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Bridging the Military Nuclear Materials Gap

NTI Military Materials Security Study Group

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Cover photo
A B-52H Stratofortress at Minot Air Force Base, N.D. This type of plane mistakenly carried six nuclear warheads from Minot to a base in Louisiana in 2007. (U.S. Air Force photo/Senior Airman Stephanie Morris)

Table of Contents

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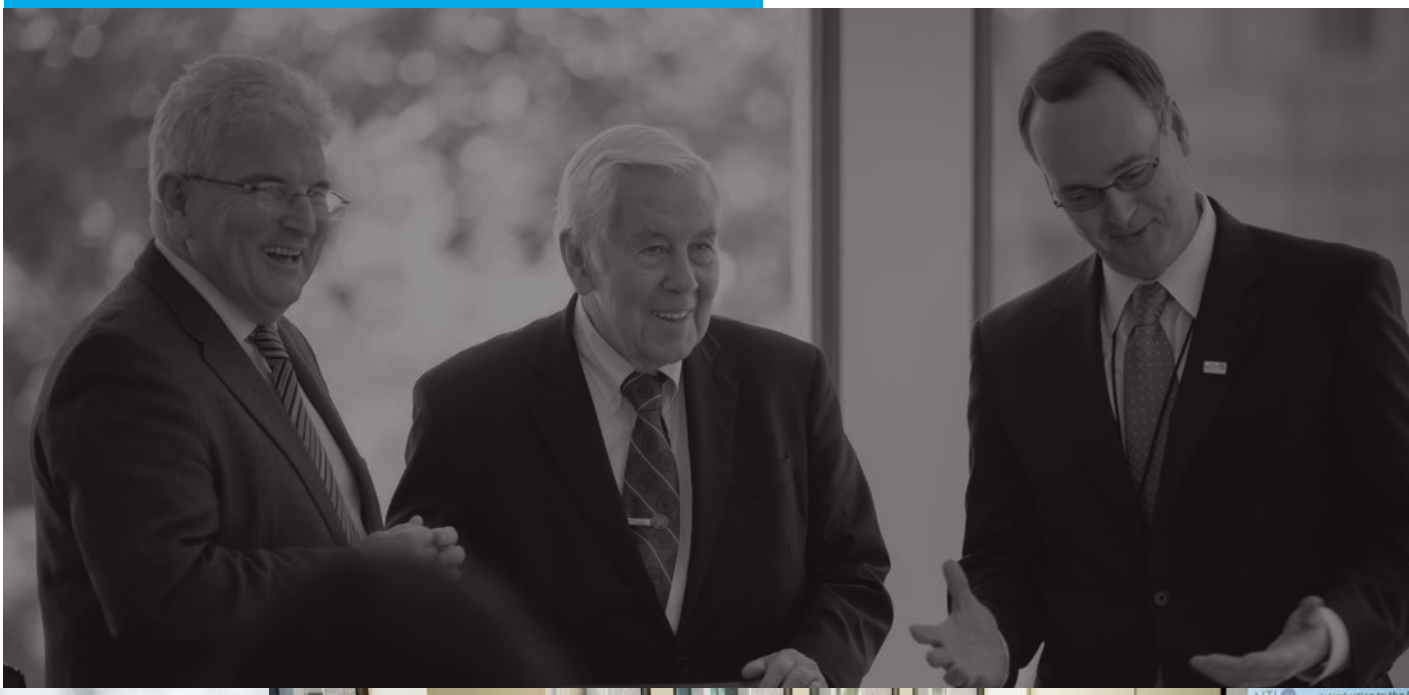

Foreword

By Des Browne, Richard Lugar, and Sam Nunn
Co-chairs of the NTI Military Materials Security Study Group

One of the greatest threats the world faces is the possibility that a terrorist group could acquire and detonate a nuclear weapon or device. A terrorist nuclear attack in any large city would likely kill hundreds of thousands of people, inflict billions of dollars in damage, and have profound effects on global security, the global economy, and our way of life. The effects of such an attack would no doubt transcend national boundaries, thus compelling a global response to a global threat.

Today, more than 1,800 metric tons of weapons-usable nuclear materials—highly enriched uranium and plutonium—remain stored in hundreds of facilities, some poorly secured and vulnerable to theft, across 24 countries. Recent security breaches and incidents at nuclear facilities illustrate that governments must do more to secure these dangerous materials and keep them out of the hands of terrorists.

In recent years, leaders have placed increased attention on nuclear materials security through a series of Nuclear Security Summits. However, despite important efforts to better secure materials in a number of countries, there is still no effective global system for how *all* weapons-usable nuclear materials should be secured. Implementation of existing international guidelines remains far from universal, and no mechanism exists for holding countries accountable for lax security at nuclear facilities.

Moreover, even those mechanisms that do exist apply almost exclusively to a small fraction of all weapons-usable nuclear materials—the 17 percent used for peaceful, civilian applications. The remaining 83 percent are commonly categorized as "military materials" and are therefore outside the scope of current international security standards, mechanisms, and confidence-building arrangements.

International standards for effective nuclear security should not stop at civilian materials but must apply to any and all nuclear materials that a terrorist could use to build a nuclear device.

This military materials gap is dangerous. It creates a significant security risk on its own—and it erects a major barrier to establishing an effective global nuclear security system. Terrorists bent on stealing nuclear materials will not distinguish between nuclear materials designated as civilian and those designated as military. They will seek to obtain materials from the most vulnerable and least protected location. That is why international standards for effective nuclear security should not stop at civilian materials but must apply to any and *all* nuclear materials that a terrorist could use to build a nuclear device.

