances, to assign a different category of physical protection.

^eOther fuel which by virtue of its original fissile material content is classified as Category I or II before irradiation may be reduced one category level while the radiation level from the fuel exceeds 1 Gy/hr (100 rad/hr) at 1 meter unshielded.

Appendix IV: Comments from the Department of Energy



Department of Energy
National Nuclear Security Administration
Washington, DC 20585
August 5, 2011



Mr. Gene Aloise
Director
National Resources and Environment
Government Accountability Office
Washington, D.C. 20548

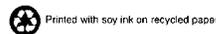
Dear Mr. Aloise:

The National Nuclear Security Administration appreciates the opportunity to review the Government Accountability Office's (GAO) draft report, *Nuclear Nonproliferation: U.S. Agencies Have Limited Ability to Account for, Monitor, and Evaluate the Security of U.S. Nuclear Material Overseas*, GAO-11-920. I understand that the GAO was asked to: (1) assess U.S. agency efforts to account for U.S. nuclear material overseas; (2) assess the Department of Energy's (DOE) and U.S. agencies' efforts to monitor and evaluate the physical security of U.S. material overseas; and (3) describe DOE'S activities to secure or remove potentially vulnerable U.S. nuclear material at partner facilities.

Overall, NNSA is concerned with the errors in fact and judgment that appear in the Congressional Considerations and recommendations for U.S. Government agencies. NNSA is working with other partners to secure weapons-usable nuclear materials in additional parts of the world and to strengthen security at civil nuclear and radiological facilities. We recognize that further work is needed and we are working with our partners to improve international security. Below are comments to clarify points in the draft report.

Comments Related to GAO Report Contents:

1. The GAO report asserts on pages 26 and 37 that the U.S. interagency has not "*formalized its goals for ...monitoring and evaluation activities.*" This is incorrect. The U.S. interagency has developed and formalized goals for monitoring and evaluating activities to use during assessment visits. Specifically, during bilateral physical protection assessment visits, the adequacy of physical protection provided to U.S.-obligated nuclear material in another state is determined based on whether a site meets the intent of the recommendations contained in the IAEA Nuclear Security Series document on "The Physical Protection of Nuclear Materials and Nuclear Facilities," Information Circular 225 (INFCIRC/225). This fact is displayed in a table, found in Appendix VI, that reviews the physical protection visits conducted since 1994.
2. The GAO report asserts that "*DOE, which has the technical lead and is the agency lead on most visits has not ...worked with NRC and State to establish a plan and prioritize U.S. physical protection visit*" and states that the U.S. interagency has not established a formal process for coordinating and prioritizing such visits. This statement is inaccurate and



contrary to the information contained in the report. Specifically, the GAO report acknowledges on page 27-28 that DOE, the NRC, and State Department work together on coordinating U.S. Government positions regarding the priorities for the physical protection visits; and the U.S. interagency is working to update its planning documents and methodology. As part of the preparation for all physical protection assessment visits, we work with other U.S. agencies, including the NRC and State Department, to prioritize and plan visits to countries based on criteria that were developed by all three agencies. Although visits to countries with highly enriched uranium (HEU) or plutonium in Category I amounts are priorities, visits also are scheduled whenever a country has had or expects to have a change in inventory of U.S.-obligated nuclear material, along with other factors, such as a finding of inadequate physical protection. Finally, the list of priorities may change from time to time, based on other factors such as a country's readiness for a visit, or the urgency of pending license requests for the provision of U.S. obligated nuclear material to a partner.

3. The GAO report asserts on pages 18, 28 and 37 that the U.S. interagency has not *"systematically visited countries believed to be holding Category I quantities of U.S. nuclear material."* We disagree with this assessment. The U.S. interagency has a specific methodology for prioritizing visits that includes consideration of, among other things, the following variables: the type, and quantity of U.S.-obligated nuclear material at a facility; whether a country is making recommended improvements; pending NRC licenses; information from previous physical protection assessments; and concerns raised through other available information. The current system for planning and prioritizing bilateral assessment visits is being updated, as necessary, to take into account the following changes: the increasing repatriation of a large amount of U.S. - obligated HEU; a shift to greater use of low enriched uranium (LEU); and the recent revision of INFCIRC/225.
4. We also disagree with the GAO assessment that *"DOE and U.S. agencies do not have a systematic process to revisit or monitor security improvements at facilities that do not meet IAEA security guidelines."* While the U.S. interagency does hold follow-up visits, these subsequent visits are not the only manner of ensuring that necessary improvements are made. NNSA and the National Laboratories also have used informal visits and other arrangements to work with countries to make needed improvements that were revealed as a result of a visit. Unfortunately, the GAO report has not integrated site visits and improvements into its analysis, and thus implied that nothing was done in between visits to improve the security of facilities.
5. On page 23, we disagree with GAO's characterization of the April 2008 U.S. physical protection assessment of a country's facilities as *"as a 'tour'."* Of particular concern is their comment, later on this page, that *"officials told us the U.S. government had shared some high-level observations regarding its visit with the country's government officials and the site operators but did not provide the government or site operators with written observations or recommendations."* As a result of the high-level observations the U.S. Government verbally shared with the government officials regarding its physical protection visit, those officials were well aware of the in-depth U.S. assessment. In years

