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The Global Nuclear Security Architecture: Closing Gaps to Build Greater Assurance, Accountability, and Action

SUMMARY

Over the past two decades, important steps have been taken to strengthen global nuclear security, but they have not yet led to the creation of a comprehensive global nuclear security architecture that is adequate to the evolving risks of nuclear terrorism and the enormous consequences that would result. The tools to do so exist but addressing these challenges and building on progress already made requires sustained political attention and resources on nuclear security. Yet, in the wake of the Nuclear Security Summits held between 2010 and 2016, attention on nuclear security has waned. Governments must take action now to place nuclear security at the top of their agendas. This paper draws from the NTI Global Dialogue on Nuclear Security Priorities and findings from the 2020 NTI Nuclear Security Index to provide an overview of today's nuclear security architecture, identify areas of weakness, and recommend ways to close gaps.

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Foreword

Over the past two decades, positive steps have been taken to strengthen global nuclear security. Two major treaties—the International Convention for the Suppression of Acts of Nuclear Terrorism and the amendment to the Convention on the Physical Protection of Nuclear Material were adopted and have entered into force. New international initiatives and forums like the Global Initiative to Combat Nuclear Terrorism, the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction, and the World Institute for Nuclear Security have become hubs for education, awareness, and capacity building; development and sharing of best practices; and sources of assistance. The International Atomic Energy Agency (IAEA) has increasingly taken on a central role coordinating activities and providing nuclear security assistance, with greater acceptance of its role on nuclear security. Countries are doing more to cooperate with one another bilaterally, through Centers of Excellence, through programs at the IAEA, the United Nations (UN), INTERPOL, or the European Union. And countries have taken countless individual actions to strengthen their domestic nuclear security regimes and reduce or eliminate stocks of materials. In fact, the number of countries with weapons-usable nuclear materials has decreased from 32 in 2012 to 22 today, permanently removing the risk that those materials could be stolen and used to detonate a nuclear bomb.

But the actions taken so far, despite representing significant progress, have not yet led to the creation of a comprehensive global nuclear security architecture that is adequate to the evolving risks of nuclear terrorism and the enormous consequences that would result in terms of loss of life, health risks, damage to the environment, economic costs, or reduced public confidence in the continued use of peaceful nuclear technology. Countries still hesitate to take what they deem politically sensitive actions or to share information about nuclear security measures or their quantities of materials. There is still complacency among many countries about nuclear risks and a lack of urgency and understanding that all countries must play a role in nuclear security to close dangerous weaknesses in the system—whether physical protection, border protection, criminalization, prosecution, or the many other actions necessary to prevent an act of nuclear terrorism. The IAEA still does not have the necessary political support and budget to fully realize its potential to strengthen global nuclear security. There are still major regulatory and capacity gaps around the world, which means that nuclear materials continue to be vulnerable to theft, smuggling, or other misuse. And the number of countries eliminating their materials has stalled.

Terrorist groups will continue to be interested in acquiring or building weapons of mass destruction and their sophistication and capabilities, whether financial or technological, will likely continue to grow, including through the use of cyberattacks. If governments are to stay ahead of these threats, they must take urgent action.

We have the tools to do so but addressing these challenges and building on the progress that has already been made requires sustained political attention and consistent prioritization of focus and resources on nuclear security. Yet, after a period of enhanced focus during the Nuclear Security Summits that were

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held between 2010 and 2016, attention on nuclear security has waned, leading to a slowing of progress on nuclear security. Governments must take action now to place nuclear security at the top of their agendas.

This paper draws from dialogue within the NTI Global Dialogue on Nuclear Security Priorities and the findings of the 2020 NTI Nuclear Security Index to provide an overview of the current nuclear security architecture, identify areas of weakness, and recommend how to close gaps.

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Introduction

Because nuclear security requires global solutions, the network of national measures, international legal agreements, and voluntary initiatives that form the basis of a comprehensive and effective global architecture depends on broad participation.

In the absence of a comprehensive and effective architecture, progress that countries have made to reduce the risks of theft and sabotage will be in jeopardy, and countries will find it challenging to build on that progress going forward. Today, countries' 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 give assurance that all countries are effectively fulfilling their sovereign responsibility to secure their nuclear materials and facilities to prevent an act of catastrophic nuclear terrorism and thereby preserve the benefits of peaceful nuclear use.

The 2020 NTI Nuclear Security Index's (NTI Index) findings highlight the limitations of the current patchwork of individual states' domestic regulations and policies, informal groups of countries voluntarily working together to enhance certain aspects of nuclear security, and more formal binding treaties and international organizations that make up the global nuclear security architecture.

This patchwork reflects an ongoing lack of political will to effectively connect these elements and to empower multilateral structures. Countries must do more to close gaps and support, contribute to, and participate in efforts to bolster the global nuclear security architecture.

A truly effective global nuclear security architecture includes the following characteristics:

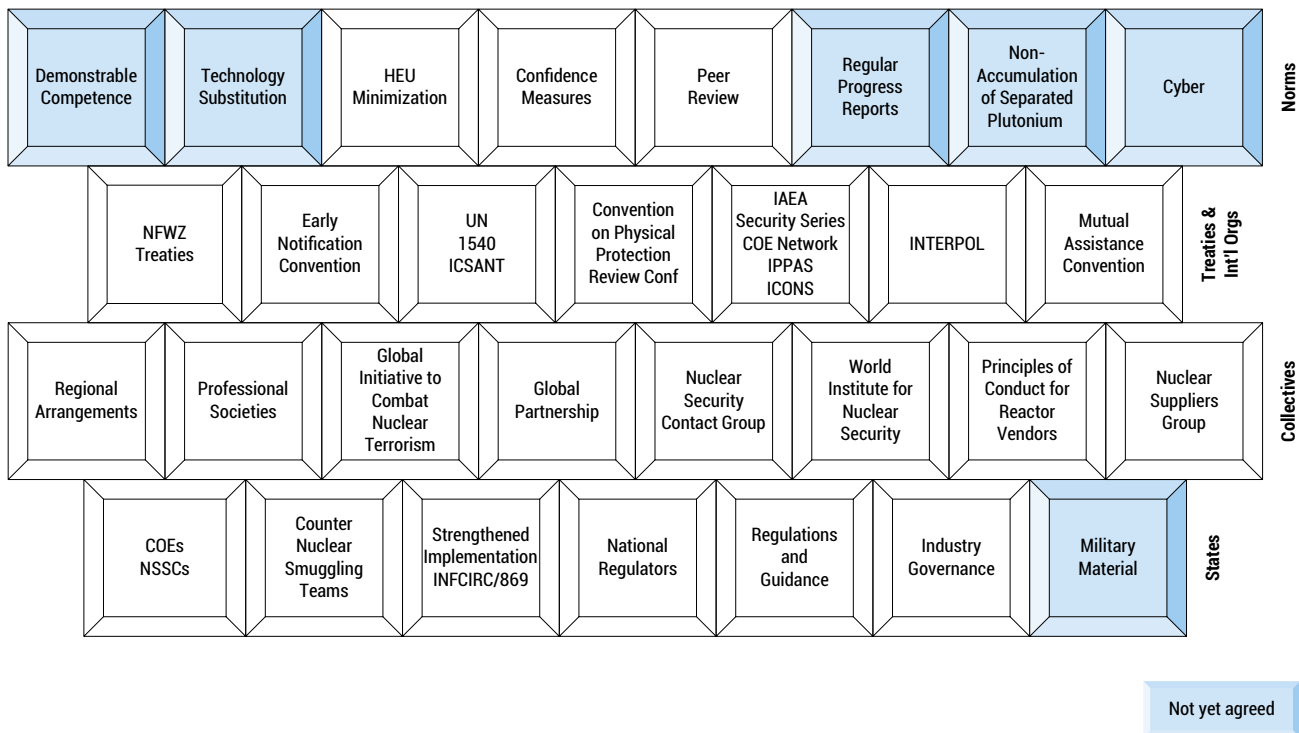
1. **Comprehensive:** All weapons-usable nuclear materials and facilities should be covered by the system, including materials outside civilian programs (or "military materials").
2. **Standards and Best Practices:** All states and facilities holding weapons-usable nuclear materials should adhere to 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.

This paper assesses the overall strength of the global nuclear security architecture by examining these characteristics to identify gaps and recommend a path for closing these gaps.

Today's Multi-Layered Nuclear Security Architecture

Today's four-layered global nuclear security architecture—made up of states, collectives, treaties and international organizations, and norms—is the result of decades of efforts to manage the global risks associated with nuclear materials while preserving sovereign control (see Figure 1). As a result, it is an uneven accumulation of actions and commitments, some binding but most voluntary, some universal and others more limited, often overlapping and interconnected, but far from complete.

Figure 1: The Global Nuclear Security Architecture



Note: Additional elements of the architecture may emerge as it moves toward a more coherent whole.