To address this risk, the Nuclear Threat Initiative (NTI) convened a high-level Military Materials Security Study Group to examine the issue of military materials security. The Study Group comprised experienced former military and national security officials from China, France, Pakistan, Russia, the United Kingdom, and the United States.

Informed by the deliberations of the Study Group, this report outlines steps that governments should take to reduce the risk of nuclear terrorism by

> Strengthening the security of military materials

> Building confidence in the security of these materials while protecting sensitive information

> Strengthening the global nuclear security system to cover all nuclear materials, including military materials, by addressing military materials at the 2016 Nuclear Security Summit and beyond.

At the 2014 Nuclear Security Summit in The Hague, leaders from more than 50 countries said in their final communiqué, "We reaffirm the fundamental responsibility of States, in accordance with their respective obligations, to **maintain at all times effective security of all nuclear and other radioactive materials, including nuclear materials used in nuclear weapons**, and nuclear facilities under their control. This responsibility includes taking **appropriate measures to prevent non-state actors from obtaining such materials**—or related sensitive information or technology—which could be used for malicious purposes, and to prevent acts of terrorism and sabotage."

The 2016 Nuclear Security Summit offers an important opportunity for governments to deliver on these commitments and to take steps toward establishing a truly comprehensive global nuclear security system.

We would like to thank NTI's generous funders, including the John D. and Catherine T. MacArthur Foundation and the Peter G. Peterson Foundation, for their support of this important project.

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About the Military Materials Security Study Group

To develop the recommendations in this report, NTI convened highly respected current and former military and government officials and other experts from countries with military materials to participate in a Military Materials Security Study Group. The Study Group provided expert feedback on draft recommendations for strengthening the security of military materials and building confidence in the effectiveness of their security. Input from the Study Group helped ensure that the recommendations take into account international perspectives.

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Experts participating in the Study Group did not represent the views or interests of their countries. Instead, they played an advisory role in their personal, not professional, capacities. Participation in the Study Group does not imply concurrence with every aspect of the report or its recommendations. The views expressed in this report do not reflect those of the institutions with which the members are associated; their affiliations are listed for the purpose of identification only.

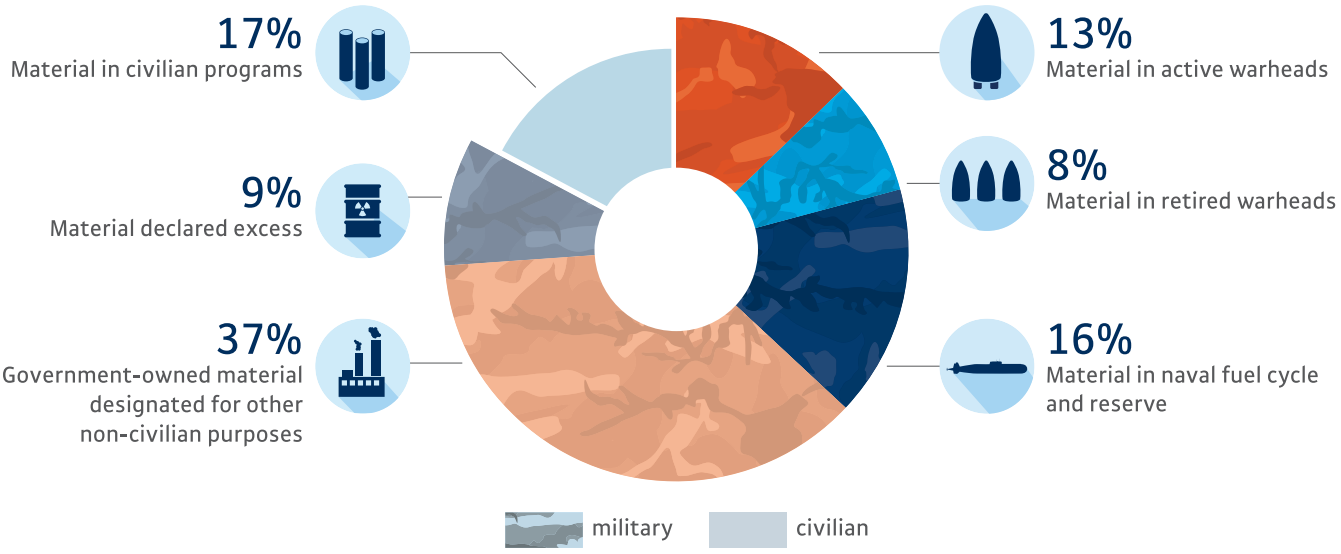
Understanding Military Materials

For the purposes of this report, military materials are defined as weapons-usable plutonium and highly enriched uranium found outside civilian nuclear programs. As a category, these materials are diverse and include materials in different forms, in different facilities, and in different uses. The five major types of military nuclear materials are as follows:

- Inside active nuclear warheads
- Inside retired nuclear warheads awaiting dismantlement
- Inside non-civilian naval reactors and materials designated for non-civilian naval reserves
- Declared excess to military needs and awaiting downblending or disposition by governments
- Designated for other non-civilian purposes, including bulk storage

Ohio-class ballistic missile submarine USS Maryland (SSBN 738). Nuclear-powered submarines use nuclear fuel for propulsion. This fuel is among the materials designated as "military" and excluded from the scope of international nuclear security standards. (U.S. Navy photo by James Kimber)

The estimated global distribution of all weapons-usable nuclear materials—across civilian and military applications—is presented below.