past, the U.S. interagency did not always provide the host country a copy of the slides it presents, but now does so on a routine basis.

Comments Related to GAO Report Recommendations:

While NNSA appreciates the GAO's effort with the review, it has concerns with the recommendation to institute an *"annual inventory reconciliation, reporting on a facility-by-facility basis for weapon-usable material where possible ..."* for all states that hold U.S.-obligated nuclear material. We do not believe that this is necessary, particularly since the GAO's interviews with foreign governments mirror the U.S. interagency view that nuclear material can be accounted for at the overall State-level, as required pursuant to Section 123(a)(1) of the Atomic Energy Act. In addition, the IAEA's comprehensive safeguards program is another important tool that helps maintain the continuity of knowledge of the location of nuclear materials in a country, including U.S.-obligated nuclear material. We believe that IAEA inspection, surveillance, and reporting processes serve as an effective, internationally sanctioned and U.S.-supported tracking and accounting mechanism.

With the existence of a system that has long proved its worth, we also are concerned that the GAO is suggesting a costly new system without addressing the inherent costs and benefits of either its recommendations or issues raised for Congressional consideration. In addition to the fact that maintaining a comprehensive inventory of U.S.-obligated nuclear material is neither practical nor always necessary to the mission of protecting U.S.-obligated nuclear material in all cases, such a new system would be highly costly. Should changes be made to the U.S. Nuclear Materials Management and Safeguards System (NMMSS) to accommodate the GAO's recommendations, there would be significant increase in costs, due to an increase in staff and equipment needed to accomplish this new objective.

In addition to the obvious economic costs, there are potential security concerns related to the new system the GAO is proposing. There is a significant possibility that other states may respond to a request for tracking information by asking for the same information from the United States. Should the U.S. Government decide to act on the GAO recommendation to *"amend the AEA ... [to include] enhanced measures regarding physical protection access rights in future agreements and renewed agreements, so that U.S. physical protection teams may obtain access when necessary to verify that U.S. nuclear materials have adequate physical protection,"* it is likely that the United States would be asked to demonstrate the physical protection of nuclear material in the United States. This, in turn, raises the question of whether this U.S. sensitive information would be adequately protected, an issue that never was raised in the GAO report.

While NNSA appreciates the GAO's recognition that the United States and its partners share a strong common interest in deterring and preventing the misuse of U.S. nuclear material or any other nuclear material, we caution against requiring physical protection access in future bilateral agreements. Physical protection assessment visits provide an important opportunity to exchange information and best practices to enhance controls in the host country and, as relevant, in the U.S. The United States has the option of placing conditions on licenses to further control U.S.-obligated nuclear material, if necessary. This is preferable, to the GAO recommendation to

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disallow "nuclear cooperation agreements ... [that do not] contain provisions allowing the United States to verify that adequate physical security is exercised over nuclear material subject to the terms of these agreements." since in the former, the United States would still have the opportunity to provide assistance and conduct follow-up visits to facilities to ensure that upgrades have been implemented to adhere to international physical protection standards. Should the United States press other states, there is a chance that the security of nuclear materials and facilities would decrease, if states chose not to pursue such agreements with the United States. Although the current system is not perfect, we recognize that it does allow for formal and informal follow-up visits that help improve the security of nuclear materials in another country.

If you have any questions related to this response, please contact JoAnne Parker, Director, Office of Internal Controls at 202-586-1913.

