

STRENGTHENING THE SECURITY OF RADIOLOGICAL SOURCES

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Abstract. Today, there are tens of thousands of radioactive sources in more than 100 countries that are used throughout medicine, industry, agriculture, academia, and government facilities for a variety of purposes, stored in thousands of facilities—many of which are poorly secured and vulnerable to theft by terrorists seeking to detonate a dirty bomb. These sources pose a serious threat and could be readily employed for use in a radiological dispersal device. Radiological terrorism is an increasing threat and states as well as the private sector must do more to secure these dangerous materials and keep them out of the hands of terrorists. A dirty bomb detonated in a major metropolitan area could result in economic losses in the billions of dollars as a result of evacuations, relocations, cleanup, and lost wages. In addition, panic and psychological impacts may contribute to the impact of a dirty bomb. Progress has been made in the past decade on securing radiological sources through efforts by the IAEA and various national and international programs. World leaders also have placed increased attention on radiological materials security in recent years through a series of Nuclear Security Summits. During the 2014 Nuclear Security Summit in The Hague, 23 countries issued a Statement on Enhancing Radiological Security and committed to secure their IAEA Category I radioactive sources by 2016. At the 2016 Summit in Washington, D.C., 28 countries and 1 international organization signed the Joint Statement on Strengthening the Security of High Activity Sealed Radioactive Sources, demonstrating countries' continued commitment to securing radiological sources. The Nuclear Threat Initiative (NTI) released a Radiological Security Progress Report in March 2016 that evaluated the progress of the 23 countries that agreed to secure their IAEA Category I sources by 2016. In addition, the NTI report provided an opportunity to encourage additional countries to similarly secure their vulnerable radiological materials. NTI's report included eight specific recommendations on how to further improve radiological security around the world, such as by strengthening the international framework, accelerating the development and use of alternative technologies, and strengthening the role of the private sector. This paper highlights the key challenges in securing radiological materials and provides an update on opportunities to implement the eight recommendations from the March 2016 NTI Radiological Security Progress Report.

Key Words: Radiological security, radioactive source security, Joint Statement on Strengthening the Security of High Activity Sealed Radioactive Sources

1. Introduction

This paper highlights the threat and challenges posed by radiological sources and offers various options for countries to consider adopting at the 2016 International Atomic Energy Agency (IAEA) International Conference on Nuclear Security and beyond to strengthen the security of radiological sources.

Today, there are tens of thousands of radioactive sources used worldwide throughout medicine, industry, agriculture, academia, and government facilities for a variety of purposes, stored in thousands of facilities—many of which are poorly secured and vulnerable to theft. These sources pose a serious threat and could be readily employed for use in a radiological dispersal device (RDD), also referred to as a “dirty bomb.” Radiological terrorism is an increasing threat and states as well as the private sector must do more to secure these dangerous materials and keep them out of the hands of terrorists. A dirty bomb detonated in a

major metropolitan area could result in economic losses in the billions of dollars as a result of evacuations, relocations, cleanup, and lost wages. In addition, panic and psychological impacts may contribute to the impact of a dirty bomb.

Progress has been made in the past decade on securing radiological sources through efforts by the IAEA and various national and international programs. In addition, leaders also have placed increased attention on radiological materials security through a series of four Nuclear Security Summits (NSS). At the 2016 NSS, the Communiqué, adopted by 52 Head of Delegations, prominently referenced radiological security in the first sentence, “The threat of **nuclear and radiological terrorism** remains one of the greatest challenges to international security, and the threat is constantly evolving.” However, despite these efforts, gaps still remain in the international radiological security regime and there is a lack of international political imperative to strengthen radiological security standards.

In March 2016, The Nuclear Threat Initiative (NTI) released the Radiological Security Progress Report¹ to evaluate the progress that 23 countries have made in meeting their commitments in accordance with the 2014 NSS Joint Statement on Enhancing Radiological Security,² which included eight recommendations that countries can take individually and collectively to strengthen global radiological security standards. The report concluded that there continues to be a **lack of an effective global system to address how all radiological sources should be secured**. Implementation of existing international standards and adherence to the Code of Conduct for the Safety and Security of Radioactive Sources (CoC) and the supplementary Guidance on the Import and Export of Radioactive Sources (supplemental Guidance) remains far from universal, and **no global legally-binding standards exist** for holding countries accountable for security at radiological facilities or throughout their lifecycle. While a limited number of states have taken steps to secure their highest risk radiological sources **by a specific date** (in accordance with the 2014 NSS Joint Statement), a vast number of radiological sources exist around the world and are potentially vulnerable to terrorists seeking to acquire these materials. An effective international radiological security regime would require states to take active national measures to secure their radiological sources and strengthen regulatory requirements, coordinate among states to share knowledge and experiences, and increase collaboration with the private sector as well as with international organizations, such as the IAEA.

