

MARCH 2016

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# Global Dialogue on Nuclear Security Priorities: *Building an Effective Global Nuclear Security System*

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## SUMMARY

Despite significant progress made during the Nuclear Security Summit process, there is no global system for securing all weapons-usable nuclear materials—the highly enriched uranium and plutonium needed to build a nuclear bomb. The Nuclear Threat Initiative has convened government officials, experts, representatives from international organizations, and industry leaders since 2012 to define what a truly comprehensive and effective global nuclear security system would look like and has developed recommendations to build such a system. This paper is the culmination of this work and lays out a vision for strengthening the global nuclear security system and the steps needed to achieve it, including after the summit process ends.

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### Frequently Used Terms and Definitions

CPPNM: Convention on the Physical Protection of Nuclear Material

Global Dialogue: NTI's Global Dialogue on Nuclear Security Priorities

HEU: highly enriched uranium

IAEA: International Atomic Energy Agency

ICSANT: International Convention for the Suppression of Acts of Nuclear Terrorism

INFCIRC: IAEA Information Circular

IPPAS: International Physical Protection Advisory Service

LEU: low-enriched uranium

Mo-99: Molybdenum-99

NTI: Nuclear Threat Initiative

NTI Index: NTI Nuclear Security Index

UNSCR 1540: United Nations Security Council Resolution 1540

WINS: World Institute for Nuclear Security

This paper represents a set of recommendations informed by participants in the Nuclear Threat Initiative (NTI) Global Dialogue on Nuclear Security Priorities. Participants comprised senior government officials, experts, representatives from the International Atomic Energy Agency and the World Institute for Nuclear Security, and industry leaders. For more information on this project, visit [www.nti.org/globaldialogue](http://www.nti.org/globaldialogue).

#### **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 with 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. Sam Nunn serves as chief executive officer; Des Browne is vice chair; and Joan Rohlfing serves as president.

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The views expressed in this publication do not reflect those of the NTI Board of Directors or institutions with which they are associated.

# Foreword

By Joan Rohlfing, NTI President and Chief Operating Officer

Since its inception, the Nuclear Threat Initiative (NTI) has encouraged governments to take ambitious action to reduce global threats posed by weapons of mass destruction, including the threat of catastrophic nuclear terrorism. We know that acquiring a nuclear weapon or the nuclear-explosive material to make one is the hardest step for terrorists to take and the easiest step for us to stop. By contrast, every subsequent step in the process—building the bomb, transporting it, and detonating it—is easier for the terrorists to take and harder for us to stop. The bottom line: Securing nuclear materials at the source is the most effective, least expensive way to prevent nuclear terrorism.

In 2010, after President Barack Obama hosted the first Nuclear Security Summit in Washington, DC, NTI identified key areas in which governments had not yet begun to make sufficient progress. Despite the unprecedented attention on nuclear security and the impressive set of commitments made by states at the first summit, there was no agreement on what steps are essential for nuclear materials security, and no mechanism for tracking progress. Without a way to measure progress, there was no way to hold states accountable for implementing their summit commitments or their nuclear security responsibilities.

To help fill these gaps, NTI embarked on two parallel and complementary projects. In 2012, NTI launched the Nuclear Security Index to measure nuclear security conditions around the world. This provided a baseline against which two subsequent editions of the Index (the most recent in January 2016) have been able to track progress and identify needed actions. Importantly, the first Index also proposed a framework of key measures that all states should take to improve their nuclear materials security. One of the key recommendations in the 2012 Index was that states should begin an international dialogue to develop common “rules of the road” for how all nuclear materials should be secured globally. Given the absence of such a dialogue in official circles, NTI launched the Global Dialogue on Nuclear Security Priorities, a series of meetings convening experts and officials from 29 governments, nuclear industry, international organizations, and the nongovernmental community to build consensus on the elements of an effective and comprehensive global nuclear security system. This invaluable process helped NTI understand perspectives from a range of countries and provided a forum to work together to define and shape a set of practical solutions that would inform the Nuclear Security Summit process.

This report is the culmination of NTI’s analysis of ways to strengthen the global nuclear security system, informed by six Global Dialogue meetings and countless discussions with government officials and experts over four years. As the summit process draws to a close, we urge leaders to continue to take key steps toward building a global system and to support a continuing mechanism for engagement on this critical task after the summit process ends.

NTI thanks all the officials and experts who have participated in the Global Dialogue over the past four years, particularly those who contributed analytic papers and presentations at meetings.

This initiative and our work to prevent nuclear terrorism would not be possible without generous donations from our funders, including the John D. and Catherine T. MacArthur Foundation, the Peter G. Peterson Foundation, and the Carnegie Corporation of New York—as well as ongoing support from Warren Buffett and NTI Co-Chairman Ted Turner.

# Strengthening the Global Nuclear Security System

In 2010, world leaders gathered for the first time to collectively address the growing threat of catastrophic nuclear terrorism. Building on a commitment to securing weapons-usable nuclear materials that has already spanned the previous two U.S. presidents, President Obama in 2009 called the possibility of terrorists acquiring a nuclear weapon “the most immediate and extreme threat to global security,” warning that “[o]ne terrorist with one nuclear weapon could unleash massive destruction.” Given the threat, he called for “a new international effort to secure all vulnerable nuclear material around the world within four years.”

At that first Nuclear Security Summit, leaders launched a major initiative to lock down the more than 2,000 metric tons of weapons-usable nuclear materials then spread across the globe and to reduce stocks of plutonium and highly enriched uranium (HEU), which are the key ingredients needed to build a nuclear weapon. Since 2010, leaders from more than 50 countries have gathered in Seoul, Korea, in 2012, and in The Hague, the Netherlands, in 2014, to continue those efforts.

The summits have led to significant progress on protecting vulnerable nuclear materials from theft by terrorists seeking weapons of mass destruction and to efforts to build a robust nuclear security system. As a result of the summit process, states have strengthened their nuclear security laws and regulations, ratified key treaties, and provided financial or other assistance to states to help them secure their materials. Significantly, 11 states have eliminated all of their inventories of these dangerous materials since 2009 and others have reduced their quantities of weapons-usable materials.

Most importantly, the summits have brought unprecedented high-level political attention to the threat of nuclear terrorism and the need to secure all weapons-usable nuclear material.