As of the end of 2014, total global stocks of weapons-usable nuclear materials were estimated at 1,366 metric tons of highly enriched uranium (HEU) and 507 metric tons of separated plutonium. Of this, 1,330 metric tons of HEU and 226 metric tons of plutonium are estimated to be outside of civilian programs. The estimated range of uncertainty regarding the total quantity of materials is +/– 140 metric tons. Material quantities are estimates made on the basis of analysis by Pavel Podvig, an independent analyst in Geneva who is also a senior research fellow at the UN Institute for Disarmament Research and a researcher with the Program on Science and Global Security at Princeton University.

Source: Global Fissile Material Report 2013: Increasing Transparency of Nuclear Warhead and Fissile Material Stocks as a Step toward Disarmament (Princeton, NJ: International Panel on Fissile Materials, 2013).

Not all military materials fall under military custody. Depending on the country, some military materials are under civilian control and protection (particularly those materials in reserves or in bulk storage); other types, such as the materials inside deployed warheads, are typically under military control. Consequently, measures to build confidence will vary depending on the sensitivity of the materials involved and the personnel responsible for securing them.

All states with military materials have a responsibility to ensure that these materials are secured effectively and to develop confidence-building measures for domestic and international constituencies.

Nimitz-class aircraft carrier USS Harry S. Truman. Highly enriched uranium fuels the U.S. nuclear fleet, including nuclear-powered submarines and aircraft carriers.

The table below illustrates the types of materials covered under the scope of military materials and the relevant stakeholders responsible for their custody, protection, and oversight in the United States. Other countries may have different stakeholders responsible for the various categories of military materials.

Military Materials in the United States			
Category of material	**Custody**	**Protection**	**Oversight**
Nuclear materials in active warheads[a]			
Nuclear materials in retired warheads awaiting dismantlement[b]			
Nuclear materials in naval programs (including naval reserve)[c]			
Nuclear materials declared excess awaiting disposition[d]			
Nuclear materials used for other non-civilian purposes (e.g., storage)[e]			

 Civilian  Military

a. For the majority of a warhead's lifetime, nuclear materials in active warheads are in the custody of the U.S. Department of Defense (DOD) and the military services responsible for deployment of the weapons to their Military First Destinations, the U.S. Air Force (intercontinental ballistic missiles and heavy bombers), and the U.S. Navy (submarine-launched ballistic missiles). The Department of Energy (DOE) takes custody of these weapons during transportation and maintenance. Military facilities containing active warheads are guarded by military security forces; security directives for the protection of warheads are issued by the U.S. DOD, and security oversight is provided by the armed services of the military and other entities of the U.S. DOD.

b. Nuclear materials in retired warheads awaiting dismantlement are located either at storage facilities owned and operated by the U.S. DOD or at facilities owned by the U.S. DOE, including at the Pantex Plant near Amarillo, Texas. The Pantex Plant is operated by a civilian contractor and is guarded by civilian security contractors. Security oversight at the Pantex Plant is provided by the U.S. DOE.

c. Nuclear materials inside naval reactors are located aboard U.S. Navy ships and fall under the custody and protection of the U.S. Navy. Materials designated for naval reserves and spent naval fuel are located at government-owned, contractor-operated civilian facilities. Security oversight for these facilities is provided by the U.S. DOE.

d. Nuclear materials declared excess and awaiting disposition are located at facilities owned by the U.S. DOE and operated by civilian contractors. Security oversight for these facilities is provided by the U.S. DOE.

e. The remaining nuclear materials are located at facilities owned by the U.S. DOE and operated by civilian contractors. Security oversight for these facilities is provided by the U.S. DOE.

The majority of global stocks of military materials are in Russia and the United States. However, all states with military materials have a responsibility to ensure that they are secured effectively and to develop confidence-building measures that provide assurance to both domestic and international constituencies. States without military materials should also ensure that their territories are not used as safe havens or transit points for illicit nuclear smuggling.

Addressing Military Materials Security

Effective global nuclear security requires that *all* weapons-usable nuclear materials be secured. Work is needed to strengthen the security of civilian materials, but several alarming security incidents indicate that more also must be done to improve the security of military materials. Security breaches at military facilities include the following:

> Three peace activists, including an 82-year-old nun, managed to break into the Y-12 National Security Complex in Oak Ridge, Tennessee, in 2012. The activists spent nearly an hour-and-a-half on the facility compound before a single guard noticed and arrested them for trespassing. The Y-12 facility is operated by the U.S. Department of Energy and houses thousands of kilograms of highly enriched uranium.

> U.S. nuclear missile launch officers in 2013 were found sleeping with a blast door open to their missile launch control capsule.

> In 2013, as many as 50 law enforcement personnel from the U.K. Ministry of Defence were investigated for sleeping on the job and not completing patrols at the Atomic Weapons Establishment in Burghfield, Berkshire, a government-owned, contractor-operated site where nuclear warheads are constructed, maintained, and disassembled.

Although nuclear materials were not in danger of being stolen in any of these cases, they demonstrate that even the most sensitive military nuclear facilities can—and sometimes do—suffer from a weak security culture and lax implementation of security protocols. The breaches also serve as powerful reminders that personnel can be the weak link in security, whether or not sound procedures and systems are in place. Each security system must be tested continuously against high standards. Those standards may need to be improved as threats change and grow, and best practices must be promulgated widely.

Plutonium Facility, Los Alamos, New Mexico. As a general rule, countries with military materials should secure these materials to the same or higher standards as comparable civilian materials.

The Military Materials Gap

Despite the need for improvement, however, there are no internationally recognized standards for the security of military materials, nor are there multilateral arrangements designed to build confidence in the security of those materials.