While all these actions, if implemented, would contribute to strengthening the global radiological security framework, they fall short in galvanizing the high-level political support needed for timely action. **States should explore opportunities to launch a new global initiative to secure the most vulnerable remaining radiological sources around the world in the next 3-4 years**. Such an effort can build upon previous NSS and IAEA commitments, and acknowledge that more work needs to be done to improve radiological security standards, build confidence that states are fulfilling their radiological security obligations, and encourage information sharing. Given the prevalence of sources worldwide, a global call for improving radiological security standards by a time bound deadline can build the needed sense of urgency and commitment for concrete actions to secure the highest-risk radiological

¹ See <http://www.nti.org/about/projects/radiological-security-progress-report/>.

² 2014 Nuclear Security Summit Joint Statement on Enhancing Radiological Security. See <http://www.state.gov/documents/organization/235507.pdf>.

materials.³

States should also ensure key stakeholder involvement in global radiological security efforts. **A forum should be established through an annual radiological conference (with the inaugural meeting in October 2017) that will bring a diverse community together to share experiences, technology solutions, and support for safeguarding radiological sources during their lifecycle.** Such a forum will also recognize industry and the non-governmental community as integral supporters and contributors to global radiological security efforts.

2. Current Challenges

There exists a number of unique challenges when it comes to securing radioactive sources, which are briefly summarized below:

- **Weak international regime for the security of radioactive materials** – There exists little in the way of international legal architecture when it comes to radiological materials. States have signed up to the IAEA’s CoC, which, while non-binding, outlines key principles of radiological security. This suffers, however, from a lack of universal coverage and implementation, with only 133 of 168 IAEA Member States having signed up to the CoC, many of which have yet to codify it into domestic law.
- **Gaps in national legislation and regulation** – In the absence of a formal international regime for radiological materials, countries have taken different legal and regulatory approaches to security. While there is no single solution to securing radioactive materials, clear gaps remain in many countries, especially when it comes to transporting materials, establishing national inventories, and the disposal of disused sources.
- **Poorly secured and open facilities** – Radioactive material is widely stored and used by the public and private sectors in hundreds of facilities around the world, such as hospitals and universities with open access and, in some cases, insufficient or no physical protection measures. These could be viewed as soft targets by potential adversaries looking to steal materials or carry out sabotage attacks. In these environments, increased security must be carefully balanced with safety and operational concerns.
- **Cradle-to-grave controls on radioactive materials remain weak** – Poor chain-of-custody procedures and insufficient or non-existent regulatory controls in many states have led to the loss of control over thousands of radiological sources. Even in states with regulatory controls in place, high disposal costs and a lack of depositories have led some end-users to abandon sources at the end of their life-cycle.
- **Complexity in tracking radioactive sources** – The use of radioactive sources is widespread and frequently involves trans-boundary movement of sources, making it difficult for states to keep track of radioactive sources, leaving them vulnerable to theft. Radioactive sources are particularly vulnerable during transport.
- **Lack of security awareness and security culture** – The diversity of radioactive

³ President Obama’s nuclear security agenda, laid out in his historic speech in Prague in 2009, included a vision of a world free of nuclear weapons and ensuring that terrorists never acquire a nuclear weapon. This effort was supported by international partners who convened four Nuclear Security Summits, bringing countries together based on a shared recognition—at the highest levels of government—of the dangers of nuclear and radiological proliferation. A similar effort should be launched to secure the most vulnerable radiological sources around the world in the next 3-4 years.

source applications and affiliated organizations, as well as the primarily “safety” orientation of operators and regulators, presents significant challenges for users.

- **Absence of dedicated venue for engaging a broad stakeholder base** – The private sector’s role in radiological security efforts is critical, but there is no *dedicated* existing forum for such engagement and contributions.
- **Lack of urgency in accelerating global radiological security efforts** – Given the increasing risk posed by terrorists seeking to acquire radiological materials, a global initiative, similar to President Obama’s four-year nuclear security effort, is urgently needed to galvanize international support for securing the most vulnerable radiological sources around the world within the next 3-4 years.

3. Recommendations

Strengthen the International Framework

There is currently no common set of international standards that all states must follow to secure their radioactive material. As the CoC and supplemental Guidance are formulated as non-legally binding instruments, they do not set forth a harmonized set of standards or rules with which states, even those having expressed political commitment, are legally obligated to comply.