In this period, however, the global threat environment has worsened. According to the results of the 2016 NTI Nuclear Security Index, progress on goals set during the summits has slowed over the last two years. Countries have taken fewer steps to improve global nuclear security, and the current global nuclear security system still has major gaps that prevent it from being truly comprehensive and effective. For instance, no common set of international standards and best practices exists, there is no mechanism for holding states with lax security accountable, and the legal foundation for securing materials is neither complete nor universally observed. In addition, 83 percent of all stocks of weapons-usable nuclear materials are categorized as “military” and remain outside existing international security mechanisms.

Without a comprehensive and effective global system in place, states’ approaches to nuclear security vary widely, creating dangerous weak links that terrorists could exploit as they seek the easiest path to weapons-usable nuclear materials. Only a common framework that holds all states accountable to the same standards can ensure that all states are effectively fulfilling their responsibility to secure their nuclear materials and facilities and to prevent an act of catastrophic nuclear terrorism.

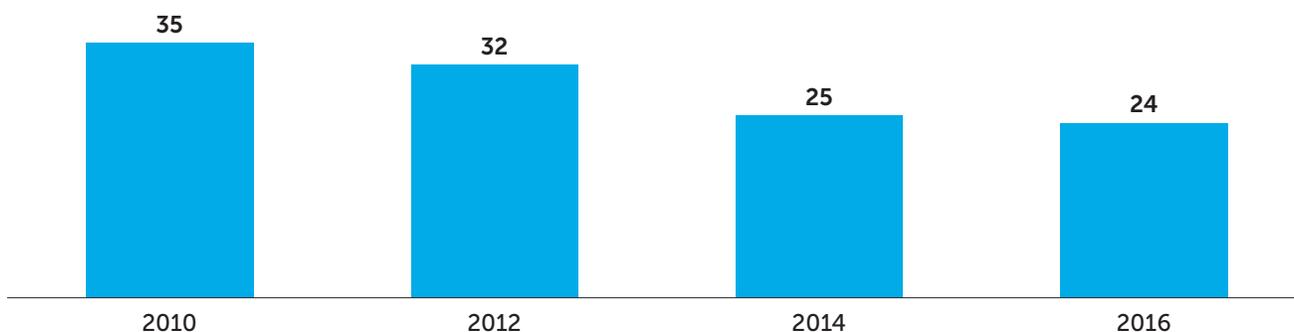
This lack of a system stands in stark contrast to other high-risk global enterprises. In international aviation, for instance, states set standards for airline safety and security through the International Civil Aviation Organization, which then audits implementation and shares concerns with member states. If airlines don’t meet the standards, states can act in the interest of their citizens and prohibit those airlines from their airports. Given the devastating global consequences of a nuclear catastrophe, states should adopt a similarly cooperative and stringent system for securing nuclear materials.

In a series of meetings called the Global Dialogue on Nuclear Security Priorities, NTI worked with senior government officials from 29 countries, representatives from the International Atomic Energy Agency (IAEA) and the World Institute for Nuclear Security, leading experts, and nuclear industry representatives to reach a consensus on the following four elements of an effective global nuclear security system.

1. **COMPREHENSIVE:** All weapons-usable nuclear materials and facilities should be covered by the system, including materials outside civilian programs (or “military materials”).
2. **STANDARDS AND BEST PRACTICES:** All states and facilities holding those materials should adhere to international standards and best practices.
3. **CONFIDENCE BUILDING:** States should help build confidence in the effectiveness of their security practices and should take reassuring actions to demonstrate that all nuclear materials and facilities are secure.
4. **MINIMIZE AND ELIMINATE:** States should work to reduce risk through minimizing or, where feasible, eliminating weapons-usable nuclear materials stocks and the number of locations where they are found.

Each of these elements, the gaps in the system, and recommendations to fill those gaps are described in detail in the following sections. For more information on the Global Dialogue on Nuclear Security Priorities, including discussion papers and meeting reports, see [www.nti.org/globaldialogue](http://www.nti.org/globaldialogue).

#### Number of Countries with One Kilogram or More of Weapons-Usable Nuclear Materials



*Note:* As of January 1 of each year listed.

# The Elements of a Global System and Current Gaps

The series of Global Dialogue meetings answered key questions such as, “What does an effective global nuclear security system look like?” and “How do we achieve it, based on the current environment?”

## COMPREHENSIVE

**All weapons-usable nuclear materials and facilities should be covered by the system, including materials outside civilian programs (or “military materials”).**

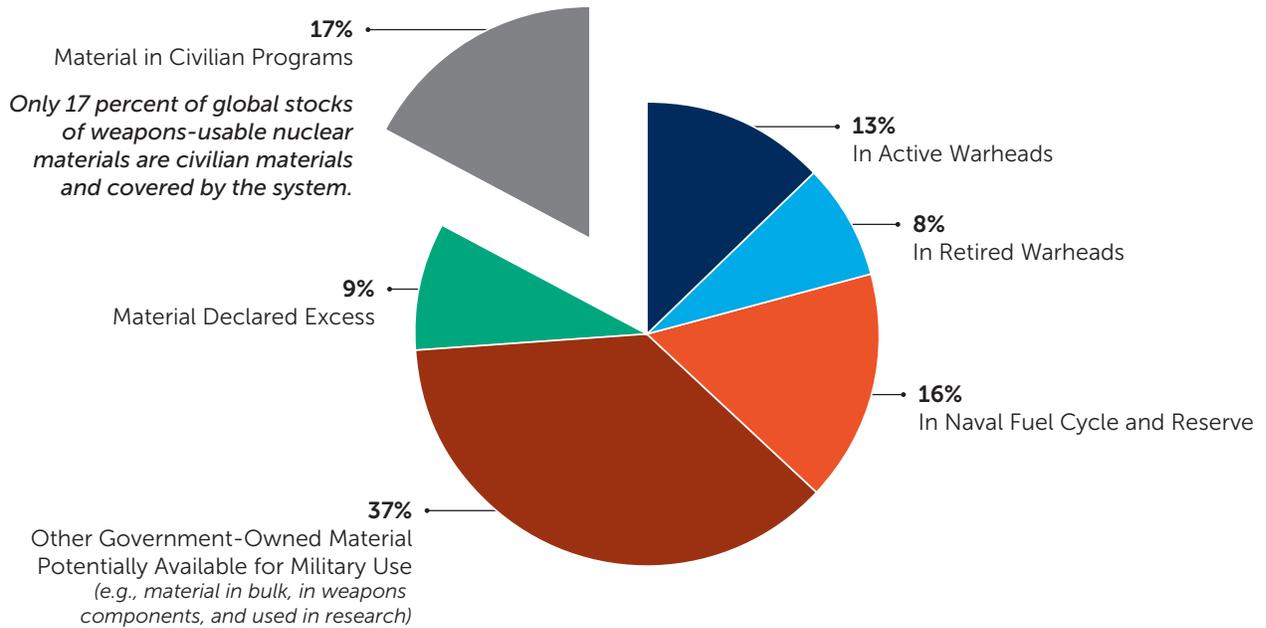
The system should cover all nuclear materials that could be used to build a nuclear bomb and nuclear facilities where sabotage could cause a major radiation release. However, 83 percent of global stocks of weapons-usable nuclear materials—those categorized as “military”—remain outside the system.