States

Fundamentally, nuclear security is handled at the national level, reflecting the sole responsibility of the state for the security of its own nuclear materials and nuclear facilities. Elements of state-level nuclear security systems include national laws, regulators and the regulations and guidance they promulgate, the governance systems of nuclear facility operators (whether public or private), and Nuclear Security Support Centers and other institutions that train domestic and international nuclear security experts and practitioners. Organizations and activities related to protecting borders and countering nuclear smuggling also exist at the national level.

The security of military nuclear materials—weapons-usable plutonium and highly enriched uranium (HEU) found outside civilian nuclear programs—is managed at the national level, but in most cases, military nuclear materials are isolated from international cooperative efforts and engagement, unlike the international cooperation that is prominent in efforts to secure and minimize civilian nuclear materials.

Collectives

National systems are the foundation for nuclear security, but they are supplemented by voluntary and informal groups of countries or organizations working to enhance global nuclear security through cooperation, assistance, capacity building, and other types of positive engagement. Collectives of governments include the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction (Global Partnership), the Global Initiative to Combat Nuclear Terrorism (GICNT), the Nuclear Security Contact Group, the Nuclear Suppliers Group (NSG), and other bilateral and regional cooperative arrangements.

In addition to government collectives, the system is bolstered by professional societies for nuclear security experts and practitioners such as the Institute for Nuclear Materials Management (INMM) and the International Nuclear Security Forum (formerly the Fissile Materials Working Group); organizations like the World Institute of Nuclear Security (WINS), which develops best practice guides and offers training and professional certification through the WINS Academy; and other groups that develop industry or governance principles, such as the adherents to the Principles of Conduct for Reactor Vendors.

Treaties and International Organizations

Although national laws and regulations guide national action, they are enhanced, and sometimes driven by, international obligations and commitments.

The IAEA is at the center of international efforts to strengthen global nuclear security. The IAEA's organizational mission has evolved to include nuclear security, with its nuclear security activities and responsibilities expanding over time; today the IAEA supports national level actions through:

- promulgating nuclear security guidance and recommendations, which countries can adopt voluntarily;
- offering training and workshops on nuclear security topics to build global capacity;
- conducting peer reviews of countries' national nuclear security regimes (e.g., national legal structures, laws, and regulations) and practices and providing recommendations for improvement;
- providing assistance to countries as they adopt nuclear technologies for peaceful purposes;
- coordinating Centers of Excellence and Nuclear Security Support Centers, which provide national and regional training opportunities;
- hosting major nuclear security conferences; and
- serving as a depositary for the foundational nuclear security treaty, the Convention on the Physical Protection of Nuclear Material (CPPNM), both in its original form and as amended.

The United Nations also plays a role in the international architecture, particularly through the 2004 United Nations Security Council Resolution (UNSCR) 1540, which obligates states to protect chemical, biological, nuclear, and radiological weapons and materials from terrorist use, and through INTERPOL's Radiological and Nuclear Terrorism Prevention Unit.

Several treaties relevant to nuclear security also contribute: the amended CPPNM, which is the only legally binding international agreement that requires countries to provide physical protection to nuclear materials and nuclear facilities; the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT), which provides the legal basis for international cooperation on criminalization and prosecution of actions that could result in nuclear terrorism; the Convention on Early Notification of a Nuclear Accident, which establishes a notification system for nuclear accidents from which a release of radioactive material occurs or is likely to occur; and the Convention on Assistance in the Case of a Nuclear Accident, which provides a framework for international cooperation among states parties and the IAEA to facilitate assistance in response to nuclear accidents.

Support for the International Atomic Energy Agency

The IAEA plays an important role in strengthening global nuclear and radiological security. It provides crucial nuclear security assistance to member states and helps coordinate international efforts. Support for the IAEA's role in nuclear security has grown in recent years but is still not as robust as its role in nuclear safeguards, nuclear safety, or development assistance.

Misplaced Competition for Resources

The IAEA's assessed budget for nuclear security has increased slightly in recent years, but it still relies on unpredictable voluntary contributions to its Nuclear Security Fund from member states who are concerned about nuclear terrorism and want to support the IAEA's nuclear security activities. Financial contributions to the Nuclear Security Fund enable the IAEA to provide assistance, host workshops and training, and conduct peer reviews. Financial contributions often are earmarked for particular projects, which hinders the IAEA's ability to prioritize resources and plan for the long term. In addition, some states worry that increasing the IAEA's assessed budget for nuclear security will decrease the resources available for development assistance, which is funded by the IAEA's Technical Cooperation budget. Countries focused on gaining the benefits of peaceful nuclear technology, whether to provide reliable energy, life-extending medical treatment, or opportunities for scientists, want the IAEA to prioritize technical cooperation and assistance.

A zero-sum approach to the IAEA's activities limits its ability to fulfill its nuclear security mission. These interests do not have to conflict and should instead be mutually reinforcing. An act of nuclear terrorism anywhere will have global consequences and could have a negative effect on the public's perception—and acceptance—of peaceful use of nuclear material and technology. The IAEA and member states supportive of its nuclear security mission should reinforce the positive link between nuclear security and countries' continued ability to benefit from peaceful use, and the IAEA's important role in both technical cooperation and nuclear security.

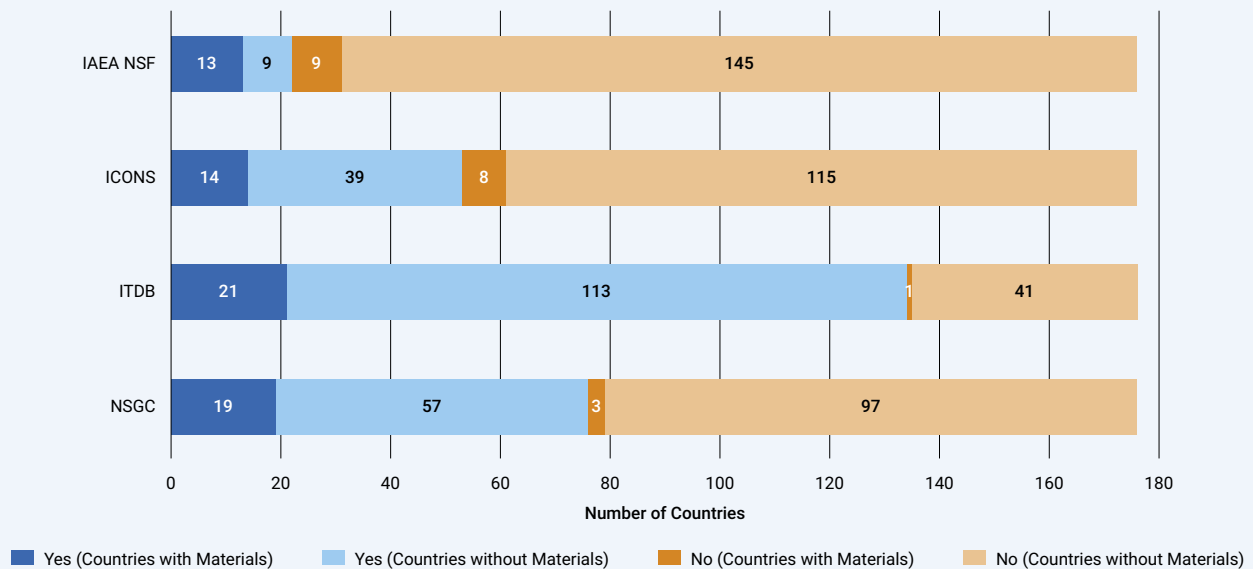
The IAEA and the NTI Index

To reflect the important role the IAEA plays in nuclear security, the 2020 NTI Index included new questions about countries’ support for the IAEA’s nuclear security activities. In addition to existing questions asking whether a country has made a **financial or in-kind contribution to the IAEA’s Nuclear Security Fund (NSF)** in the past two years and whether a country has hosted an International Physical Protection Advisory Service (IPPAS) mission, the Index also now measures whether countries participate in the following:

- **The IAEA’s International Conference on Nuclear Security (ICONS) at the ministerial level:** Participation in ICONS at the ministerial level demonstrates support for ICONS as a forum to increase political attention on nuclear security. If more countries send high-level representatives, ICONS is more likely to become a forum for making political commitments and reporting on progress.
- **The IAEA’s Incident and Trafficking Database (ITDB):** Participation in the ITDB demonstrates political support for the IAEA’s efforts to track incidents of theft, loss, and misuse of nuclear and radiological materials.
- **The IAEA’s Nuclear Security Guidance Committee (NSGC):** Participation in this committee demonstrates support for the IAEA’s role developing guidance for countries to update their nuclear security laws and regulations.

The Radioactive Source Security Assessment also includes questions assessing countries’ engagement with the IAEA’s Code of Conduct for the Safety and Security of Radioactive Sources and related Supplemental Guidance.