The Convention on the Physical Protection of Nuclear Material and its 2005 Amendment explicitly apply to nuclear materials used for peaceful purposes. Although United Nations Security Council Resolution 1540 requires countries to have effective physical protection for all nuclear materials, including those in nuclear weapons, it does not offer specific guidelines for implementing this obligation. The nuclear security recommendations issued by the International Atomic Energy Agency (IAEA)—the only guidelines that come close to providing any international security standards for how to secure nuclear materials—are intended for the protection of civilian materials.[1]

The absence of any international standards or established confidence-building measures for military materials leaves significant gaps in global security and is a major barrier to the creation of an effective global nuclear security system. These materials represent the vast majority of the world's weapons-usable nuclear materials, and the absence of standards and confidence-building measures significantly detracts from the credibility of international efforts to strengthen nuclear security.

[1] Section 1.18 of the 2011 IAEA Nuclear Security Series No. 13, "Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities" (INFCIRC 225/Rev. 5), notes, "States may decide whether or not to extend the publication's use to other purposes." States with military materials should declare that these materials are protected to the same or higher standards as those set forth in INFCIRC 225/Rev. 5.

Recommendations

To address the military materials gap, NTI—informed by the discussions of the NTI Military Materials Study Group—developed recommendations for the following:

> Strengthening the security of military materials

> Building domestic and international confidence in the security of these materials

> Addressing military materials at the 2016 Nuclear Security Summit and beyond.

Strengthening the Security of Military Materials

As a general rule, countries with military materials should secure military materials to the same or higher standards as those that apply to comparable civilian materials, including through the application of standards and best practices that are at least consistent with the IAEA nuclear security guidelines.[2]

In particular, this report identifies three principles for military materials security: (a) accountability, (b) risk management and minimization, and (c) continuous improvement. Those principles and the elements on the following pages should be reflected in a comprehensive regulatory framework that distinguishes the responsibilities of the multiple stakeholders involved in nuclear security at the national and facility levels. Regulations should provide enough guidance to ensure high security standards while allowing operators flexibility to design security procedures at their facilities in keeping with the local environment, type of material at the facility, and other relevant factors. Regulations also should establish a graded approach to security that assesses the material and locations that face the highest risks and consequences if they are targeted.

Those primarily responsible for implementing these security principles and standards will vary depending on the custodian (civilian or military) of the material. Irrespective of the custodian, however, those security elements must apply to the full spectrum of military materials—and reflect the recommendations found in the IAEA's nuclear security guidelines.

[2] "Comparable" in this context refers to comparable fissionable properties of the material. That is, military materials should be provided with at least the same or higher standard of physical protection provided to civilian materials of similar fissionable characteristics. The IAEA "Nuclear Security Recommendations on Physical Protection of Nuclear Materials and Nuclear Facilities" (INFCIRC 225/Rev.5) offer a useful approach to categorization of nuclear materials, which can serve as the basis for a graded approach to military materials security linked to the characteristics of the nuclear material.