Military materials are weapons-usable plutonium and HEU 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 (i.e., not all military materials are in the form of weapons). In addition, contrary to assumptions, not all military materials fall under military custody. Depending on the country, some military materials are under civilian control and protection; other types, such as the materials inside deployed warheads, are under military control.

The five major types of military nuclear materials and estimated global distribution of all weapons-usable nuclear materials—across civilian and military applications—are presented in the chart on the next page.

Several alarming security incidents at facilities containing military materials indicate that more must be done to improve the security of military materials. The most well-known example in recent years occurred when 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—often referred to as America’s nuclear Fort Knox. 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 HEU.

**Categories of Weapons-Usable Nuclear Materials Globally  
(Estimated Percentages)**



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).

Note: As of the end of 2014, total global stocks of weapons-usable nuclear materials were estimated at 1,366 metric tons of 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.

Despite making up such a large percentage of global stockpiles and despite the need for improvement, military materials are outside the scope of current international security standards, mechanisms, and confidence-building arrangements—a serious gap in the global system. A key international agreement forming the legal foundation for nuclear materials security, the Convention on the Physical Protection of Nuclear Material (CPPNM) and its 2005 amendment, apply to nuclear materials used for peaceful purposes. The IAEA nuclear security guidelines are intended for the protection of civilian materials. Although UN Security Council Resolution 1540 requires countries to apply effective physical protection for all nuclear materials, including in nuclear weapons, it does not provide specific guidelines for doing so.

This gap in the system is extremely dangerous and undermines the credibility of efforts to secure all nuclear materials. 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. Effective global nuclear security requires that all weapons-usable nuclear materials be secured—including military materials.

**LEARN MORE**

For more on military materials, see the NTI report *Bridging the Military Nuclear Materials Gap*, available at [www.nti.org](http://www.nti.org).

## STANDARDS AND BEST PRACTICES

### All states and facilities holding those materials should adhere to international standards and best practices.

Effective nuclear security requires implementing international standards and guidelines. Employing best practices consistently and globally is a strategy for rapidly and effectively improving nuclear security practices worldwide.

#### International Standards

There is currently no common set of international standards or “rules of the road” that all states must follow to secure their weapons-usable nuclear materials because the two key mechanisms that come closest to providing international standards are not being used to their full potential. The CPPNM and its 2005 amendment is the only international legal agreement that requires countries to protect their materials. However, the CPPNM applies only to civilian materials—17 percent of global stocks—and its amendment, which significantly expands the treaty’s scope and requirements, is not yet in force.

The IAEA’s detailed nuclear security guidelines for securing nuclear materials (which are the closest thing to nuclear standards that currently exist) are voluntary and apply only to civilian materials. Moreover, newer threats to nuclear security, like the cyber threat, are only beginning to be addressed. Many countries do not yet have the capacity to develop or implement guidelines and practices to secure nuclear facilities against cyber attacks.

The current legal foundation for nuclear security also remains weak. Two important treaties are not universally observed or implemented: the CPPNM and the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT), which commits states to criminalize acts of nuclear terrorism and to cooperate in bringing those who commit such crimes to justice.

Because states are left to interpret international treaties themselves or selectively apply IAEA guidance, approaches to nuclear security vary. This situation is borne out by the results of the 2016 NTI Nuclear Security Index (NTI Index), which confirms that states have disparate approaches to nuclear security and may not have updated their legal and regulatory frameworks to follow the latest IAEA guidance. This ad hoc approach, combined with a lack of any accountability mechanism, reduces international confidence in the global system. Until all states are following a minimum set of security standards, the international community cannot have confidence that all nuclear materials and facilities are secure.

#### Best Practices

As important as international standards are the promulgation and exchange of best practices. Standards are generally established by consensus, are static, and define minimum performance requirements. Best practices, on the other hand, develop from the experience of many, are dynamic, and can be tailored to a specific set of circumstances and conditions. Standards and best practices play parallel, complementary roles in ensuring security, with standards setting a basic set of minimum responsibilities and best practices supporting a process of continuous improvement as the threat and technologies evolve. Continuous improvement is a vital component of establishing a culture of security excellence that goes beyond the minimum security requirements found in national laws and international treaties.

The World Institute for Nuclear Security (WINS) is the only international organization solely devoted to developing, exchanging, and promulgating nuclear security best practices. WINS offers a series of best practice guides on a wide range of topics and conducts workshops to gather and disseminate best practices. Best practices are transmitted informally through other mechanisms as well, such as workshops or training programs where security professionals gather from around the world, including at regional Centers of Excellence and IAEA Nuclear Security Training and Support Centers, and through peer reviews offered by the IAEA.

Although more and more countries are taking advantage of WINS and its workshops and trainings at regional Centers of Excellence, states must do more to ensure they are continuously improving their security practices through best practice exchanges and other joint activities with other countries.

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MORE**

Read the non-paper, *The Strategic Value of Best Practices for Nuclear Security*, available at [www.nti.org/globaldialogue](http://www.nti.org/globaldialogue) (October 2012 meeting).

## CONFIDENCE BUILDING

### States should help build confidence in the effectiveness of their security practices and should take reassuring actions to demonstrate that all nuclear materials and facilities are secure.

Nuclear security is a sovereign responsibility, but the consequences—security, economic, environmental, and societal—of a nuclear catastrophe would reverberate around the globe and shake public confidence in both nuclear industry and governments. All governments and the global public have an equity in how effective other governments are in meeting their security responsibilities. As a result, nuclear security becomes both a shared and a sovereign responsibility, and countries must take actions to build confidence in the security of their materials and facilities.