Index Results Show Mixed Support for the IAEA



Norms

The final element of the global nuclear security architecture is the set of norms that guide state behavior. Norms are principles that evolve over time and may be adopted by some nations, but not others. These principles, or “soft law,” have not yet been manifested in formal elements of the architecture, such as through treaty obligations. Many international legal obligations began as norms, including components of international humanitarian law and the laws of armed conflict.

In the area of nuclear security, the following concepts have been developed and discussed in various multilateral forums, including non-government forums, but have not yet garnered universal support or legal status:

- minimizing civilian use and stocks of HEU;
- avoiding accumulation of separated plutonium that is unnecessary for energy production needs;
- building public confidence in national nuclear security behavior through information sharing and confidence-building activities like peer review of nuclear security and regular reports on nuclear security progress;
- protecting nuclear facilities from cyberthreats;
- substituting risky technology with effective alternatives; and
- expecting that nuclear security professionals be demonstrably competent.

These four layers of the global nuclear security architecture build on one another and contribute to the overall system, but even taken together, they do not form a complete and fully effective system for the security of some of the world’s deadliest materials. This incompleteness is not an accident: states have jealously guarded their sovereign responsibility for security of nuclear materials since the beginning of the Atomic Age, and that control was the fundamental reason for the failure of early efforts, such as the ill-fated 1946 Baruch Plan, to place all nuclear activities under international ownership and control. Similarly, advocates for an overarching nuclear security treaty that mandates legally binding standards and includes verification provisions have found no country willing to take that idea forward.

Assessing the Global Nuclear Security Architecture

Just as a patchwork quilt can keep away the cold, a legal and institutional patchwork can, over time, be augmented and elements expanded to provide a comprehensive nuclear security architecture built on standards and best practices, that builds confidence, and leads to reductions in overall stocks of HEU and plutonium. With that goal in mind, how well does the current patchwork meet the four characteristics of an effective nuclear security architecture?

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

The system should cover all nuclear materials inside nuclear weapons and materials that could be used to build a nuclear bomb, as well as nuclear facilities where sabotage could cause a major radiation release. However, according to an NTI study published in 2016, approximately 83 percent of global stocks of weapons-usable nuclear materials are categorized as “military” and are not generally covered by the norms, cooperation, or treaties of today’s nuclear security architecture.

Military nuclear materials are weapons-usable plutonium and HEU owned by governments and not for use in 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.

Assessment:

In the nine countries with nuclear weapons, the security of military nuclear materials is almost exclusively handled at the national level due to the sensitivities around the countries’ nuclear programs. This is one of the biggest weaknesses of the existing architecture because most international nuclear security instruments—whether obligatory or voluntary—only cover nuclear materials in peaceful use and, in some cases, explicitly exclude military nuclear materials. For example:

- The CPPNM (original and amended) mentions the importance of securing military materials, but only in the preamble. Otherwise, the nuclear materials and facilities covered by the treaty are explicitly defined as those used for peaceful purposes.¹
- Although ICSANT does not restrict its scope to nuclear materials used for peaceful purposes when defining acts of nuclear terrorism, the convention only criminalizes offenses and does not cover security or protection of nuclear materials or facilities.

¹ Article 2, paragraph 5 of the amended CPPNM states: “This Convention shall not apply to nuclear material used or retained for military purposes or to a nuclear facility containing such material.” The same phrase is used in the original CPPNM.

- NSG guidelines only apply to materials used for peaceful purposes.
- The IAEA’s various products and services generally exclude nuclear materials used for military purposes, although the primary IAEA guidance document, the Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities Information Circular (INFCIRC)/225/Revision 5, notes that “[s]tates may decide whether or not to extend the publication’s use to other purposes.”
- The four Nuclear Security Summit communiqués of the Nuclear Security Summits acknowledge that states should “maintain at all times effective security of all nuclear and other radioactive material, including nuclear materials used in nuclear weapons.”² More detailed undertakings contained in the communiqués, joint statements (or “gift baskets”), and Action Plans were generally identified as applying to civilian materials. Efforts to persuade countries with nuclear weapons to make even a very limited joint statement at the 2016 Summit around the security of military materials were unsuccessful.
- In the area of confidence building, only two countries—the United States and the United Kingdom—have made declarations about their military materials stocks. Other countries claim that doing so would reveal sensitive information.

An exception to the exclusion of military materials can be found in UNSCR 1540, which makes no distinction between civilian or military materials in calling for “appropriate effective physical protection measures” for “nuclear, chemical, or biological weapons and their means of delivery, including by establishing appropriate controls over *related materials*.”³ However, details on how to achieve this objective are left to each country and there is little to no accountability for states’ implementation of UNSCR 1540 obligations.

Steps toward coverage of military nuclear materials were seen in bilateral cooperation between the United States and Russia, in some cases including the United Kingdom, on security of nuclear weapons and weapons-usable nuclear materials, but these engagements in the 1990s and 2000s were episodic and no longer take place. Consultations on security of military materials also have taken place among France, the United Kingdom, and the United States. At the 2016 Nuclear Security Summit, the United States’ national progress report indicated an intent to include security of military materials in its future UNSCR 1540 reports, and the U.S. report submitted in 2020 included multiple references to security provisions for military materials and nuclear weapons. These modest steps offer a template for future discussions on military nuclear materials security at the level of a small collective, for example among the five nuclear-weapons states recognized by the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)—China, France, Russia, the United Kingdom, and the United States—and perhaps for expansion over time to other states with military nuclear materials. It is unlikely, however, that a large, consensus-based international organization would be acceptable to nuclear weapons holders as a venue for developing standards or expectations for security of military materials.

² Nuclear Security Summit 2016 Communiqué.

³ UNSCR 1540, Paragraph 3 [emphasis added].

Recommendations:

- **Security:** Countries with military nuclear materials should secure them 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's nuclear security guidelines, in particular INFCIRC/225/Revision 5 (or future revisions). The principles of strong security culture, independent oversight, and demonstrable competence should apply equally to military materials, in addition to the physical protection, control and accounting, insider threat prevention, and cybersecurity measures that are covered in IAEA guidance.
- **Confidence Building:** The military nuclear materials gap can be narrowed by openly acknowledging in international forums like ICONS and the IAEA General Conference the need to secure military materials to the highest standards and to build confidence around them. Countries can build confidence in the security of military materials in several ways. They can provide aggregate data about those stocks without compromising sensitive national security information. Countries also can build confidence around military materials by publishing reports and other general information about security practices around military materials, as well as fulfilling UNSCR 1540 reporting obligations, which do not distinguish between civilian and military materials. Openness about these materials, while protecting sensitive information, is crucial to building a comprehensive system.
- **Peer Reviews:** Although IAEA peer reviews are not appropriate for military materials, peer reviews, best practice exchanges, and joint training exercises are possible on a bilateral or multilateral basis among countries with military materials and/or other trusted partners—keeping in mind the nonproliferation obligations of the NPT—and would build confidence in the security of military materials.

STANDARDS AND BEST PRACTICES: All states and facilities holding weapons-usable nuclear materials should adhere to international standards and best practices.

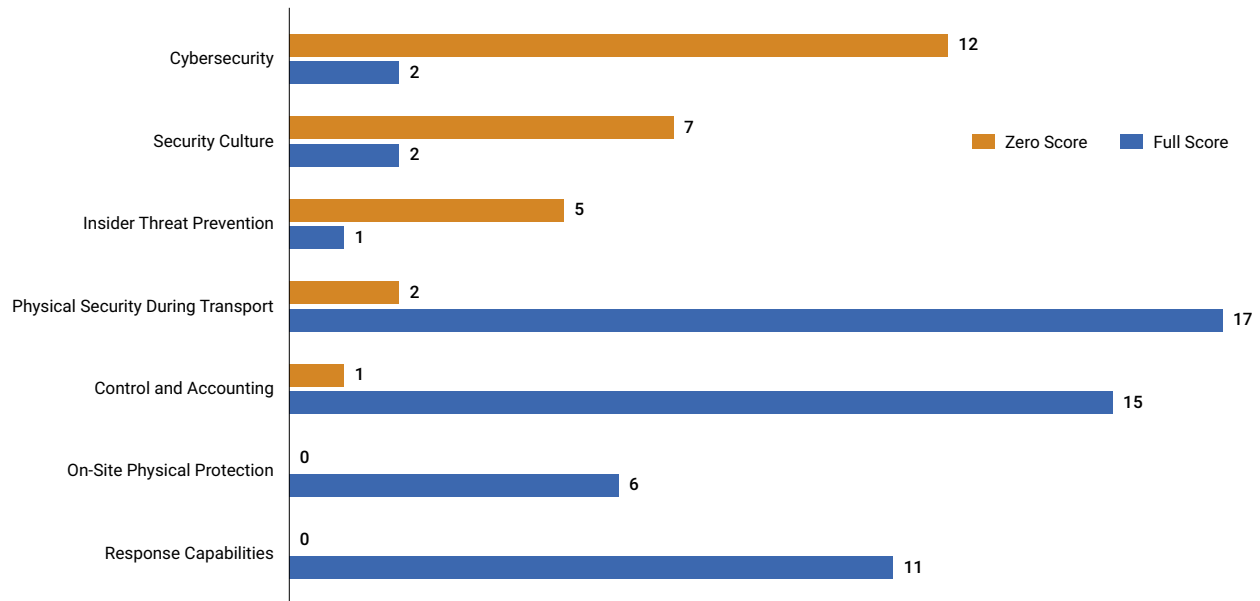
Standards and best practices play parallel, complementary roles in strengthening global nuclear security, with standards setting a basic set of minimum responsibilities and best practices supporting a process of continuous improvement. Effective nuclear security requires implementing international standards and guidelines that are generally established by consensus, are static or slow to change, and define minimum performance standards. Employing best practices consistently and comprehensively is a strategy for rapidly and effectively improving nuclear security practices worldwide. These practices derive from the experience of many, are dynamic, and can be tailored to a specific set of circumstances and conditions. Best practices can improve nuclear security implementation in the near term and, over time, influence both mandatory and voluntary security provisions.