The result is that states’ national approaches to radiological security vary and that states are left to interpret the provisions of this voluntary framework or selectively apply the supplemental Guidance. During the 2016 Open-ended Meeting of Technical and Legal Experts to Share Information on States’ Implementation of the Code of Conduct (2016 Code Review Meeting), it was noted that, while substantial progress has been made, the CoC along with its supplemental Guidance, used in conjunction with other tools of the IAEA (technical guides, self-evaluation, and peer review missions), does provide a sound infrastructure for radiological security. However, there are still gaps in national and international coverage for the CoC and the implementation of its provisions. This ad hoc approach, combined with a lack of an accountability mechanism (through the CoC’s “Formalized Process for Information Sharing”), reduces confidence in the global radiological security system. While the CoC has received wide acceptance as the primary instrument and framework for security of radiological sources, the international community cannot have confidence that all radiological materials are secure until all states are following a minimum and harmonized set of standards.

Several pivotal meetings have taken place to discuss the effectiveness of the CoC’s provisions including, among other topics, the pros and cons of establishing a stronger governance framework.⁴ The recommendation to strengthen the international framework applicable to radioactive sources was also referenced in the 2016 NSS Joint Statement on the Security of High Activity Radioactive Sources,⁵ “encouraging IAEA to assess the existing international framework applicable to radioactive sources in order to identify the gaps related to their security (i.e., in their physical protection) and associated issues of safety, and to make guidance and recommendations to bridge such gap.” However, there continues to be no consensus on establishing a forum for exploring a convention or utilizing the IAEA’s

⁴ See IAEA Report of the Chairman from the Abu Dhabi Conference, UAE, 2013.

⁵ See <http://www.nss2016.org/document-center-docs/2016/4/6/joint-statement-on-the-security-of-high-activity-radioactive-sources>.

International Working Group on Radioactive Source Security (IWGRSS) to hold these discussions. In order to reinforce the need to strengthen global radiological security architecture, it is important to re-examine the advisability of establishing a stronger international instrument for radioactive sources through the IWGRSS or another working group.

In parallel to these discussions, the IAEA and its Member States have undertaken proactive steps to clarify aspects of the CoC and identify areas where the revision of or additional supplemental guidance is needed.⁶ Several important activities underway in the past year include the much needed IAEA Guidance on the Management of Disused Radioactive Sources. This document, once formally adopted, will provide recommendations on the long-term management of disused sources in order to identify appropriate storage and disposal practices and encourage a policy of returning materials to supplier. The IAEA is also finalizing guidance on the Preparation, Conduct and Evaluation of Exercises for Nuclear and Other Radioactive Materials Transport Security; Model Regulations for the Security of Radioactive Sources in Use, Storage and Transport; Technical Guidance on Security Management and Plans for Radioactive Materials and Facilities; and revision to Nuclear Security Series No. 9 Security in the Transport of Radioactive Material, to name a few. As for the additional IAEA Nuclear Security Series implementing guides, the IAEA should consider more detailed technical guidance on topics of interest to competent authorities and operators (for example, on specific security measures, cybersecurity, information protection, and safety and security interface), or the expansion and integration of radiological security in existing nuclear guides to strengthen the current framework.⁷

Other efforts have advocated indirect means to strengthen the radiological security framework by strengthening complimentary instruments, such as the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, Global Initiative to Combat Nuclear Terrorism (GICNT),⁸ United Nations Security Council Resolution 1540, International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT), and promotion of IAEA Information Circular/869.⁹ While there are positive references to the CoC and radiological security in these frameworks, membership and legal status varies from one international agreement to another.

⁶ During a meeting held in Berlin, Germany in September 2016, most participants concluded that the CoC is impressively farsighted and comprehensive. However, there are a few topics that in retrospect might have been included or received more detailed coverage (e.g., transport security, security response measures, insider threat mitigation, safety and security interface, and alternative technologies to name of few). See www.nss2016-berlin.com for further information on this event.

⁷ For example, a much needed IAEA classification guideline addressing radiological security can build upon IAEA Nuclear Security Series No. 23-G (Security of Nuclear Information). See <http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1677web-32045715.pdf>.

⁸ During the GICNT 10th Anniversary meeting in June 2016, the Chairman called for states to do more on strengthening the radiological security legal framework. The IAG Coordinator recommended that legal experts be more broadly involved in the work of the working groups to assess and strengthen legal frameworks. He further noted radioactive source security as a future priority work area, which was echoed by the partners. Further, GICNT partners noted their activities can promote the development of national mechanisms to promote interagency cooperation and thus ensure policymakers receive essential information to support decision making, for example, in prioritizing allocation of resources.