At the 2014 Nuclear Security Summit, countries recognized the value of taking measures “to show they have established effective security of their nuclear materials and facilities while protecting sensitive information” and identified several actions that countries could take. Despite this statement, information sharing among countries and with the public is limited, creating very little visibility into whether countries are effectively securing their nuclear materials and facilities.

For instance, 12 of 24 countries with weapons-usable nuclear materials and 9 of 23 countries without weapons-usable nuclear materials but with nuclear facilities publish both nuclear security regulations and an annual nuclear security report, according to the 2016 NTI Index. In addition, participation in other confidence-building activities, such as peer review, is still not the norm. International peer review is an evaluation of security processes or practices that uses independent, qualified reviewers from international organizations and other states to make impartial assessments and to provide recommendations for improvement. As such, peer review is an important tool for improving security performance and for building confidence about the effectiveness of a state’s security. The NTI Index found that 16 of 24 countries with weapons-usable nuclear materials have had a nuclear security peer review in the past five years. Fulfillment of international reporting obligations could also be improved: most countries have not yet submitted a required report under the CPPNM’s Article 14 and the quality of reports submitted under UNSCR 1540 varies widely.

Those limited activities mean there is little sense of accountability, even though poor security in any one state can affect all other states. Until all states regularly participate in peer reviews and share more information about their nuclear security practices, confidence that all states with weapons-usable nuclear materials and nuclear facilities have effective nuclear security will remain lacking.

**LEARN  
MORE**

For more details, see *Next Steps on International Assurances*, available at [www.nti.org/globaldialogue](http://www.nti.org/globaldialogue) (May 2013 meeting).

## MINIMIZE AND ELIMINATE

**States should work to reduce risk through minimizing or, where feasible, eliminating weapons-usable nuclear materials stocks and the number of locations where they are found.**

Minimizing or eliminating weapons-usable nuclear materials permanently reduces the risk of nuclear terrorism because the more materials and sites, the greater the exposure to the risk of theft or sabotage. Yet, today, there is no international obligation to minimize or eliminate holdings of weapons-usable nuclear materials or radioactive sources, and there is no ready way to track what states are doing in this regard, because few states disclose their holdings of these materials.

A major international program is working to phase out the civilian use of HEU and eliminate HEU holdings, but 24 countries still possess either HEU or separated plutonium for civilian use, nuclear weapons purposes, or both. Although the work to eliminate HEU from civilian use has been very successful, very little work has been accomplished to address growing stocks of separated plutonium and the challenges related to plutonium management.

More worrisome, although the number of countries with weapons-usable nuclear materials has decreased from 52 in 1991 to 24 today and overall global stocks of weapons-usable nuclear materials have decreased in recent years, trends indicate that global stocks are expected to plateau or even increase in the immediate future. This is because six states have been increasing their stocks of weapons-usable nuclear materials in the last few years (mostly increases in separated plutonium in the nuclear energy sector, but also for weapons purposes in India, North Korea, and Pakistan) and the U.S.-Russia HEU Purchase Agreement, which was responsible for a large portion of declining global stocks of HEU, ended in 2013.

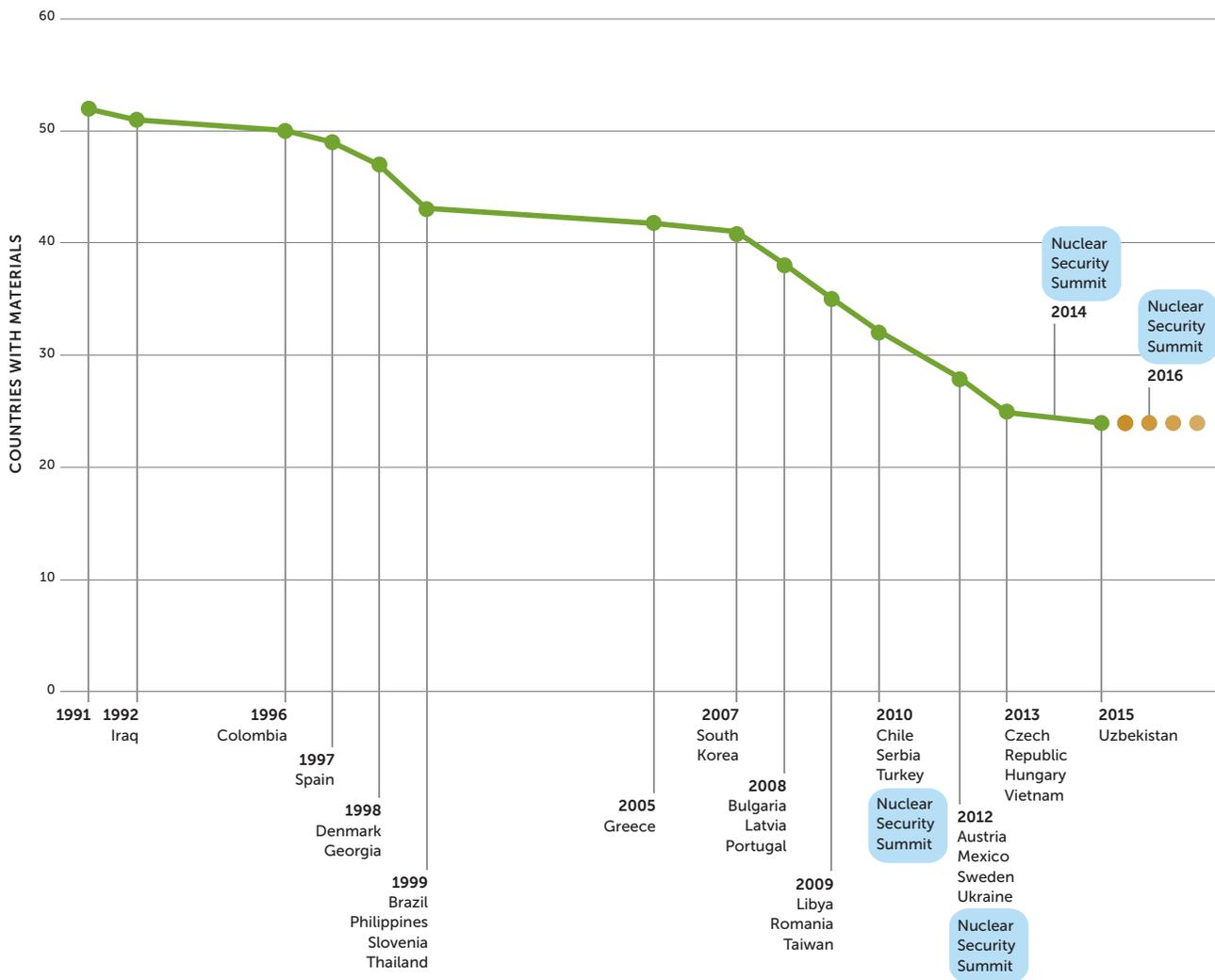
In addition, radioactive sources that could be used to build a “dirty bomb” are found in almost every country in the world in unsecured facilities such as hospitals and universities. The relevant international instrument, the Code of Conduct on the Safety and Security of Radioactive Sources, is not universal and compliance is voluntary.