Sincerely,



Kenneth W. Powers
Associate Administrator
for Management and Budget

cc: Deputy Administrator for Defense Nuclear Nonproliferation

Appendix V: Comments from the Nuclear Regulatory Commission



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 27, 2011

Mr. Gene Aloise
Director
Natural Resources and Environment
United States Government Accountability Office
Washington, D.C. 20548

Dear Mr. Aloise:

On behalf of the U.S. Nuclear Regulatory Commission (NRC), I am providing the NRC's views of the U. S. Government Accountability Office (GAO) draft report, "Nuclear Nonproliferation: U.S. Agencies Have Limited Ability to Account for, Monitor, and Evaluate the Security of U.S. Nuclear Materials Overseas."

The NRC appreciates the opportunity to comment on this report. As is reflected in the report, the NRC conducts licensing activities for exports of special nuclear material (SNM), equipment and components, and works closely with other U.S. Government agencies to implement other aspects of the Atomic Energy Act of 1954, as amended (AEA). In the staff-level discussions on March 2, 2011, concerning the Statement of Facts which preceded the final report, and in response to this draft, NRC notes its belief that GAO's study contains serious errors in fact and in judgment that undermine the Congressional Considerations and the recommendations for U.S. Government agencies.

The overarching thesis of the report is that, although U.S. Government agencies, including NRC, are complying with applicable national laws, the United States is not informed about locations and inventories of U.S.-origin SNM located abroad, and that this material is potentially insecure. To demonstrate this thesis, the GAO made an "assessment" based on U.S. agencies not conducting activities which are, in fact, neither authorized nor required by U.S. law or by agreements negotiated under Section 123 of the AEA. The AEA establishes clear criteria for authorizing exports and imports of nuclear materials, equipment and components. The countries which have entered into an Agreement for Cooperation with the United States pursuant to AEA Section 123 have been evaluated using those criteria, and, among other things, have agreed to verify peaceful end use and to implement internationally-accepted standards for physically securing the U.S.-origin exports. The GAO report clearly states that the AEA does not require Section 123 Agreements to stipulate that partners report information on the quantity or location of SNM subject to the Agreement. However, at the conclusion of this report the GAO indicates that the lack of this information, which is not authorized or required by U.S. law, or agreed to by the importing country, is a weakness of the Section 123 Agreements.

The GAO acknowledges the existence of the International Atomic Energy Agency's (IAEA) comprehensive safeguards program, but does not view it as an additional important tool to safeguard the SNM. The NRC believes that IAEA safeguards maintain the continuity of knowledge of the location of nuclear material in countries, including U.S.-origin SNM. For example, in the case of spent power reactor fuel, representing a significant fraction of the U.S.-obligated SNM located outside the United States, the IAEA inspection, surveillance, and

G. Aloise

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reporting process serves as an effective internationally-sanctioned and U.S.-supported tracking and accounting mechanism.

Further, the NRC believes the GAO report does not give sufficient weight to foreign sovereign responsibilities for ensuring physical protection of imports within their borders consistent with national law and international obligations. Countries must report to the United States any changes in chemical or physical form of the exported SNM unless prior approval is granted in a Section 123 Agreement. All locations of U.S.-origin Category I material must be reported to and approved by the U.S. Government prior to the exports of the SNM. In GAO's interviews with foreign governments, the latter do not suggest that additional intrusive measures be taken bilaterally by the United States to account for the U.S.-origin material, nor do the foreign governments indicate that they would be willing to have their current Section 123 Agreements altered for that purpose. Instead, they do agree that overall State-level reconciliation could be undertaken between countries.

The GAO report maintains that the legally binding agreement to physically protect U.S.-origin SNM, equipment and components which is framed in the Section 123 Agreement text and implemented through the bilateral physical protection program has not been adequately implemented. We disagree with this view. The Executive Branch develops a nonproliferation assessment of each country before entering into a Section 123 Agreement which, inter alia, assesses the country's ability to protect and account for any material which may be transferred pursuant to the Agreement. The NRC independently reviews that assessment and relays its findings to the President and Congress. Physical protection and safeguards practices are part of a wider network of relationships between the agencies of the United States and its corresponding partners in which the country's practices as a whole are taken into account. For each SNM export, government-to-government peaceful use assurances are received which reinforce these requirements. Prior to issuing an export license, NRC staff conducts a review of all available foreign physical protection and threat information. Physical protection bilateral visits are used to exchange information and best practices to enhance controls in the host country and, as relevant, in the United States. The NRC has the option of placing conditions on licenses to further control SNM, if that is deemed prudent. Where appropriate, the United States, with active NRC participation, has worked closely with partners to provide assistance and has revisited facilities to ensure that upgrades have been implemented.