⁹ At the 2014 NSS, 35 States signed the Joint Statement on Strengthening Nuclear Security Implementation. By signing this initiative, those states agreed to go beyond their existing international obligations. In October 2014, the Joint Statement was circulated by the IAEA as an Information Circular. It became INFCIR/869 and is now open to all IAEA Member States to join. It currently has the support of 38 States. See <https://www.iaea.org/sites/default/files/publications/documents/infcircs/infcirc869.pdf>.

States should explore opportunities to launch a new signature initiative to secure the most vulnerable remaining radiological sources around the world in the next 3-4 years. Such an effort can build upon previous NSS and IAEA commitments, and acknowledge that more work needs to be done to improve radiological security standards, build confidence that states are fulfilling their radiological security obligations, and encourage information sharing. Given the prevalence of sources worldwide, a global call for improving radiological security standards by a time bound deadline can build the needed sense of urgency and commitment for concrete actions to secure the highest risk radiological materials.

Broaden Universal Coverage for the Code of Conduct

There are clear gaps in national and international coverage for the CoC and the implementation of its provisions. More targeted efforts are needed to broaden the CoC's coverage within the auspices of the IAEA as well as share information on the concrete actions states are taking to implement the CoC and related guidance. Although the CoC has wide acceptance as the primary instrument for the security of sources, it still lacks universal coverage and implementation, with only 133 of 168 IAEA Member States, or 79 percent, having expressed political commitment.¹⁰

The IAEA Secretariat has continued to call on states that have not yet made a political commitment to the CoC and/or the supplemental Guidance to do so and has held many regional,¹¹ bilateral, and international assistance meetings for states that have not made a political commitment to the CoC. Several countries have also joined this outreach campaign and have undertaken diplomatic demarches to encourage states to sign up to the CoC. However, in order for global radiological security efforts to be effective, it must be comprehensive. All countries that produce, use, or import/export radiological sources should be covered by the current system. To date, there are 35 IAEA Member States that still remain outside of the regime and even more outside the auspices of the IAEA.

This gap in the global system is extremely dangerous and undermines the credibility of international efforts to secure all radiological sources. The pace of progress since the CoC was introduced in 2004 is not commensurate with the growing threat. Terrorists bent on stealing radiological materials will seek to obtain materials from the most vulnerable and least protected locations. In order to bring high-level attention to the undervalued risks posed by radiological materials, states need to acknowledge that their individual security regime contributes to the global architecture to prevent, detect, and respond to potential acts of radiological terrorism. This will require sustained political commitment and resources for the IAEA to continue to assist countries through guidance, training, and advisory services. More importantly, this will require countries that have not signed up to the CoC to do so, and for countries that have already signed up, to implement the provisions of the CoC.

Build and Strengthen the Regulatory Framework

There continues to be a lack of uniformity in the interpretation and application of

¹⁰ See <http://www-ns.iaea.org/downloads/rw/imp-export/status-list.pdf>.

¹¹ The Association of Southeast Asian Nations (ASEAN), a network of regulatory bodies and other agencies, has served as a forum for best practices, and technical and legal assistance for the CoC in the Asia-Pacific region, including outreach to states that have not yet joined the CoC.

international guidance and standards. Regulatory gaps in the effective management of radiological sources remain a challenge both at the national as well as the international levels. During the 2016 Code Review Meeting, most states generally considered that progress has been made since the last review meeting in the lifecycle management of sources. Of those states that submitted reports, most, if not all, have requirements and arrangements in place to ensure the safe and secure management of sources within a cradle-to-grave approach. However, exact progress is difficult to quantify due to lack of transparency and national reporting. On the basis of national reporting, the 2016 IAEA Report of the Chairman indicated that more work needs to be done in adapting or in establishing regulatory infrastructure, specifically for security.¹² Despite overall progress, implementation of the CoC's security related provision remains incomplete at the state, regulator, and operator levels. Security awareness and motivation is an impediment to implementation of all aspects of the CoC.