As long as these dangerous materials exist, the threat of nuclear or radiological terrorism will persist. The only way to permanently reduce risk is to minimize and, where possible, eliminate those materials.

### LEARN MORE

For more detailed information on steps to eliminate HEU, see *A Roadmap to Minimize and Eliminate Highly Enriched Uranium*, and *The Case for Highly Enriched Uranium-Free Zones*, available at [www.nti.org](http://www.nti.org).

### Reduction in Weapons-Usable Nuclear Materials since 1991



Note: Since 1991, the number of countries with weapons-usable nuclear materials has been cut in half. Jamaica, which already had less than one kilogram of weapons-usable nuclear materials, also removed its materials in 2015.

# Building an Effective System

## Recommendations for Closing Gaps in the System

This section summarizes NTI's recommendations for closing gaps and building an effective, comprehensive global nuclear security system.

### Closing the Gaps on Comprehensive Coverage

At the 2014 Nuclear Security Summit in The Hague, leaders from more than 50 countries stated 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.

To identify steps to turn this declaration into action, NTI convened a high-level Military Materials Security Study Group to examine the issue of military materials security. The Study Group included 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, NTI identified steps that governments should take to reduce the risk of nuclear terrorism by (a) strengthening the security of military materials, (b) building confidence in the security of these materials while protecting sensitive information, and (c) 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.

One of the key recommendations of both the Global Dialogue process and the Study Group was that countries with military materials should secure military materials to the same or higher standards as those that apply to comparable civilian materials, including through applying standards and best practices that are at least consistent with the IAEA nuclear security guidelines.

### ***Strengthening the Security of Military Materials***

The following recommendations for strengthening the security of military materials are organized by three principles: (a) accountability, (b) risk management and minimization, and (c) continuous improvement:

<b>Accountability</b>	<ul style="list-style-type: none"> <li>• Build a strong security culture.</li> <li>• Ensure independent national oversight for those with nuclear security responsibilities.</li> <li>• Establish clear roles and responsibilities.</li> </ul>
<b>Risk Management and Minimization</b>	<ul style="list-style-type: none"> <li>• Conduct and evaluate security measures against comprehensive threat assessments.</li> <li>• Put in place effective material control and accounting measures.</li> <li>• Apply the principle of defense-in-depth.</li> <li>• Protect against cyber threats.</li> <li>• Secure nuclear material in transport.</li> <li>• Minimize materials quantities and the number of sites they are located, where feasible.</li> </ul>
<b>Continuous Improvement</b>	<ul style="list-style-type: none"> <li>• Perform realistic training and exercises.</li> <li>• Ensure personnel are trusted, certified, and well-equipped.</li> <li>• Conduct performance tests and update threat assessments.</li> </ul>

### ***Building Confidence in the Security of Military Materials***

Nuclear security is a sovereign responsibility, especially when it comes to military materials. Because the consequences of a nuclear catastrophe—security, economic development, and societal—would be global in scope, each country has a legitimate interest in how effectively other countries are meeting their security responsibilities. However, the need for transparency must be balanced with ensuring effective security and protecting sensitive information.

States can achieve that balance through the following steps for increasing confidence in the security of military materials. Actions countries choose to take would depend on the sensitivity of the nuclear material and the type of personnel responsible for those materials.

<b>Unilateral Activities</b>	<ul style="list-style-type: none"> <li>• Declaring aggregate data on materials quantities, as appropriate to national circumstances and security concerns.</li> <li>• Publishing non-sensitive results of accident and security incident investigations.</li> <li>• Reporting information about military materials security regulations.</li> <li>• Fulfilling UNSCR 1540 reporting obligations.</li> <li>• Publishing information about nuclear security certification and training programs.</li> </ul>
<b>Bilateral and Multilateral Activities</b>	<ul style="list-style-type: none"> <li>• Conducting international nuclear security peer reviews.</li> <li>• Exchanging best practices.</li> <li>• Conducting training exercises and demonstrations related to military materials security.</li> <li>• Using trusted agents to review security.</li> </ul>

Providing confidence to others regarding the protection of military materials can (a) improve security; (b) deter terrorists; (c) increase domestic and international confidence; (d) enhance credibility; and (e) ensure the sustainability of nuclear energy.

### ***Strengthening the System to Cover Military Materials***

Efforts to address military materials must continue beyond the summits. One recommendation is for countries with military materials to consider forming a new multilateral technical-level working group, consistent with their international treaty obligations. This forum would ensure communication among representatives of organizations responsible for the security of military materials in each of these countries to exchange best practices, conduct training exercises, and share lessons learned related to military materials security. Past U.S.-Russia cooperation demonstrates that cooperation around military materials is indeed possible.

#### **LEARN MORE**

For the composition of the Study Group and a full set of recommendations, read NTI's report, *Bridging the Military Nuclear Materials Gap*, available at [www.nti.org](http://www.nti.org).

### **Closing the Gap on Standards and Best Practices**

#### ***Improving Standards***

A vital first step to improve standards would be for all states to become parties to the Convention on the Physical Protection of Nuclear Material (CPPNM) and the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT). In particular, they must work to bring the 2005 amendment to the CPPNM into force. States should also commit to implement, at a minimum, IAEA nuclear security guidance or equivalent measures. At the 2014 Nuclear Security Summit, 35 states signed the Joint Statement on “Strengthening Nuclear Security Implementation,” through which they committed to implement IAEA nuclear security guidance and to engage in actions to continuously improve their national nuclear security regimes, such as peer review. By signing that initiative, those states agreed to go beyond their existing international legal obligations, demonstrating a high level of ambition toward strengthening global nuclear security. In October 2014, the 35 states requested that the Joint Statement be circulated by the IAEA Secretariat as an IAEA Information Circular. It became INFCIRC/869 and is now open for all IAEA member states to join.