The NRC does not believe that the GAO's assessment is based on risk-informed approach nor does it posit the cost-benefit basis for the Congressional Considerations or the recommendations. It is NRC's view that obtaining and maintaining a comprehensive and current inventory of U.S.-origin SNM is neither practical nor critical to the mission of security of U.S.-origin materials in all cases. For example, the inventory knowledge is very important for high-consequence materials, e.g., high enriched uranium and separated plutonium, while the precise amount of plutonium in spent fuel is less risk significant. Knowing that reactor fuel has been irradiated and is in storage under IAEA safeguards is sufficient and consistent with the requirements established under the AEA and the 1978 Nuclear Non-Proliferation Act. Were the U.S. Government's database tasked with tracking U.S.-origin SNM after export, the Nuclear Materials Management and Safeguards System (NMMSS, which is jointly funded by NRC and DOE) would need changes to the database and software, and additional staff and funding resources. Although the GAO emphasizes the current inventory reconciliation with five partners as a best practice, the NRC notes that these reconciliations are not facility-specific but at a State level and do not indicate if the material is irradiated or non-irradiated. In addition, the

G. Aloise

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foreign government declared holding of nuclear material is not entered into NMMSS. Furthermore, the outcome of the necessary sustained diplomatic effort to engage foreign governments to discuss inclusion of facility-specific physical protection visits would hinge on foreign government consideration of whether a change to the status quo is in their national interest. Should the outcome be favorable, and that cannot be assumed, its implementation would be costly, requiring additional staff and funding at multiple agencies, including the NRC. The GAO makes no estimate of the cost, nor of the time, effort, or possible success of its recommendations.

Finally, we believe alterations in the current Section 123 Agreement and/or AEA language would need to take into account reciprocity. The GAO's report is silent with regard to the information security aspect of sharing detailed facility-specific location of nuclear materials. In the United States facility-specific information on the quantity and form of high-enriched uranium and separated plutonium would be considered "Safeguards Information" or classified as "Confidential National Security Information." Most of the Section 123 Agreements are reciprocal in nature and the trend in negotiating new or renewals of such agreements is to emphasize reciprocal responsibilities. The implementation of some of the GAO recommendations may require the United States to share facility-specific sensitive information with dozens of countries, most of which are not currently authorized to have such access. If the United States seeks to further impose on sovereign responsibilities for its exports, it must be willing to accept foreign imposition of reciprocal rights on imports. It should be noted that the NRC anticipates licensing greater numbers of imports if nuclear energy new builds increases. The GAO recommendations would need a thorough assessment of whether the physical protection of the material is, in fact, enhanced by the recommended changes, and whether the United States' sensitive information can be protected appropriately.

In short, we believe the study does not persuasively demonstrate that the AEA is insufficient as a framework for ensuring U.S.-origin SNM is protected; that there is a physical protection problem with exported SNM that is not addressed through existing agreements or ongoing bilateral exchanges; that any country with a Section 123 Agreement has or is likely to divert U.S.-origin SNM to weapons programs; that unilateral changes to existing agreements will be accepted by foreign partners; or that there is a clear cost-benefit basis for suggesting these changes based on a risk-informed approach.

The NRC takes its export and import licensing responsibility very seriously, and welcomes the GAO's study of the existing system to protect U.S.-origin material. It should be noted that the NRC has actively participated in the U.S. governments efforts to urge the world to amend the Convention on the Physical Protection of Nuclear Material, and in revising IAEA security guidance documents in order to establish more stringent internationally accepted norms that obligate all countries equally. The NRC continuously reviews the effectiveness and efficiency of its relevant processes. It has worked closely with appropriate federal agencies to improve and document the process used to determine the periodicity of bilateral physical protection visits, focusing on new exports of SNM, and reflecting changes made in the IAEA security guidance documents.

G. Aloise

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If needed, I would be glad to discuss the NRC's comments with you or have a member of the NRC staff discuss our comments with your staff.

Sincerely,



R. W. Borchardt
Executive Director
for Operations

Appendix VI: Comments from the Department of State



United States Department of State

Chief Financial Officer

Washington, D.C. 20520

Ms. Jacquelyn Williams-Bridgers
Managing Director
International Affairs and Trade
Government Accountability Office
441 G Street, N.W.
Washington, D.C. 20548-0001

AUG 01 2011

Dear Ms. Williams-Bridgers:

We appreciate the opportunity to review your draft report, "NUCLEAR NONPROLIFERATION: Agencies Have Limited Ability to Account for, Monitor, and Evaluate the Security of U.S. Nuclear Material Overseas," GAO Job Code 361315.