Recommendations to Strengthen Security

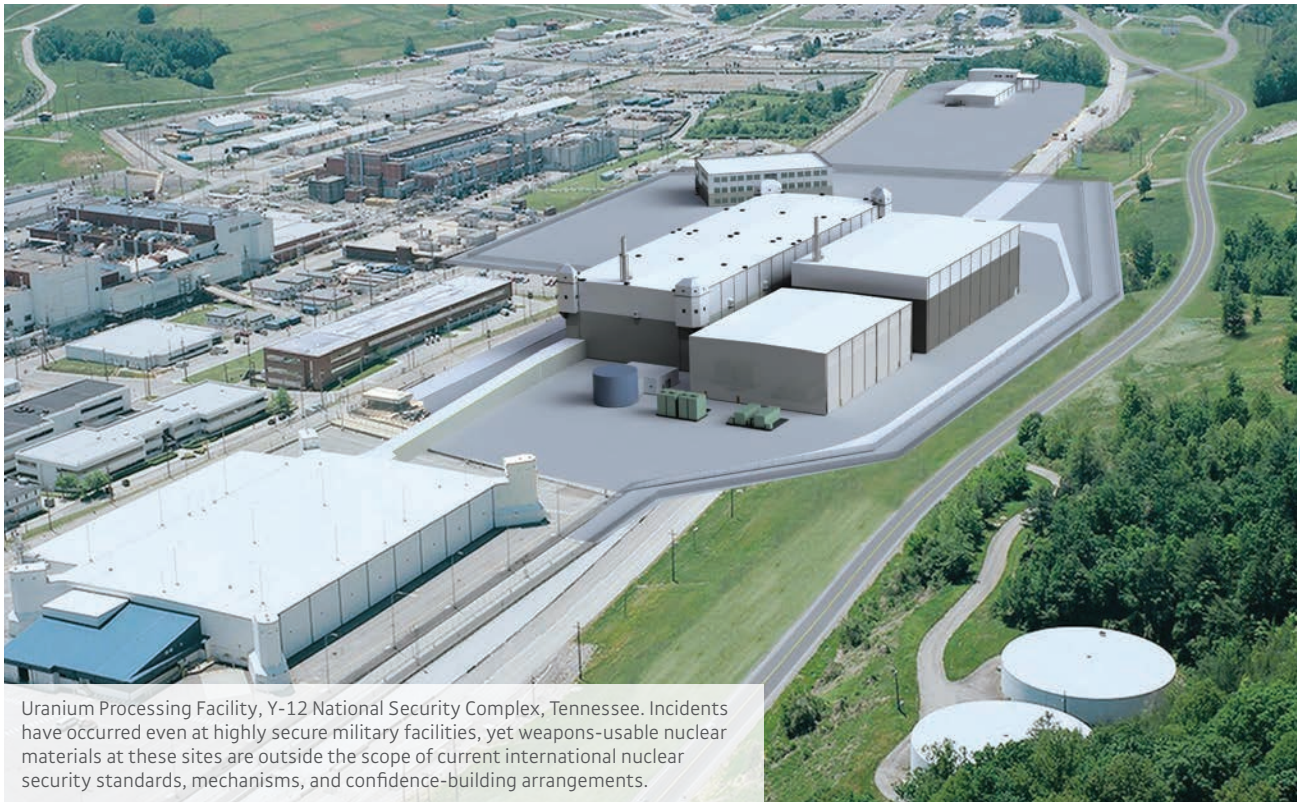
Accountability

Strong Security Culture. Even the most sophisticated security equipment can be compromised in a facility that lacks strong security culture, a concept defined by the International Atomic Energy Agency (IAEA) as "the assembly of characteristics, attitudes and behavior of individuals, organizations and institutions which serves as a means to support and enhance nuclear security."[a] Having a strong security culture means that all facility personnel understand that they each bear personal responsibility for the protection of nuclear materials. Procedures, training, resources, and leadership should be implemented at the facility and at the national level to prevent the mindset that "it's not going to happen here."

Independent Oversight. Independent national oversight is essential to provide accountability for those with nuclear security responsibilities. The credibility of an oversight organization is largely linked to its degree of operational independence from the custodian of the materials on site (i.e., operator of the facility or base) and its ability to take corrective action. Oversight for the security of weapons may not necessarily come from outside the military but should still meet the criteria for independence.

Clear Roles and Responsibilities. Nuclear facilities should ensure that all personnel understand their roles and responsibilities pertaining to security. Supervisors and facility leadership should reinforce this understanding through training, demonstrations, exercises, and regular reviews of rules and regulations. Personnel should be encouraged to report problems when they are identified and take ownership of responsibilities pertaining to nuclear security.

a. IAEA Nuclear Security Series No. 7, "Nuclear Security Culture Implementing Guide," 2008.



Uranium Processing Facility, Y-12 National Security Complex, Tennessee. Incidents have occurred even at highly secure military facilities, yet weapons-usable nuclear materials at these sites are outside the scope of current international nuclear security standards, mechanisms, and confidence-building arrangements.

Recommendations to Strengthen Security

Risk Management and Minimization

Comprehensive Threat Assessments. Countries should establish a written Design Basis Threat (DBT) or other formal document that specifies the "attributes and characteristics of potential insider and/or external adversaries who might attempt unauthorized removal of nuclear material or sabotage."[a] Regardless of whether a DBT or an alternative threat assessment tool is used, rigid assumptions about nuclear security should be avoided. Nuclear facilities should regularly perform vulnerability assessments, effectiveness evaluations, and self-inspections to determine how well security systems fare against a variety of challenging stress tests and then update written guidance on the basis of lessons learned.

Effective Material Control and Accounting. To prevent theft of nuclear materials, facilities must be able to detect unauthorized diversions of even small quantities of nuclear materials. Robust accounting methods should include (a) process monitoring (in the case of a facility that actively works with nuclear materials), (b) process uncertainty assessment and risk reduction techniques, (c) item monitoring (in the case of a storage facility and during transportation), (d) effective surveillance methods, and (e) tamper-indicating devices (TIDs). Facilities should also effectively integrate their security systems, which are designed to interdict theft, with their accounting systems, which are designed to detect unauthorized removal of material, so that the two types of systems are mutually reinforcing.

Defense-in-Depth. Nuclear materials should be protected by multiple layers and methods of protection (structural, technical, personnel, and organizational) to make it more difficult to steal materials and to improve chances of interdicting an adversary. Defense-in-depth measures should include elements of a facility's physical protection system, control measures to prevent and detect unauthorized access to sensitive areas of nuclear facilities, and accounting systems that can help detect unauthorized removal of materials, particularly by an insider. Flexibility and agility is important because prediction is often flawed and surprise is likely.

Cyber Security. To address the threat of a cyber-mediated theft of weapons-usable nuclear materials or sabotage of a nuclear facility, nuclear facilities should ensure that their security plans (a) incorporate measures to protect against cyber attacks and (b) establish a set of procedures to protect digital networks and assets from cyber attacks that could lead to physical consequences, such as the destruction of important safety, security, or operational equipment.

Effective Transportation Security. Governments should ensure that well-armed, well-trained guards are protecting any movements of nuclear material between buildings at one facility or between facilities. Governments should also (a) ensure the development and deployment of systems that track nuclear transports in real-time, (b) monitor the state of physical protection systems of the materials during transport, (c) provide secure containers and vehicles with delayed access mechanisms, and (d) identify the location of a response force in case of an emergency.

Minimize Materials and Sites. One of the best ways to strengthen nuclear security is to minimize the quantity, use, and storage of weapons-usable nuclear materials where feasible and operationally viable. Consolidating material to fewer buildings within a nuclear facility and to fewer facilities nationally may increase confidence in security by reducing the number of locations vulnerable to theft. Consolidation can offer greater security for the material without increasing costs (or even while reducing costs) because fewer locations must be secured.

a. IAEA Nuclear Security Series No. 13, "Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities" (INFCIRC 225/Rev.5.), 2011.