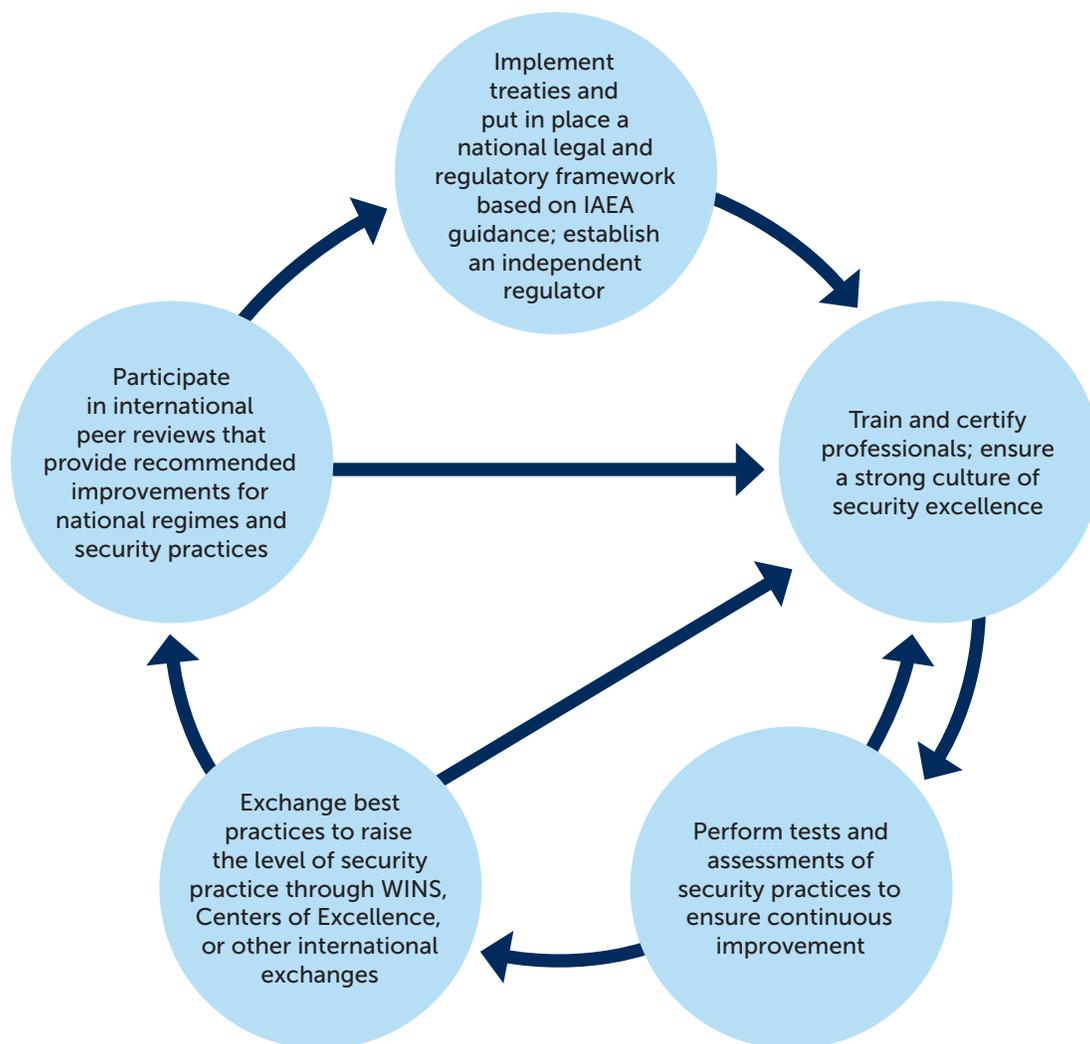
#### ***Exchanging Best Practices***

In addition to following a minimum set of standards, states should also ensure they are continuously improving the level of security practice through best practice exchanges. The international community has also authoritatively established the value of best practices for rapid and effective security improvement. The 2014 Nuclear Security Summit communiqué “encourage[d] States, regulatory bodies, research and technical support organisations, the nuclear industry and other relevant stakeholders, within their respective responsibilities, to . . . share good practices and lessons learned at [the] national, regional and international level.” Although sharing best practices has helped increase standards of security in many places, more work should be done to expand sharing and implementation of best practices and to garner political and financial support for these activities. States should take advantage of offerings by WINS, regional Centers of Excellence and IAEA Nuclear Security Training and Support Centers, and other joint activities through which they can learn and share best practices and continuously raise their level of security practice.

### *Achieving a Common Approach*

By ratifying and fully implementing important international legal agreements, committing to implement IAEA nuclear security guidance through INFCIRC/869 or otherwise, and increasing participation in international best practice exchanges through WINS and other fora to ensure continuous security improvement, the international community can move closer toward the goal of adhering to a common set of international security guidelines and best practices that all states apply.

#### **Recommended Steps to Implementing Standards and Best Practices**



## Closing the Confidence Gap

In an effective global system for securing nuclear materials, words alone are not enough to give states confidence in one another's security practices. States must instead take steps to build the confidence of others in their security and be held accountable for their commitments, while protecting sensitive information.

States can build confidence in their security through activities, information sharing, or other voluntary measures that build the confidence of others (other governments, a designated international organization, the public, etc.) about the effectiveness of nuclear security within a given state. Confidence building can occur unilaterally, bilaterally, or multilaterally. Reassuring actions or confidence-building measures, sometimes called "assurances," do not require a treaty or convention, are not negative security assurances, are not necessarily linked to disarmament, are not verification or inspections, and are not disclosure of locations of nuclear materials or sensitive specifics of security practices. In fact, confidence-building mechanisms are widely used across many industries, including those involving sensitive information (nuclear safety, aviation, shipping, etc.). There is also broad experience through current and past activities (notably through U.S.-Russia cooperation) that provides lessons on how states can build confidence in the effectiveness of their security, while protecting sensitive information.

Building confidence in nuclear security can enhance a country's credibility when it discusses nuclear security issues. This credibility in turn can have a potential deterrent effect on terrorists by dissuading them from attempting to stage an attack against a nuclear facility. It can also restore and maintain public trust in the safety and security of nuclear energy, ensuring public support for the nuclear energy enterprise. Some confidence-building activities, such as sharing best practices, engaging in peer review, and sharing information regarding legal and regulatory frameworks, can also help all states improve their security.