Assessment:

There is no common set of mandatory international standards or “rules of the road” that all states must follow to secure their weapons-usable nuclear materials or facilities. A number of tools and incentives exist to strengthen nuclear security implementation around the world, but they are no substitute for commonly applied binding standards.

The only truly binding standards of nuclear security are found at the national level, with regulators and in some cases security bodies setting requirements for secure operations at nuclear facilities and sites housing nuclear materials. These regulations have the force of the state, which can inspect and sanction entities that fail to meet them (unlike standards that would be contained in a treaty with no enforcement mechanism). However, as the NTI Index has shown over a decade, regulations are uneven both in content and in implementation. This reflects disparate approaches to nuclear security, including differences in how nuclear programs are structured and governed and differences in resources, education levels, capacity, and culture. Many countries have updated their nuclear security regulations and practices over the last decade or so, sometimes as part of bilateral or regional cooperation, but some countries continue to lag. The NTI Index found significant weaknesses in the areas of insider threat prevention, security culture, and cybersecurity (see Figure 2).

Figure 2: Countries with a Full Score and a Zero Score in the NTI Index for Regulatory Actions Captured in the Security and Control Measures Category



At the international level, there are numerous mechanisms related to nuclear security that are both legally binding and voluntary. Collectively, they are important tools for guiding and raising security practice, but their limited implementation means countries are still taking different approaches, leaving gaps in the system.

- The primary source of obligation at the international level is the **CPPNM**, both the original convention and its amended version, which entered into force in 2016. The amendment has been ratified by 125 countries (as of June 16, 2021), with 36 more parties to the original left to ratify the amendment so that it can replace the original treaty, and 32 additional ratifications required to achieve universality among the 193 UN member states. This is important because the amended CPPNM expands the scope from protection of nuclear materials in international transport (which was the sole scope of the original treaty) to protection of nuclear materials in use, storage, and transport, both domestic and international, and protection of nuclear facilities against sabotage. Adherents to the amended CPPNM commit to follow 12 “fundamental principles” of nuclear security for nuclear materials and nuclear facilities and adhere to a general obligation to provide physical protection. These provisions are, however, quite broad, and the treaty does not provide for any enforcement mechanism to verify compliance or penalize noncompliance. The one mandate of the CPPNM for which compliance is readily visible is that nations provide information to the IAEA on the laws and regulations by which it implements the treaty, as stated in Article 14. As of July 1, only 56 of 125 states parties to the amended CPPNM have submitted this basic information.
- Another binding international mechanism—and the only universal one—is **UNSCR 1540**. Its very general obligation to provide “appropriate effective physical protection” is theoretically backed up by the availability of enforcement under Chapter VII of the United Nations Charter, but the resolution offers no means of confirming its application and the likelihood of any action to remedy non-compliance is low.
- A more detailed set of guidance—and the closest thing to international standards that exists—is the **IAEA’s Nuclear Security Series**, with INFCIRC/225/Revision 5, also known as Nuclear Security Series 13, being the primary document. The series includes guidance on physical protection, material control and accounting, computer security, security of radiological materials, and many other topics. However, these recommendations are purely voluntary and applied selectively. As a result of consensus-based negotiation among experts from member states, they also are seldom adequately robust. IAEA Director General Rafael Grossi has suggested that this guidance be elevated to the level of “standards” in keeping with the IAEA’s documentation of safety provisions; the safety standards themselves, however, also are voluntary.
- Informal collectives can be quite valuable in bridging voluntary guidelines and binding national regulations by promoting greater acceptance of the IAEA recommendations and raising the level of nuclear security practice. The **NSG** is one such collective. Its guidelines for all nuclear exporters indicate that they “should” place certain nuclear materials and facilities under protection consistent with INFCIRC/225. The United States is the only country that legally mandates—and verifies through on-site visits—such a provision as a condition of supply of nuclear materials. This policy creates a legal basis for the mandatory application of otherwise voluntary measures.
- Another informal collective, known as **IAEA INFCIRC/869**, which was derived from a gift basket issued at the 2014 Nuclear Security Summit and became the first gift basket to become available to countries that did not participate in the Nuclear Security Summits, reflects a public commitment by 39 countries to reflect the basic IAEA guidance documents in their national regulations, which would translate voluntary IAEA provisions into mandatory national ones. Expanding the application of this collective tool to additional countries would show support for the enhanced

authority of the IAEA's recommendations. This could help bring the world closer to uniform minimum standards that all countries follow, thereby raising global standards. There are nine other INFCIRCs that were derived from gift baskets on various topics, including insider threat mitigation, counter nuclear smuggling, transport security, and minimizing stocks of HEU. Subscribing to INFCIRCs is another way to commit to raising the level of security practice.

- Another informal collective is the Vienna-based **WINS**. It supplements binding national and voluntary international provisions with the development and promulgation of best practices for implementing nuclear security. These best practices are publicly available and form the basis for training and certification carried out by the WINS Academy. Promulgation and exchange of best practices are an important component of strengthening nuclear security implementation.
- Finally, **professional societies**, such as the **INMM**, are another type of collective that provide conferences, workshops, and publications for practitioners in the nuclear security field to share their research and operational experience. These societies are important for creating networks of professionals who can support each other's work globally, share best practices and lessons learned, and develop and advance concepts that improve global security.

Recommendations:

- **Universalize the CPPNM/A and ICSANT:** To close the gap on standards and best practices, it is vital that all countries become party to the two foundational nuclear security legal agreements: the amended CPPNM and ICSANT. Until these treaties are universal, there will be dangerous holes in global coverage of physical protection, criminalization, and the ability for countries to cooperate on prosecuting nuclear theft, smuggling, sabotage, and terrorism.
- **Subscribe to INFCIRCs:** Countries should subscribe to nuclear security INFCIRCs to demonstrate commitment to nuclear security and help raise nuclear security standards. By subscribing to INFCIRC/869, countries will help raise the prominence of the IAEA's nuclear security guidance by committing to translate them into enforceable national regulations.
- **Strengthen Regulations:** Countries should strengthen their nuclear security regulatory regimes and strive for continuous improvement, particularly in areas necessary for long-term, sustainable nuclear stewardship such as insider threat prevention, security culture, and cybersecurity.
- **Cooperate Internationally:** Countries should participate in best practice exchanges on a bilateral or multilateral basis, by attending workshops and trainings held at regional Centers of Excellence and IAEA Nuclear Security Support Centers, and other joint activities. They also should take advantage of the best practice guides that have been developed and promulgated by WINS and the related training and certification. Best practice exchanges can occur between regulators to share lessons learned in different regulatory environments. Best practice exchanges can also occur between operators, to share lessons learned from on-the-ground implementation of nuclear security.
- **Verify Actions:** Follow the U.S. model requiring verifiable implementation of INFCIRC/225 as a condition of supply of nuclear materials.

- **Adopt Codes of Professional Conduct:** Some professional societies outside the nuclear security realm have developed individual codes of professional conduct. Such professional codes could be introduced into nuclear-related societies to emphasize the individual's responsibility to promote nuclear security.

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 forums to promote continuous 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.

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.

Because the consequences of an act of nuclear terrorism—whether in lives lost, health effects, environmental consequences, economic damage, or reduction in public confidence of peaceful use of nuclear technology—would be global, all countries have an interest in knowing that neighboring countries or countries in their region are taking their security responsibilities and commitments seriously by securing their nuclear materials and facilities to the highest standards. How any given state protects its nuclear materials can impact its own citizens, its neighbors, and even distant countries and populations. Lax security in one country can allow for theft of materials, sabotage of facilities, or the detonation of an improvised nuclear device with potentially devastating local and global implications for economies and health. On the other hand, effective security practices that are made visible through information sharing or other activities, such as peer reviews, can enhance public acceptance for a country's peaceful nuclear activities and build confidence among other states.