The enclosed Department of State comments are provided for incorporation with this letter as an appendix to the final report.

If you have any questions concerning this response, please contact Jake Mentz, Foreign Affairs Officer, Bureau of International Security and Nonproliferation, Office of Nuclear Energy, Safety and Security at (202) 647-3342.

Sincerely,

A handwritten signature in black ink, appearing to read "James L. Millette".

James L. Millette

cc: GAO – Gene Aloise
ISN – Eliot Kang
State/OIG – Evelyn Klemstine

Department of State Comments on GAO Draft Report

**NUCLEAR NONPROLIFERATION: Agencies Have Limited Ability to
Account for, Monitor, and Evaluate the Security of
U.S. Nuclear Material Overseas**
(GAO-11-920, GAO Code 361315)

The Department of State appreciates the opportunity to comment on GAO's draft report, *"Nuclear Nonproliferation: Agencies Have Limited Ability to Account for, Monitor, and Evaluate the Security of U.S. Nuclear Material Overseas."*

The GAO report outlined four recommendations for the Secretary of State, working with the Secretary of Energy and the Chairman of the Nuclear Regulatory Commission. The first recommendation is "to determine, for those partners with which the United States has transferred material but does not have annual inventory reconciliation, a baseline inventory of weapon-usable U.S. nuclear material, and establish a process for conducting annual reconciliations of inventories of nuclear material on a facility-by-facility basis." Determining annual inventories and reconciliations of nuclear material is a Department of Energy/National Nuclear Security Agency (DOE/NNSA) function, not a Department of State function.

The second recommendation is "to establish for those partners with which the United States has an annual inventory reconciliation, reporting on a facility-by-facility basis for weapon-usable material where possible." Establishing annual inventory reconciliations is a DOE/NNSA function, not a State Department function.

As we noted to the authors of this report, we do not believe that the recommendations noted in the preceding two paragraphs are necessary. Moreover, with IAEA Safeguards declarations, U.S. export license applications and U.S. physical protection visits, we believe that we have sufficient data to confirm adequately the quantities of U.S.-obligated nuclear material in other countries.

The third recommendation is "to facilitate visits to sites that U.S. physical protection teams have not visited that are believed to be holding U.S. Category I nuclear material." Facilitating physical protection visits requested by the Department of Energy is the Department of State's current practice.

The fourth recommendation is “to seek to include measures that provide for physical protection access rights in new or renewed nuclear cooperation agreements so that U.S. interagency physical protection teams may in the future obtain access when necessary to verify that U.S. nuclear materials are adequately protected.” The U.S. must take into account the fact that physical protection of nuclear material is considered a sovereignty issue by all States and by international treaty. Therefore, the Department of State believes that careful consideration should be given to the potential impact on our bilateral relationships, on U.S. national security and U.S. commercial competitiveness in the nuclear arena of including new explicit rights for physical protection access. U.S. physical protection teams have been granted access to every site that they have requested access to under the consultation provisions of our nuclear cooperation agreements currently in force, and we therefore believe that the provisions of the current agreements adequately facilitate the accomplishment of U.S. policy objectives.

The Department of State believes that the implementing these GAO recommendations would adversely impact U.S. commercial competitiveness in overseas markets, diminish U.S. influence overseas to advance our national nonproliferation objectives and cost jobs at home. There are multiple suppliers for nuclear material and equipment and little reason why a country, when given a choice to purchase from the United States under the regime recommended by the GAO or from another country without the more onerous conditions, would not chose the latter. In that regard, we note the following quote in the GAO report: “However, it may be possible to do so [i.e., add access requirements to nuclear cooperation agreements] in a way that includes greater access to critical facilities where weapon-usable U.S. nuclear material is stored, without infringing on the sovereign rights of our partners or hampering the ability of the U.S. nuclear industry to remain competitive.” Based upon our decades of experience working with our partner governments on these issues, the Department of State does not believe this would be possible.

Appendix VII: GAO Contact and Staff Acknowledgments

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Staff Acknowledgments

In addition to the individual named above, Glen Levis, Assistant Director; Antoinette Capaccio; Julia Coulter; Michelle Munn; and Alison O'Neill made key contributions to this report.

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