Peer review, in particular, is an important tool for improving security performance and for building confidence in the effectiveness of a state's security, and this practice should be universalized. The IAEA provides a full suite of peer review services, including International Physical Protection Advisory Service (IPPAS) missions, which assess a country's nuclear security regulations and measures. More resources should be provided to the IAEA to meet additional demand for these peer reviews.

The chart below shows several options that are available to countries, some of which were noted in the 2014 Nuclear Security Summit communiqué language on confidence building:

<b>Peer Review</b>	<ul style="list-style-type: none"> <li>• IAEA peer reviews, such as IPPAS missions.</li> <li>• Bilateral or multilateral peer reviews between and among countries.</li> <li>• Corporate governance peer reviews.</li> </ul>
<b>Information Sharing and Reporting</b>	<ul style="list-style-type: none"> <li>• CPPNM, Article 14.1 report.</li> <li>• UNSCR 1540 report.</li> <li>• Publishing broad outlines of laws and regulations and/or an annual nuclear security report.</li> </ul>
<b>Best Practice Sharing</b>	<ul style="list-style-type: none"> <li>• Sharing WINS best practices.</li> <li>• Sharing bilateral or multilateral best practices among states with similar materials and facilities.</li> <li>• Conducting joint workshops and table top exercises.</li> </ul>
<b>Bilateral Cooperative Measures</b>	<ul style="list-style-type: none"> <li>• Providing bilateral nuclear security assistance.</li> <li>• Creating cooperation agreements.</li> </ul>
<b>Declarations</b>	<ul style="list-style-type: none"> <li>• Declaring aggregate data on nuclear materials stocks.</li> </ul>
<b>Training and Certification</b>	<ul style="list-style-type: none"> <li>• IAEA Nuclear Security Support Centers and Centers of Excellence.</li> <li>• WINS Academy training and certification.</li> <li>• National training and certification programs.</li> </ul>

**LEARN MORE**

For more detailed information on this concept, see the discussion paper, *Next Steps on International Assurances*, available at [www.nti.org/globaldialogue](http://www.nti.org/globaldialogue) (May 2013 meeting).

### Closing the Gap on Minimization and Elimination

All states should do more to reduce the risk posed by stocks of weapons-usable nuclear materials and radiological materials. States should minimize their use of those dangerous materials in civilian energy programs, and they should reduce or eliminate stocks of those materials where possible.

#### *Highly Enriched Uranium*

The use of HEU, a central ingredient needed to build a bomb, should be ended wherever possible for civilian purposes, and production for such purposes should cease where it is still occurring. Since 1992, the international community has removed and eliminated thousands of kilograms of HEU, converted HEU-fueled reactors to use low-enriched uranium (LEU), which is not weapons-usable, and promoted the adoption of LEU alternatives for medical isotope production. Although most HEU is designated for nuclear weapons purposes, significant amounts remain in civilian programs and non-weapons applications.

Given that nearly all civilian and naval applications of HEU fuel have proven LEU alternatives, the international community must take steps now to accelerate efforts to minimize—and ultimately eliminate—HEU in the civilian and naval spheres. States should commit to a roadmap for eliminating civilian and naval HEU through (a) HEU reactor conversions or shutdowns, (b) HEU fuel removals, (c) LEU alternatives for medical isotope production, (d) developing LEU naval fuels, and (e) HEU downblending.

To implement these commitments, countries should focus on five pathways toward the elimination of HEU for civilian use and the minimization of HEU for naval use.

### Five Pathways toward the Elimination and Minimization of HEU

Pathway	Objectives
HEU Reactor Conversions and/or Shutdowns	<ul style="list-style-type: none"> <li>• Develop conversion pathways for the remaining six civilian HEU reactors in the United States.</li> <li>• Accelerate reactor conversions in Africa, Asia, Canada, Europe, and the Middle East. Develop a conversion, shutdown, and replacement plan or a combination of these for Russia’s 63 HEU facilities.</li> </ul>
HEU Fuel Removals	<ul style="list-style-type: none"> <li>• Continue HEU fuel repatriation to the United States and Russia, particularly from Belarus, Canada, Japan, and Poland.</li> <li>• Build international momentum for development of HEU-free regions, particularly in Africa, Europe, Latin America, the Middle East, and Southeast Asia.</li> </ul>
LEU Alternatives for Medical Isotope Production	<ul style="list-style-type: none"> <li>• Convert to LEU targets, or verify the shutdown of remaining HEU-based Molybdenum-99 (Mo-99) production facilities in Belgium, Canada, the Netherlands, Russia, and South Africa.</li> <li>• End subsidies for Mo-99 production that create barriers for new firms getting into the market.</li> <li>• Accelerate medical approval for non-HEU-based Mo-99 in Europe.</li> </ul>
Naval Reactors	<ul style="list-style-type: none"> <li>• Address gaps in the current system that allow states to produce weapons-grade HEU for naval reactors or to lease HEU-fueled vessels.</li> <li>• Accelerate research, analysis, testing, and prototyping for LEU naval fuels and reactor designs that meet key operational requirements.</li> </ul>
HEU Downblending	<ul style="list-style-type: none"> <li>• Accelerate efforts to downblend HEU stocks already declared excess, and continue to identify additional HEU stocks to be declared excess and downblended.</li> <li>• Encourage countries to establish national timetables for HEU downblending and to create a reporting mechanism to track progress.</li> </ul>

To consolidate achievements in eliminating HEU, states should also consider creating regional HEU-free regions that would cement a global norm against civilian HEU use in much the same way that nuclear-weapon-free zones have strengthened global non-proliferation and disarmament efforts.

**LEARN MORE** For more detailed information on steps to eliminate HEU, see *A Roadmap to Minimize and Eliminate Highly Enriched Uranium*, and *The Case for Highly Enriched Uranium-Free Zones*, available at [www.nti.org](http://www.nti.org).

## Plutonium

States with plutonium stocks should focus in the near term on prudent management practices for minimizing the security risks from the way plutonium is handled—that is, produced, stored, processed, transported, and used. States should also work to keep their stocks of separated plutonium to minimum levels, thereby adhering to a policy of keeping new plutonium production in balance with consumption in any given cycle. In the long term, states must grapple with the challenge of how to consume or dispose of accumulated stocks of separated plutonium and must explore alternative technologies to reprocessing.