Information Sharing: Information sharing is an important way for countries to demonstrate they have adequate security measures in place. This could include publication of nuclear security regulations and associated budgets, inclusion of nuclear security attestations in the annual reports of regulators and licensees, nuclear security progress reports, public review of nuclear security incidents and any remedial provisions, and internal or external peer reviews, with due care taken, of course, to avoid release of site-specific information that could increase risks of theft or sabotage.

- Information can be shared at treaty review conferences, through mandatory reporting under Article 14 of the amended CPPNM and under UNSCR 1540; at annual meetings of international organizations and professional societies; at regular or special-purpose high-level events; and at working-level and expert meetings held by international organizations like the IAEA. In addition, informal collectives like the GICNT can provide venues for information exchange and reporting on nuclear security progress. Working-level and expert meetings give national representatives an opportunity to describe in depth how nuclear security works in their countries.
- Reporting on quantities of civilian plutonium and HEU holdings using the mechanisms provided under INFCIRC/549 (plutonium) and INFCIRC/912 (HEU) increases confidence that materials are properly accounted for and enables governments and non-governmental organizations to

track global inventories. INFCIRC/549 on plutonium management guidelines includes a reporting template for plutonium stocks, although some countries also use it to report on civilian HEU stocks. INFCIRC/912—derived from the Norway-sponsored gift basket on HEU minimization at the 2016 Nuclear Security Summit—includes a reporting mechanism for civilian HEU. It is possible to share information about materials stocks while also protecting sensitive information.

Peer Review: Peer review is a critical tool to strengthen nuclear security, share best practices, demonstrate commitment to continuous improvement, and build confidence in a country's nuclear security. Peer review can be international, through organizations like the IAEA. It can also be done on a multilateral or bilateral basis.

- The IAEA offers peer reviews upon a member state's request. The most prominent peer reviews are International Physical Protection Advisory Service (IPPAS) missions, during which international experts review regulations and implementation at national and site levels to gauge consistency with the IAEA's nuclear security guidance. While just the fact that a country has undergone such a review suggests that it is taking nuclear security seriously and seeking advice, confidence is much greater when the results of such reviews are published, even partially, along with the plans for improving any shortcomings. Unfortunately, the IAEA only has the capacity to carry out four to six IPPAS missions each year, although it is unclear if there is the demand for more.

Bilateral Exchanges: Bilateral assistance or best practice exchanges also can contribute to a broader perception of effective security between two states that are working together and to outside observers who may not know the details, but who may welcome general indicators of commitment to good nuclear security. As noted above, the United States carries out on-site security reviews in connection with exports of nuclear material, which adds to the understanding that recipients of such material are equipped to secure it appropriately.

Assessment:

There is increasing acceptance of the need for confidence building, reflecting a growing recognition of the shared consequences countries face and the responsibilities they have to each other. For example, the 2019 Nuclear Security Resolution adopted by the IAEA General Conference took note of the benefits of good security for enhancing public confidence in peaceful nuclear applications. The 2020 ICONS ministerial declaration also highlighted the link between security and public confidence to support sustainable development goals.

According to the 2020 NTI Index results, 45 of the 49 countries with weapons-usable nuclear materials and/or nuclear facilities publish their nuclear security regulations. In addition, of those 49 countries, 57 percent publish an annual nuclear security report; 67 percent have made a public declaration about their nuclear security progress in the past two years, in conjunction with international, multilateral, or regional nuclear security conferences; and 18 percent made declarations previously but have not done so in the past two years. These actions are a positive sign that countries are interested in sharing their successes and in demonstrating they are being responsible stewards of nuclear materials and technology. These steps build confidence that a country has an effective regulatory framework in place.

However, there are still some significant areas of weakness. Transparency around stocks of weapons-usable nuclear materials is extremely limited, even for civilian materials. Only 10 countries with nuclear materials—fewer than half—have made public declarations or reports about civilian nuclear materials since January 1, 2019. (China did so before that date.) Eleven countries have never made declarations about their civilian materials, and Norway and Australia are the only two countries that have made a declaration of civilian HEU stocks using INFCIRC/912. Transparency around military stocks is even more limited. Only the United Kingdom and the United States have ever made declarations about their military stocks.

With respect to peer review, of countries with nuclear materials and/or facilities, 65 percent have hosted an IPPAS mission, but only 33 percent have done so in the past five years. Whereas 35 percent have never hosted an IPPAS mission or follow-up mission, 10 countries have never had a nuclear security peer review of any type, from the IAEA or otherwise. Only five countries—Australia, Canada, Japan, Norway, and Sweden—have taken the extra confidence-building step of publishing the results of an IPPAS mission in the past five years.

Recommendations:

- **Increase Transparency:** Countries with nuclear materials and nuclear facilities should take more steps to build confidence in their nuclear security, including improving transparency around stocks of nuclear materials and increasing participation in peer reviews.
- **Publish Annual Reports:** Countries should publish annual reports about nuclear security. These build confidence in a country's security practices by providing useful information about how a country is implementing nuclear security.
- **Make Routine Declarations:** Countries should regularly make declarations about nuclear security progress at international, multilateral, or regional conferences on nuclear security (such as ICONS). Doing so demonstrates commitment to nuclear security progress and underscores the need for continuous improvement.
- **Publish Nuclear Material Inventories:** Countries with weapons-usable nuclear materials should be more transparent about their civilian stocks of nuclear materials. It is possible to share information about material stocks while also protecting sensitive information. Countries that have subscribed to INFCIRC/912 on HEU minimization should fulfill their commitment to report on HEU stocks. Countries should use both INFCIRC/912 and INFCIRC/549 to report on their civilian HEU and separated plutonium stocks, and they should do so regularly. Countries with military stocks should build confidence by providing aggregate data about those stocks without compromising sensitive national security information.
- **Host IPPAS Missions Every Five Years:** All countries with nuclear materials and/or facilities should host IPPAS missions every five years to build confidence and demonstrate a commitment to nuclear security and continuous improvement. In addition to IPPAS missions, countries should participate in bilateral or multilateral peer reviews as another means of continuously improving nuclear security and sharing best practices. Peer reviews are most useful when conducted regularly to follow up on the implementation of recommendations from previous peer reviews. All countries that have had peer reviews should host regular follow-up missions.

- **Share Peer Review Results:** Countries should publish summaries of the results of peer reviews to further build confidence that they are taking remedial actions to strengthen security. Publicity and annual reporting on assistance provided by the IAEA to member states also can enhance broader understanding about the effectiveness of a nation's security measures.
- **Strengthen IPPAS Missions:** The IAEA can do more to promote its peer review services, and to encourage publication of some or all of their results. However, the ability of the IAEA to conduct more IPPAS missions is hampered by a lack of experts to participate. Experts on IPPAS missions come from member states (there are no IAEA reviewers). To support increased demand, countries should send their experts to receive IAEA training to serve on IPPAS mission teams and encourage them to participate in those missions.

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.

The more weapons-usable nuclear materials there are in the world, the greater the risk of theft. Countries that completely eliminate their stocks of weapons-usable nuclear materials—whether through reactor conversions, HEU blend-down, or removal of materials to their country of origin—eliminate the risk of theft in their territory and reduce the costs associated with security. Countries that reduce their quantities of materials, even if they do not eliminate them, also reduce the risk of theft.