Recommendations to Strengthen Security

Continuous Improvement

Realistic Training. Governments should ensure that protective forces for nuclear facilities are well trained at regular intervals, are well equipped and well tested, and are knowledgeable about the asset they are protecting. Realistic tests of security performance against the unexpected, including force-on-force exercises where groups attempt to defeat security at nuclear sites, should be incorporated into training; the results of these exercises should help find security vulnerabilities, assess risk, and convince policymakers to support improvements where necessary. Opportunities to exchange information and share lessons learned across the military and civilian divide also can strengthen the training of personnel.

Trusted, Certified, and Well-Equipped Personnel. First, governments should ensure that nuclear facilities implement effective measures to mitigate insider threats. Those measures should include having a personnel or human reliability program and other measures that ensure that personnel who have access to nuclear materials or those who are responsible for security at nuclear facilities are reliable, trustworthy, and not vulnerable to outside influence either wittingly or unwittingly. Second, national authorities also should establish nuclear security certification programs—or require personnel to participate in existing national or international certification programs—to ensure that security personnel at nuclear facilities are trained to perform to the highest standards. Last, nuclear facilities should have well-trained and well-equipped armed guards who can respond to a wide range of threats.

Security Reviews and Updates. Nuclear facilities and regulators should (a) conduct regular performance tests of security systems (personnel, procedures, and equipment) to ensure effective protection against sophisticated adversaries; (b) review and update Design Basis Threats, site-specific security plans, and on-site security culture to improve readiness and protection capabilities; and (c) invest in nuclear security research and development to ensure that security systems designed to protect nuclear materials stay ahead of the capabilities of the adversaries who seek to steal them.

The Mayak Production Association, one of the biggest nuclear facilities in the Russian Federation. The United States and Russia house the vast majority of the world's military materials.

Building Confidence in the Security of Military Materials

Nuclear security is a sovereign responsibility, especially when it comes to military materials. However, because the consequences of a nuclear catastrophe—security, economic development, and societal—would undermine global confidence in the nuclear industry, in the country's military, and in the country's government, each country has a legitimate interest in how effective other countries are in meeting their security responsibilities. Of course, security is the utmost priority, and the desire for transparency must be balanced with ensuring effective security and protecting sensitive information.

Taking into account this balance, states should take the necessary steps to reassure others that they are appropriately and consistently discharging their nuclear security mission. Providing confidence to others regarding the protection of military materials offers a number of benefits to both countries with military materials and countries without military materials, as well as to the public.

Pantex Plant, Texas. Retired nuclear weapons scheduled for disassembly account for eight percent of all weapons-usable nuclear materials.

Benefits of Building Confidence

Providing confidence to others regarding the protection of military materials has the following benefits:

- ***Improve security.*** Sharing information on the security of military materials through best practices, workshops, and information exchanges will lead to improved security as countries adapt security strategies to emerging threats, learn from one another's practices, and implement additional improvements. Learning that such sharing can take place without exposing vulnerabilities also will enhance international security cooperation.

- ***Deter terrorists.*** By implementing visible confidence-building measures, a country sends a strong message to terrorists that military materials are effectively secured. Such a message can dissuade terrorists from attempting to stage an attack against a nuclear facility. Recent embarrassing security incidents, such as the Y-12 break-in by an 82-year-old nun and her fellow peace activists, should compel governments to dispel any doubt regarding the security systems at nuclear facilities by sending a clear message to terrorists that security systems will deter future threats to nuclear facilities.

- ***Increase domestic and international confidence.*** Confidence-building measures will assure other countries that their security will not be affected by lax security elsewhere. Furthermore, such measures can help governments respond to domestic concerns about the security of nuclear materials and can help build trust between nuclear facilities and local communities.

- ***Enhance credibility.*** Given the potential global consequences of a nuclear security incident, a "trust me" approach to military materials security is not good enough. When countries take steps to demonstrate that they have effective security for all nuclear materials, their international and domestic credibility on nuclear security is enhanced.

- ***Ensure the sustainability of nuclear energy.*** A single, serious security incident involving nuclear materials—civilian or military—could undermine public support for nuclear power. Actions that build international confidence in the security of all materials, including military materials, will help to restore and maintain public trust in the safety and security of nuclear energy.

Confidence-Building Steps

Steps for increasing confidence in the security of military materials could comprise a variety of unilateral, bilateral, and multilateral commitments and activities. The options described in the following pages provide varying levels of confidence and acknowledge the range of sensitivity of all nuclear material, military or civilian, and the variety of personnel responsible for those materials. These options are designed to serve as a menu from which countries may choose the most appropriate actions depending on their circumstances and the relative sensitivity of the materials.

For many of the menu options in the following tables, information-sharing arrangements can facilitate building confidence between countries, particularly for more sensitive types of materials; the arrangements can allow governments to exchange sensitive information in a way that protects unauthorized disclosure of the information and fosters meaningful nuclear security cooperation. Such information-sharing arrangements have facilitated cooperation on military materials security between the United States and the United Kingdom, between the United States and France, and between the United States and Russia. Other bilateral security agreements between the United States and Russia, such as implementation of the New Strategic Arms Reduction Treaty (known as New START), also involve the use of information-sharing arrangements.

Recommendations for Confidence Building

Unilateral Activities

Declarations of Aggregate Data. Countries with military materials could publish periodic reports on each of the different categories of weapons-usable nuclear materials. Such declarations, depending on how detailed they are, could provide a level of confidence that military material is accounted for effectively in national inventories. For example, in June 2012, the U.S. National Nuclear Security Administration published an unclassified report, "The United States Plutonium Balance, 1944–2009." This report lists the total quantity of plutonium in the custody of the U.S. Department of Energy and the U.S. Department of Defense. It also provides information on specific quantities of plutonium at sites in the U.S. nuclear weapons complex. Other countries with military materials could make similar declarations, if appropriate to their national circumstances and security concerns.