### LEARN MORE

For more detail on both the challenges and near-term and long-term options for management of separated plutonium, see *Managing Stocks of Separated Plutonium to Mitigate Security Risks: Near-Term Steps*, available at [www.nti.org/globaldialogue](http://www.nti.org/globaldialogue) (May 2015 meeting).

## Radiological Sources

To date, only 23 countries have agreed to secure their highest activity sources by a specific date. Additional countries should take steps to either secure or replace their radiological sources. All states with radiological sources should commit to and implement the Code of Conduct on the Safety and Security of Radioactive Sources. States should also consider developing a legally binding convention on radiological security to strengthen the international legal architecture. Countries should also accelerate the development and use of alternative technologies. For some isotopes, such as the use of cesium in blood irradiators, effective alternate technologies are currently available, such as x-ray devices, which cannot be used to make a dirty bomb. Hospitals and other medical facilities should replace their existing cesium blood irradiators with such Food and Drug Administration-approved alternate technologies. For other applications, research should be accelerated to develop effective replacement technologies.

### LEARN MORE

For more detail, see *Radiological Security Progress Report: Preventing Dirty Bombs—Fighting Weapons of Mass Disruption*, available at [www.nti.org](http://www.nti.org).

## Ensuring Progress on Nuclear Security

No matter how many actions are taken at the upcoming Nuclear Security Summit, the job of securing all weapons-usable nuclear materials and of building an effective global nuclear security system will be far from finished. To be successful, the 2016 Nuclear Security Summit must put a process in place to continue building an effective global system for assurance, accountability, and action after the summits end.

Sustained political leadership is needed to ensure that a terrorist can never use a nuclear weapon or cause the dispersal of radioactive material through sabotage or a dirty bomb. If the summits end without a mechanism to enable continued progress and to ensure implementation of existing commitments, the international community risks seeing efforts to strengthen nuclear security languish or, worse, backslide. The 2016 summit should make defining a path to sustain momentum and high-level attention a priority outcome. Doing so will ensure that collective efforts to strengthen the global nuclear security system and to reduce the threat of nuclear terrorism do not fade after the summit process ends.

In addition to sustained leadership, the United States and Russia, which together possess the vast majority of the world's nuclear materials and weapons, have a special responsibility to lead. Those two countries must look beyond their differences and work together to prevent terrorists from getting these dangerous materials.

The following recommendations provide a path to sustain high-level political attention on and ensure implementation of nuclear security after the summit process ends.

## A Core Group Must Drive Progress

A core group of countries must keep nuclear security high on international and national agendas through continued meetings focused on an ambitious program. Doing so will allow states to continue building consensus on a global nuclear security system, assess implementation of nuclear security commitments, serve as a forum for reporting and accountability, and provide opportunities for new individual and joint commitments. This group could comprise all or a subset of the 35 countries that signed the Joint Statement on “Strengthening Nuclear Security Implementation” at the 2014 summit (and published as IAEA INFCIRC/869 in 2014).

## A Vehicle Is Needed to Ensure Long-Term Attention and Accountability

In addition to the leadership provided by the core group, states will need a way to sustain high-level attention on nuclear security in the long term. The CPPNM provides a mechanism for regular review conferences at intervals of at least five years. The stated purpose of the CPPNM’s review conference mechanism is to review the implementation of the CPPNM and “its adequacy as concerns the preamble, the whole of the operative part and the annexes in the light of the then prevailing situation.” Apart from the mandatory review conference that was held in 1992, five years after the CPPNM’s entry into force, the review conference mechanism has never been exercised. However, it could provide the legal basis and structure to serve as a framework for progress after the summit, particularly after the 2005 amendment to the CPPNM enters into force, which will trigger a mandatory review conference after five years.

The CPPNM review conference provision provides the flexibility necessary to address a broad range of nuclear security topics, including the security of military materials, and it brings to the conversation a broader group of states than those at the summits. However, this mechanism will be used to good effect only if states choose to do so, because it requires a majority of states that are party to the CPPNM to request a meeting. The core group of states that drives the process after the 2016 summit will need to push so that the CPPNM can meet its full potential as a vehicle for continued progress.

## The IAEA’s Central Role Must Be Strengthened

The IAEA must be strengthened so that it can enhance its already central role in nuclear security through its Nuclear Security Series recommendations and guidance, through IAEA services (such as peer review), through training programs and workshops, and through its Nuclear Security Conferences. As the depositary for the CPPNM, the IAEA will also play an important role in international discussions to strengthen global nuclear security by serving as the designated convener of regular CPPNM review conferences.

## States Must Prioritize National Resources to Support Nuclear Security

To support sustained high-level political attention and action on nuclear security after the summits end, each state should ensure that it has an office to coordinate and track nuclear security efforts and should provide political support, staff, and financial resources to that office to ensure that its work remains a top priority and that it can properly coordinate activities within and between governments.

### LEARN MORE

For more detail on NTI’s recommendations to sustain high-level political attention on nuclear security, see the non-paper, *High-Level Political Engagement to Strengthen Nuclear Security Beyond 2016*, available at [www.nti.org/globaldialogue](http://www.nti.org/globaldialogue) (January 2016 meeting). For more detail on how the CPPNM review conference mechanism could provide a path forward for further progress after the summit process ends, see Jonathan Herbach and Samantha Pitts-Kiefer, “More Work to Do: A Pathway for Future Progress on Strengthening Nuclear Security,” *Arms Control Today*, October 2015, p. 8, available at [www.armscontrol.org](http://www.armscontrol.org).

## Looking Forward

This paper provides the framework and recommendations for building an effective, comprehensive global nuclear security system. Although progress has been made in recent years in part due to the Nuclear Security Summits, there is still no such global system. It is therefore vital that efforts to fill gaps in the system continue. As the threat of nuclear terrorism continues to evolve with new actors and new threats emerging, countries cannot rest upon the progress that has already been made. As long as nuclear materials and facilities exist and the terrorist threat remains, the cooperative work needed to prevent nuclear terrorism must continue. Although the 2016 summit will be an important milestone, it must not mark the end of high-level attention on nuclear security. Instead, the upcoming summit provides a final window of opportunity for countries to agree on a path for continued nuclear security progress in a new phase of strengthened and lasting international cooperation.

## Authors

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