- **International organizations** can advocate for and support minimization and elimination efforts. In September 2000, when former IAEA Director General Mohamed ElBaradei wrote to countries operating research reactors based on HEU to offer support in removing and/or converting their fuel, it kicked off two decades of minimization activities that reduced by half the countries with weapons-usable nuclear materials. Many of those removals were carried out through the IAEA, but others took place with direct bilateral cooperation. The IAEA created numerous platforms to share knowledge and experience, to develop alternatives to HEU fuel, and to increase use of and cooperation at the shrinking number of HEU-fueled facilities to avoid construction of new ones. Although some IAEA member states have recently questioned the necessity of HEU minimization, IAEA leadership during this period shows how international organizations can strike a balance between promotion of a global norm and respecting member states' own choices.
- **Informal groupings** have shown that they can help achieve such global goals as HEU minimization. Twenty-three countries pledged to support minimization of HEU through INFCIRC/912, based on the Norway-sponsored gift basket at the 2016 Nuclear Security Summit. Additional countries beyond the original subscribers can subscribe to INFCIRC/912 or make similar pledges. Bilateral partners can be matched through the Global Partnership to support reactor conversion and/or HEU removal. A consortium of European countries is making progress on developing new low-enriched uranium (LEU) fuels that would allow additional reactors to be converted from HEU. With respect to plutonium, the United States and Russia had a bilateral agreement to each eliminate 34 metric tons of plutonium from their weapons programs. Although the Plutonium Management and Disposition Agreement is not currently being implemented by either country, the United States

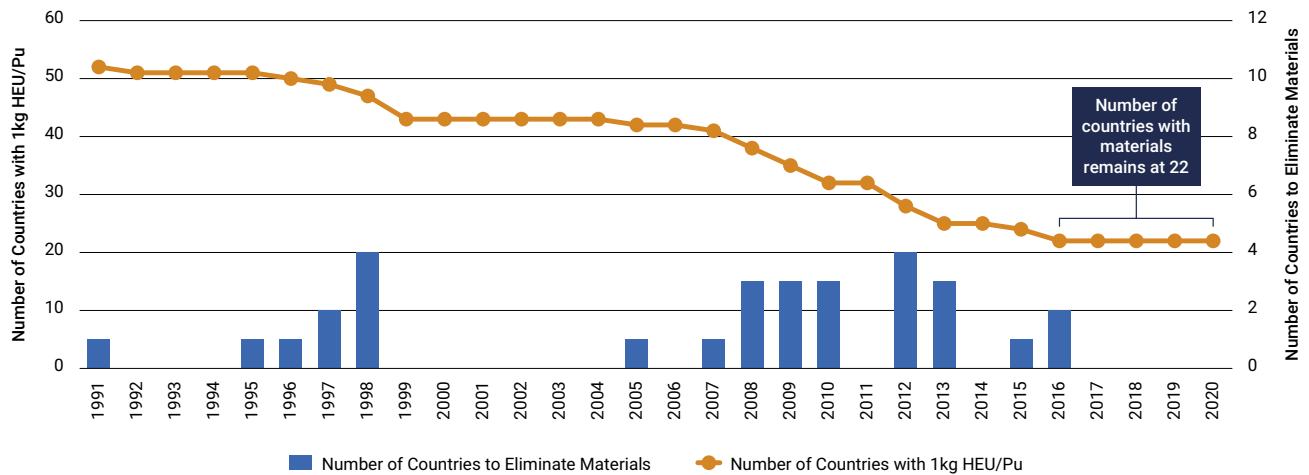
and Russia have each taken some steps toward disposition, and the agreement remains available as a potential vehicle for verified elimination should future political changes allow.

Assessment:

This element of the architecture, after growing in strength for several years, seems to have weakened. No countries with one kilogram or more of HEU or plutonium have removed or disposed of all their stocks since 2016.⁴ The number of countries plateaued at 22 after having decreased from 32 countries in 2012 (see Figure 3). Conversely, four countries—India, North Korea, Pakistan, and the United Kingdom—are increasing their holdings of these materials, whether for weapons production or in connection with peaceful nuclear activities. Russia is manufacturing new HEU to fuel its own research reactors as well as one in Germany. The six countries that have decreased their overall quantities during the past four years have done so at a much slower pace. Those decreases were not significant enough to improve their score for materials quantities in the 2020 NTI Index.

Despite advocacy and support for minimization and elimination efforts by international organizations, informal groupings, and some countries, actions to minimize and eliminate nuclear materials have slowed, in some cases owing to technical, economic, and political hurdles. Nine of the 22 countries have nuclear weapons programs, which are unlikely to be eliminated in the near future. Although the norm in favor of phasing out civilian HEU use is still strong, there is no similar norm for ending plutonium production.

Figure 3: Trends in Numbers of Countries with 1kg or More of HEU/Plutonium



⁴ Note that Ghana and Nigeria also removed their small stocks of HEU (approximately 1.2 kilograms) to China in 2017 and 2018, respectively. Uncertainties over the quantities of their materials and assumptions that their stocks were below the one-kilogram threshold used in the NTI Index means the Index has never included Ghana and Nigeria among countries with one kilogram or more of weapons-usable nuclear materials for purposes of the Index.

Recommendations:

- **Minimize Materials:** All countries should do more to reduce the risk posed by stocks of weapons-usable nuclear materials by minimizing their use in civilian energy programs and reducing or eliminating stocks where possible.
- **Address Hurdles:** More work is needed to address civilian stocks of nuclear materials in countries that continue to possess HEU or plutonium, including identifying and tackling technical, economic, and political challenges to further eliminations. Recent advances in new LEU fuels will allow additional research and test reactors to convert from HEU and provide more LEU fuel options for new research reactors. These developments will help eliminate the need for new HEU production. HEU holders could accelerate domestic blend-down operations to reduce HEU in storage.
- **Reduce Plutonium Stocks:** Countries with plutonium should seek to reduce stockpiles to minimum levels necessary for energy purposes and to avoid new production that lacks near-term uses. Forward movement on spent fuel storage will relieve pressure to separate additional plutonium.
- **Consolidate and Secure Materials:** As long as countries continue to possess these materials, they should focus on the tools necessary to consolidate nuclear materials to fewer locations and for long-term sustainable stewardship, including building a strong security culture, boosting capacity through training and education, and strengthening the ability to mitigate cyberthreats.

Sustaining Attention on Nuclear Security

Strengthening the global nuclear security architecture requires coordinated and serious effort on the part of all nations. The recommendations above are readily achievable as long as there is the political will to do so. The international community knows what it takes to prevent an act of nuclear terrorism; doing so is to the advantage of every single country that currently benefits from peaceful nuclear technologies, or that decides to do so in the future. Unfortunately, there are signs the political will and attention has waned and therefore nuclear security progress has slowed.

Assessment:

The NTI Index showed substantial improvements in national regulatory structures and a strengthened global nuclear security architecture between 2012 and 2018. Countries are still taking actions to strengthen regulations and support global norms, but since 2018, the number of countries improving their score in the Index has declined and the average amount by which countries' scores have improved has decreased (see Figures 4, 5, and 6).

Figure 4: Trends in Overall Score for Countries with Weapons-Usable Nuclear Materials