Publication of Results of Accident and Security Incident Investigations. Following security incidents, national authorities should report the non-sensitive findings of investigations and the corrective measures taken. As an example, the U.S. Department of Energy's Office of Inspector General published the findings of its investigation into the Y-12 security incident, identifying deficiencies in communication, equipment, and procedures at the facility and issuing recommendations for addressing those deficiencies. The report was useful for nuclear operators in the United States and for those in other countries to identify lessons learned and incorporate them into their security processes.

Reporting of Information about Military Materials Security Regulations. Countries can use the Nuclear Security Summit process and other international forums (such as the United Nations Security Council Resolution 1540 [UNSCR 1540] reporting process) to publish certain details about regulations for the security of military materials. Such publications could include non-sensitive, unclassified content found within regulations, as well as the titles of regulations pertaining to aspects of military materials security. The publications would thereby demonstrate regulatory coverage of security topics such as materials control and accounting, cyber security, and transportation security.

Fulfillment of UNSCR 1540 Reporting Obligations. In their reports to the UNSCR 1540 Committee, countries with military materials should include information regarding the physical protection approaches used for military materials (for example, declaring to what extent they are applying the recommendations embedded in the 2011 International Atomic Energy Agency [IAEA] INFCIRC 225/Rev.5 to their military material stocks). Similar declarations could be released at meetings of the Nuclear Security Summit, the Global Initiative to Combat Nuclear Terrorism, or other international nuclear security forums.

Certification. Countries could build confidence by publishing information about nuclear security certification and training programs used for nuclear security personnel in their countries or by acknowledging participation in existing internationally recognized certification programs, such as the World Institute for Nuclear Security Academy. Such steps would build confidence in the effectiveness of security guard forces at nuclear facilities and could help alleviate any concerns regarding lax security.

Recommendations for Confidence Building

Bilateral and Multilateral Activities

Peer Reviews. Countries should consider participating in international nuclear security peer reviews. Managed access principles can guide the conduct of such reviews to ensure that sensitive information is protected. These reviews could offer suggestions for improving security and could include exchanges of lessons learned and best practices. Operators of nuclear facilities containing military materials also could conduct security peer reviews of each other. Such operator-to-operator peer reviews of nuclear safety are common among industry groups such as the World Association of Nuclear Operators, based in London, and the Institute of Nuclear Power Operations in the United States. Governments should create incentives for voluntary participation in peer reviews and make public the occurrence and frequency of such reviews.

Best Practice Exchanges. Best practice sharing should apply to the security of materials in civilian programs and to military materials. Because of the challenges of sharing sensitive information, best practice sharing on military materials security could be done by small groups of countries with military materials or between countries with existing relationships of trust. For example, in 2014, the United States hosted a nuclear security best practice exchange with the United Kingdom and France. Such exchanges should eventually be expanded to include other countries, including countries without military materials, to build international confidence in military materials security.

Training Exercises and Demonstrations. Countries could conduct training exercises related to military materials security, inviting participants from countries with military materials and countries without military materials as observers. Countries could also conduct joint exercises with other countries. These activities could include tabletop exercises, demonstrations, and technical exchanges. Country representatives also could use such opportunities to facilitate best practice exchanges and classroom exercises related to physical protection and material control and accounting.

Trusted Agents. When it is not possible to grant access to particular foreign nationals to review sites containing nuclear materials, confidence in the security of these materials could be developed through the use of a "trusted agent," such as someone from a host state or a trusted ally of a host state, who—by force of scientific reputation, standing, and training in security matters—could be relied on to ensure the adequacy of the host state's security.

Addressing Military Materials at the 2016 Nuclear Security Summit and Beyond

The 2016 Nuclear Security Summit offers an important opportunity for governments to deliver on commitments made at each of the previous summits for the security for all nuclear materials, including military materials. However, efforts to address military materials must continue outside of and beyond the summits. Specifically, countries could take the following steps, the first three of which can be taken at the 2016 summit:

> ***Ensure that military materials are addressed in the 2016 summit communiqué.*** Each of the past three summit communiqués has affirmed the responsibility of countries to maintain effective security for all nuclear materials, including materials inside nuclear weapons. The 2016 summit communiqué should reaffirm this commitment using a similar statement that emphasizes the importance of measures to build confidence in these materials' security.

> ***Deliver a "tailored gift basket" on military materials security.*** Countries with military materials could deliver a gift basket at the 2016 summit with a tailored approach for countries with military materials to declare security and confidence-building measures consistent with their national activities and interests. The military materials gift basket could consist of the following:

- A consensus statement reaffirming the responsibility of each state to develop and maintain appropriate effective accounting and physical protection of all nuclear materials, consistent with its obligations under UNSCR 1540
- A consensus statement committing to secure military materials to standards equivalent to or higher than those reflected in the most recent revision of the IAEA's "Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities" (INFCIRC 225/Rev.5)
- A tailored confidence-building section in which countries would describe specific steps that they are either implementing or committing to implement to secure military materials (e.g., training exercises, regulatory reforms, best practice exchanges)

At the 2016 Nuclear Security Summit, governments will have an opportunity to address military materials security as a key element in developing a sustainable, comprehensive, and effective global security system.