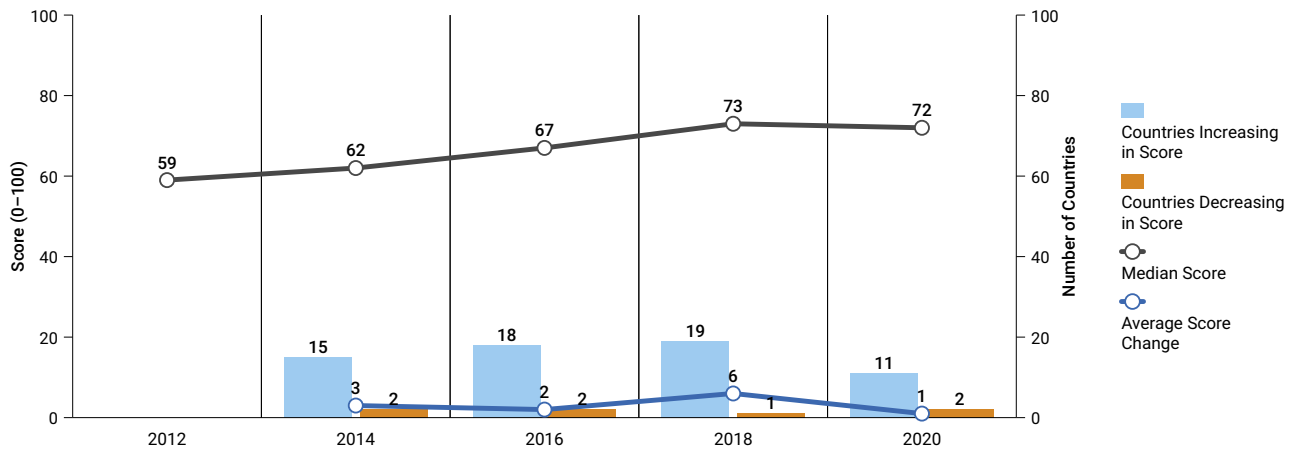


Figure 5: Trends in Overall Score for Countries with Nuclear Facilities

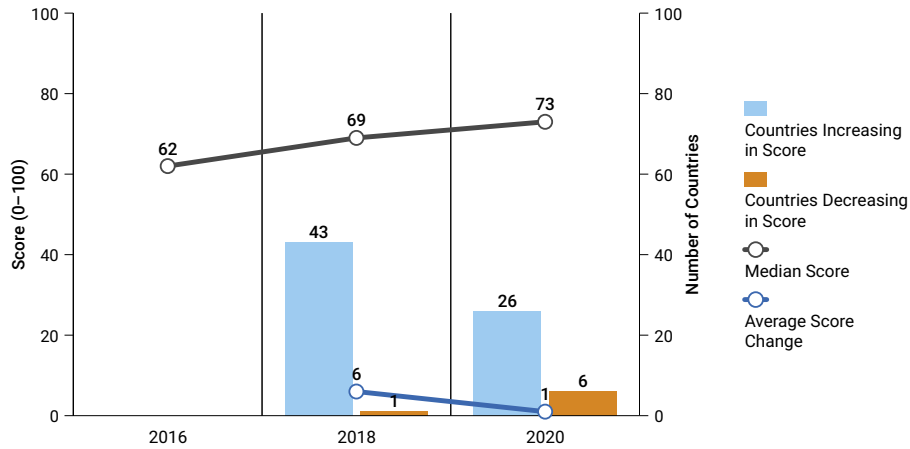
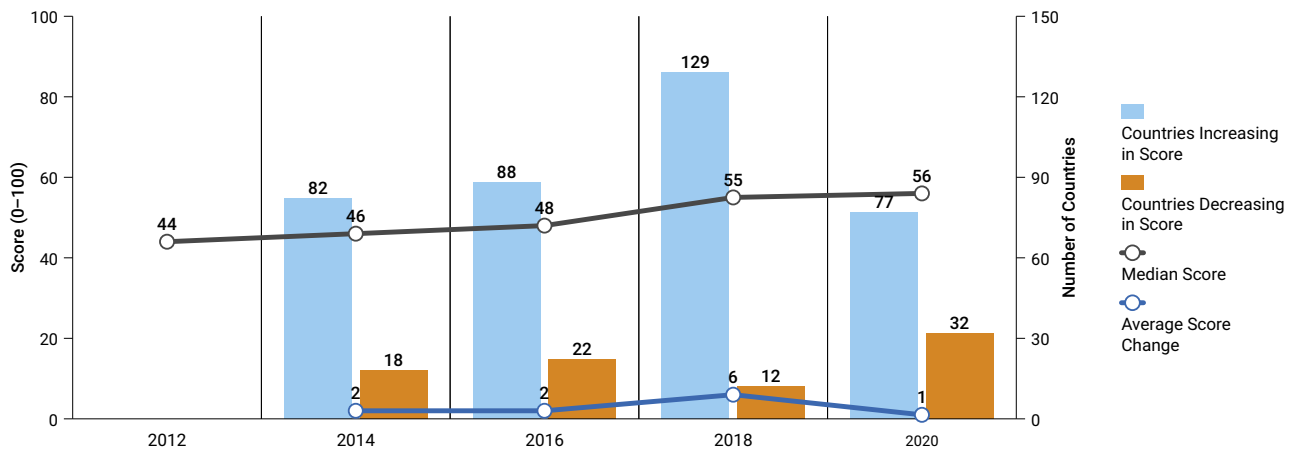


Figure 6: Trends in Overall Score for Countries without Weapons-Usable Nuclear Materials



The rate of decline does not reflect that there is less work to do. Significant gaps remain, including in important areas such as cybersecurity, international assurances, and efforts to make treaties universal. Countries at the top of the rankings also still need to address weaknesses in their regulatory structures; all countries, no matter how well they perform in the NTI Index, should focus on continuous improvement and avoid complacency.

The decline in the rate of improvement may indicate that without the driving force of the Nuclear Security Summits or any similar senior-level, high-visibility milestone, attention on nuclear security has waned, leading to slowed progress. The political will and sense of accountability that arose from the summits were vital to driving actions in governments to strengthen nuclear security. The improvements captured between 2012 and 2018 coincided with the summits and in many cases reflected commitments made or progress announced at the summits. Not only has the rate of progress slowed after the last summit in 2016, as indicated by fewer improvements in the 2020 NTI Index, but the summits' influence on progress, as measured by the percentage of improvements that can be linked to summit-related activities, also has begun to decline.

All countries, including countries without nuclear materials, have a role in strengthening the global nuclear security architecture, but the NTI Index data show that nuclear security may not be as high a priority for countries without materials and for countries in certain regions. The data show that countries without nuclear materials have lower rates of participation in international legal agreements and voluntary initiatives (see Figures 7 and 8). There is also a disparity in rates of participation of countries without nuclear materials between different regions and members of the G-77, which was established in 1964 and whose membership has increased to 134 countries (see Figures 9 and 10). These disparities may reflect a lack of resources or capacity, competing priorities, and different perspectives about nuclear security and the role of the IAEA. Some countries prioritize ensuring continued access to peaceful nuclear technology and protecting the IAEA’s technical assistance resources that support peaceful use; other countries prioritize preventing nuclear terrorism and want to strengthen the IAEA’s role in nuclear security.

Figure 7: Status of Treaty Ratifications among Countries with and without Nuclear Materials

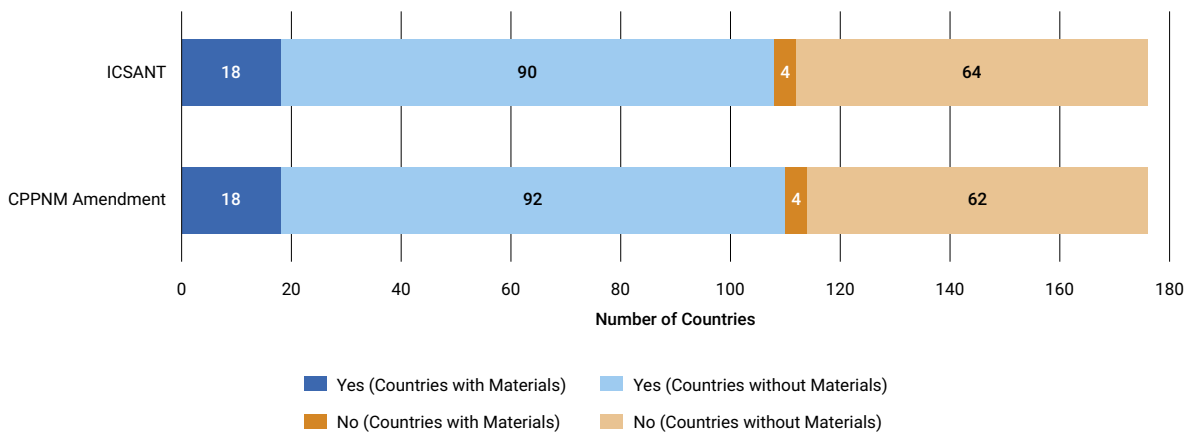


Figure 8: Number of Countries with a Full Score and a Zero Score for Voluntary Commitments for Countries with and without Nuclear Materials

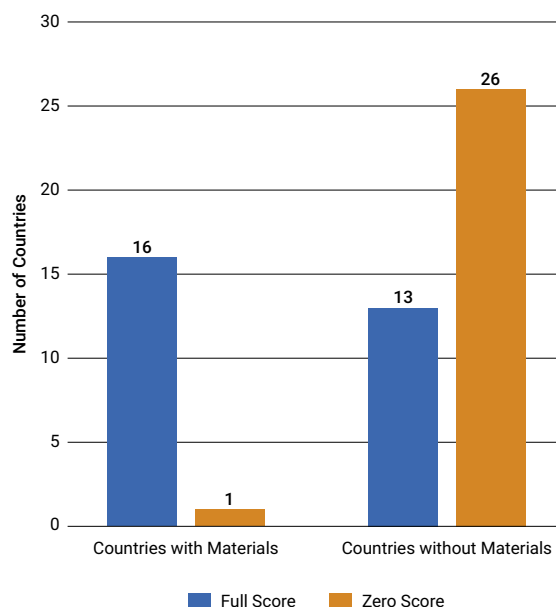


Figure 9: Median Score for Countries without Materials by Region for International Legal Commitments