- ***Reflect military materials security in national statements and national progress reports.*** Countries with military nuclear materials can reaffirm the importance of military materials security in their national statements at the 2016 summit and use those statements to commit to secure their military materials to standards equivalent to or higher than those found in INFCIRC 225/Rev. 5. Such countries could also use their national progress reports to disclose steps that they are taking to build international confidence in the security of their military materials. Countries without military materials could use their national statements to declare their support for enhanced international attention to the security of military materials.

- ***Establish a multilateral technical-level working group.*** Countries with military materials already have developed tremendous experience working through bilateral and multilateral mechanisms to build confidence in military materials security, including through cooperative efforts among the United States, the United Kingdom, and France and between the United States and Russia. Countries with military materials should now consider forming a new multilateral technical-level working group, consistent with their international treaty obligations, to provide a forum for communication between representatives of organizations responsible for the security of military materials in each of these countries. The working group would allow these organizations to exchange best practices, conduct training exercises, and share lessons learned related to military materials security. The group also could invite observers from countries without military materials to observe or to participate in exercises.

Taking Action

The absence of any international standards or established confidence-building measures for military materials leaves significant gaps in global security and is a major barrier to the creation of an effective global nuclear security system. These materials represent the vast majority of the world's weapons-usable nuclear materials, and the absence of standards and confidence-building measures significantly detracts from the credibility of international efforts to strengthen nuclear security.

Policymakers should implement the recommendations described in this report for strengthening the security of military materials and building confidence in the effectiveness of their security. The 2016 Nuclear Security Summit, in particular, offers governments an opportunity to address military materials security as part of developing a sustainable, comprehensive, and effective global nuclear security system.

About the Nuclear Threat Initiative

The Nuclear Threat Initiative works to protect our lives, livelihoods, environment and quality of life now and for future generations from the growing risk of catastrophic attacks from weapons of mass destruction and disruption (WMDD)—nuclear, biological, radiological, chemical and cyber.

Founded in 2001 by former U.S. Senator Sam Nunn and philanthropist Ted Turner, NTI is guided by a prestigious, international board of directors. Joan Rohlfing serves as president.

Additional NTI Resources on Nuclear Security

The following resources can be found at *www.nti.org*

NTI Nuclear Security Index

The NTI Index, published in 2012 and 2014, assesses the security of the world's deadliest materials—highly enriched uranium and plutonium—and is recognized as the premiere resource and tool for tracking progress on nuclear security and identifying priorities.

The third edition of the NTI Index will be released in January 2016. It will assess nuclear materials security conditions in 24 countries with weapons-usable materials and 152 countries with a small amount of material or none at all. In addition, the 2016 NTI Index for the first time will assess security in 45 countries where an act of sabotage against a nuclear facility could result in a significant radiological release.

The NTI Index can be found at ***www.ntiindex.org***

Global Dialogue Papers

NTI's Global Dialogue on Nuclear Security Priorities is an international, cross-sector dialogue among leading government officials, experts, nuclear security practitioners, and other stakeholders to help shape the Nuclear Security Summit process and strengthen global nuclear materials security.

White Paper: ***Challenges and Opportunities for Strengthening the Global Nuclear Security System*** (September 2014)

Crossing the Finish Line - Ending the Civilian Use of HEU (developed for the Stanley Foundation), Miles A. Pomper and Philippe Mauger (May 2014)

Non-Paper: ***High-Level Political Engagement to Strengthen Nuclear Security Beyond 2016*** (May 2015)

Nuclear Security Primer: The Existing System (updated, May 2015)

Discussion Paper: ***Managing Stocks of Separated Plutonium to Mitigate Security Risks: Near-Term Steps***, John Carlson (May 2015)

NTI Papers

The Case for Highly Enriched Uranium-Free Zones, Andrew J. Bieniawski, Miles A. Pomper, and Elena Sokova (June 2015)

A Roadmap to Minimize and Eliminate Highly Enriched Uranium, Andrew J. Bieniawski and Miles A. Pomper (May 2015)

"Countries with military nuclear materials have a special responsibility to make sure those materials are secure against terrorists and to take actions that demonstrate the materials are secure. Sharing our experience securing those materials with one another can help all countries with military materials improve their security."

— General Patrick Charaix (Retired), Former Commander, French Strategic Air Forces

"How can we be confident that all nuclear material worldwide is safe and secure from being used to make an improvised nuclear device when 83% of that material is not covered by any internationally recognized security standards or confidence-building arrangements? This timely report recommends considered steps to fill this worrying gap in our global responsibilities for nuclear material security."

— Sir Mark Welland, Professor of Nanotechnology, Nanoscience Centre, University of Cambridge and former Chief Scientific Adviser, UK Ministry of Defence

"Senators Sam Nunn and Richard Lugar have joined together once again, this time with former U.K. Defence Minister Des Browne, to tackle a dangerous gap in our global security—the absence of any international standards or confidence-building norms around the security of 83% of the world's weapons-usable nuclear materials. I hope leaders at the next Nuclear Security Summit take note of the sensible recommendations contained in this report in their efforts to build a safer world."

— General Eugene Habiger, (U.S. Air Force, Retired), Former Commander, U.S. Strategic Command

"We live in a world where nuclear weapons are an unfortunate reality. Given the growing terrorist threat around the world, I encourage leaders at the final Nuclear Security Summit in Washington to take concrete steps and make significant progress by agreeing on ways to build confidence in the security of all weapons-usable nuclear material, not just the 17% in civilian programs."

— Tom McKane, Former Director General for Strategy and Director General for Security Policy, UK Ministry of Defence

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