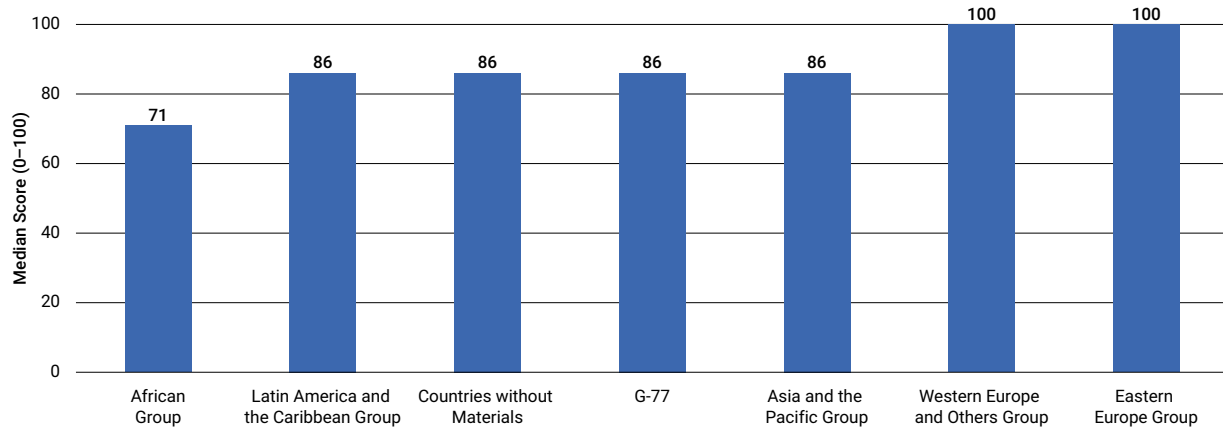
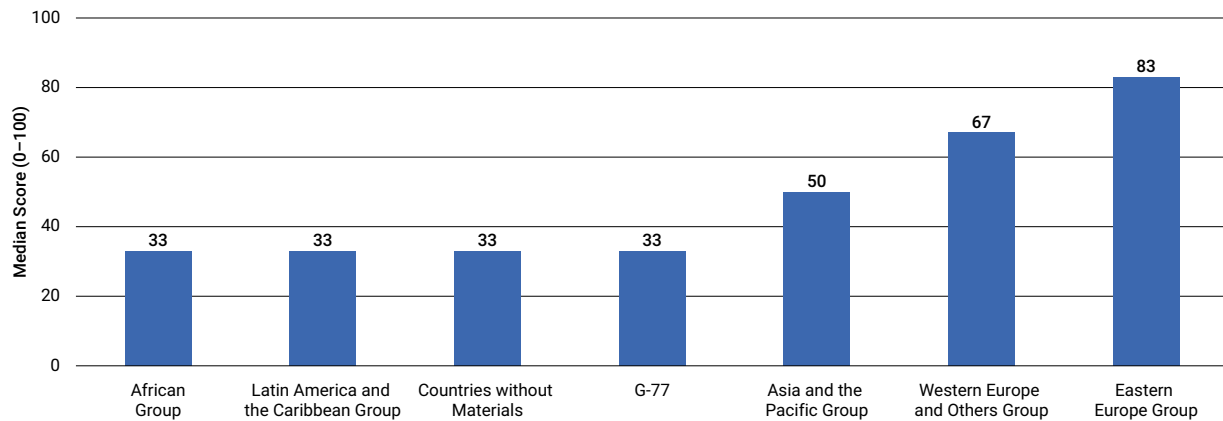


Figure 10: Median Score for Countries without Materials by Region for Voluntary Commitments



Recommendations:

To drive country action and progress in nuclear security, countries must sustain political attention on nuclear security.

- **Regain Focus:** Greater effort is needed to strengthen and sustain political attention on nuclear security and to make continued progress in improving national regulatory frameworks and building an effective global nuclear security architecture.
- **Use Major Conferences to Drive Attention:** Countries should take advantage of upcoming conferences and meetings to increase attention and accountability by sending high-level delegations and using such opportunities to report on progress and make new commitments. Upcoming opportunities include the 2022 review of the amended CPPNM, the next IAEA ICONS in 2024, and smaller venues such as annual meetings of the GICNT, the Global Partnership, and the IAEA General Conference. Consideration might also be given to holding a dedicated summit on nuclear security to review the status of global nuclear security and reset the agenda for the next decade,

taking into account evolutions that have taken place since the most recent summit-level event in 2016.

- **Increase Political Attention:** High-level political attention also is needed to generate actions at the national level to strengthen domestic nuclear security. Senior government officials should place nuclear security high on national agendas to demonstrate to regulators, policymakers, operators, and the public that nuclear security is a priority. Heads of government and other senior officials should also incorporate nuclear security into high-level discussions with their counterparts from other countries to galvanize political attention elsewhere.
- **Develop More Inclusive Narrative:** Countries supportive of nuclear security should work to build a stronger, more inclusive narrative about the importance of nuclear security and its beneficial contribution to peaceful nuclear activities in order to achieve broader participation in global efforts to strengthen nuclear security and increased support for the IAEA's nuclear security role.
- **Strengthen Regional Outreach:** The regional divides exposed in the NTI Index results provide further evidence that work is needed to develop a broader, more inclusive narrative for nuclear security that respects different national and regional perspectives and priorities and moves away from a zero-sum approach that pits nuclear security and peaceful use assistance against each other.
- **Emphasize Security and Technology Linkage:** A more compelling narrative would remind countries of the link between nuclear security and public support for peaceful use of nuclear technology. This in turn is linked to countries' ability to meet their sustainable development goals. Tying the importance of nuclear security to a more diverse set of national and regional priorities can provide a better understanding of how nuclear security and access to peaceful use of nuclear technology for nuclear energy, science, and research go hand in hand.

The Role of the Amended CPPNM in Sustaining Attention and Progress

The amended CPPNM provides perhaps the most important near-term opportunity for high-level political attention and is worthy of special attention. Article 16 of the amended CPPNM requires the IAEA, as treaty depositary, to convene a conference to review the amendment five years after its entry into force. The 2022 conference, postponed from July 2021 due to the COVID-19 pandemic, will be the first opportunity for states parties to review implementation of the treaty.

Article 16 also allows states parties to call for further conferences to review the treaty at no less than five-year intervals after the mandatory conference in 2022, if a majority agree to do so. States should use the review conference to create a forum for parties to engage in regular dialogue on how the treaty is being translated into on-the-ground nuclear security progress, monitor and identify gaps in implementation, review progress, promote continuous improvement, and discuss emerging trends that impact security.⁵ States parties can accomplish this goal if they agree, at the 2022 review, to hold regular review conferences as a standing arrangement instead of waiting for a request of a majority of states parties. Parties do not have to agree to hold future review conferences on a fixed cycle but should agree that each review conference would set the next conference date.

Regular review conferences will enable a sustainable treaty regime that can adapt as threats, technology, and best practices evolve. By agreeing to regular review conferences, parties can turn the amended CPPNM into a living, breathing tool for dialogue and progress and demonstrate their commitment to building a strong, effective, and sustainable treaty regime.

⁵ For a more detailed set of recommendations for the 2022 review conference, see Samantha Neakrase, “Strengthening Nuclear Security with a Sustainable CPPNM Regime,” January 2020, paper prepared for the 2020 IAEA International Conference on Nuclear Security, https://media.nti.org/documents/IAEA_CN_278_95_Neakrase.pdf; Samantha Neakrase, “Strengthening Nuclear Security with a Sustainable CPPNM Regime,” June 2019, *Arms Control Today*, <https://www.armscontrol.org/act/2019-06/features/strengthening-nuclear-security-sustainable-cppnm-regime>.

Conclusion

Although the analysis of each of these characteristics differs, a common thread emerges: treaties and international organizations set aspirations and provide vehicles that can increase the effectiveness of nuclear security in individual countries, but they are not yet doing all they can and must do to build an effective nuclear security architecture. Informal collectives often can fill gaps between binding national laws and regulations and voluntary, unverified global commitments through active cooperation to improve implementation of nuclear security measures. They also can help push action at the treaty level or the state level. In addition, the flexibility of informal collectives allows them to adapt more rapidly to a changing world and promulgate voluntary improvements ahead of their ability to be codified in formal treaties or national laws and regulations.

Taken together, the layers of this architecture do not yet add up to a comprehensive nuclear security system that is based on standards and best practices, that builds confidence, and that leads to reductions in overall stocks of HEU and plutonium. Each level shows progress over the last decade, and the interconnections among the levels are growing stronger. But, as outlined in this paper, much work is still needed to build such a system.

As with most issues in nuclear security, the components of an effective global nuclear security architecture are evident—what remains inadequate is focused attention and prioritization necessary to make them real. Leaders, experts, and organizations—both in and outside governments—must work harder to build awareness and attention and interest in nuclear security, and to broaden the understanding of why nuclear security is vital to continue benefiting from peaceful nuclear use. Doing so is a necessary ingredient to further strengthening the global nuclear security architecture so that the elements, individually and collectively, can meet their full potential.

As with most issues in nuclear security, the components of an effective global nuclear security architecture are evident—what remains inadequate is focused attention and prioritization necessary to make them real.

About the Author

Samantha Neakrase is a Senior Director in the Materials Risk Management program at NTI. Since joining NTI in 2012, she has led two major projects: the NTI Nuclear Security Index and the Global Dialogue on Nuclear Security Priorities. Her expertise includes international institutions and treaties, including analysis on the amended Convention on the Physical Protection of Nuclear Material. In May 2012, Neakrase completed an MPA degree at the Harvard Kennedy School, where she focused on foreign policy and national security and received the Donald K. Price Award for academic excellence and community service. She also served as a research assistant for David Sanger on his book *Confront and Conceal: Obama's Secret Wars and Surprising Use of American Power*. Prior to attending the Kennedy School, Neakrase practiced law at Simpson Thacher & Bartlett LLP and clerked for the Honorable Maryanne Trump Barry on the U.S. Court of Appeals for the Third Circuit. Neakrase holds a BA from St. Olaf College and a JD from Villanova University School of Law, where she was elected to the Order of the Coif.

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