To improve or sustain this progress, many states at the 2016 International Workshop on the Security of Sealed Radioactive Sources in Berlin noted several areas of the CoC that remain difficult for regulatory authorities to implement. It was recommended that the IAEA develop technical publications and training materials specifically for radiological security in the areas of human resource capacity, security awareness, threat assessment, insider threat mitigation, security inspections of facilities with radioactive materials, information protection, and safety and security interface. It was also noted that all states should take this guidance into account in their efforts to strengthen and continuously improve radiological security. Another key recommendation was the establishment of an IAEA online collection of available national regulations on the security of radioactive sources, and make these available to Member States and other stakeholders.¹³ Taken together, these collective measures can strengthen the global regulatory framework for source security.

Strengthen the Role of the IAEA

The IAEA plays a vital role in promoting and strengthening global radiological security architecture, facilitating cooperation, and providing assistance to states. However, it must be strengthened so that it can enhance its already central role in nuclear and radiological security through its Nuclear Security Series recommendations and guidance, IAEA services (such as peer reviews), training programs and workshops, and its Nuclear Security Conferences. As the central coordinator and platform for the CoC, the IAEA also plays an important role in international discussions to strengthen global radiological security by serving as a designated convener for review meetings. This requires both political support as well as predictable programmatic funding to support the IAEA's core nuclear and radiological functions within the IAEA's Division of Nuclear Security.¹⁴

The 2016 NSS produced an IAEA Action Plan that recognized the central and unique role of the IAEA in nuclear and radiological security, putting forward several key recommendations

¹² See <http://www-ns.iaea.org/downloads/rw/code-conduct/info-exchange/chairman-report-may2016.pdf>.

¹³ Recommendations made at the September 2016 International Workshop on the Security of Sealed Radioactive Sources – Are the Provisions of the Code of Conduct Effective?" presentation by Fred Morris and Key Findings of the Working Group on Regulatory Control Concerning the Security of Radioactive Sources. See www.nss2016-berlin.com for further information on this event.

¹⁴ To date, the IAEA has relied on extra-budgetary contributions to implement its Nuclear Security Action Plans through the Nuclear Security Fund and to fulfill requests from Member States for radiological security support, including training, equipment, and physical protection upgrades.

for strengthening radiological security.¹⁵ However, the transfer of priorities from the IAEA Action Plan to the decision-making process of the IAEA will rely on the ability of states to attract support from members outside the NSS process. In order to align these priorities, including those made during the four Summits, the IAEA's essential role in coordinating global nuclear and radiological efforts should be strengthened, support from Member States for radiological security training, equipment, and continued development of technical guidance should be encouraged, and increased political support and predictable and programmatic funding should be provided to support the IAEA's core nuclear and radiological functions. Consideration should be given to funding the IAEA's Division of Nuclear Security through the IAEA's regular budget, not extra-budgetary contributions.

The 2016 International Conference on Nuclear Security should solidify the political message that nuclear and radiological security should be recognized globally as a priority.¹⁶ The results of the conference can serve as important input for work scope and implementation actions in the forthcoming IAEA Nuclear Security Action Plan (2018-2021), as well as funding requirements needed to support expanded efforts.

Increase Voluntary Actions and Reporting

Transparency and reporting helps to demonstrate that a state has met its commitments or obligations, and builds trust and confidence within the international community. Within the framework of the CoC, the information exchange process (often referred to as the "Formalized Process for Information Sharing") represents an opportunity for all states to undertake rigorous self-assessment and share their experiences in implementation with others. However, in line with the non-legally binding and flexible nature of the CoC and international meetings, both participation and presentations are voluntary and vary in level of attendance and information exchange. In addition, representatives from regulatory organizations compose most of the participants and only a limited number of other stakeholders attend such meetings. During the 2016 Code Review Meeting, 30 countries that have expressed their political support for the CoC did not send representatives, and only 76 countries shared their National Papers on the status of their progress toward implementing the CoC. This represents only 57 percent of states expressing support for the CoC.¹⁷ Moreover, recommendations in the 2016 Report of the Chairman are not formally adopted within the IAEA's policy organs and is often times short of concrete actions.

In order to strengthen the current information sharing mechanism within the CoC, Member

¹⁵ The 2016 NSS IAEA Action Plan recommended three key actions: 1) Implement the IAEA's CoC and continue developing related existing and new guidance in support of the CoC; 2) Advocate for the IAEA to promote and facilitate technical exchanges of experience, knowledge, and good practices on the use and security of high-activity radioactive sources and the exploration of alternative technologies; and 3) Advocate for the IAEA to facilitate further cooperation among suppliers and users of radioactive sources on management of radioactive sources no longer in use.

¹⁶ The 2016 International Conference on Nuclear Security will include a high-level session on the security of radioactive materials and associated facilities, as well as two technical sessions on the security of radioactive materials.

¹⁷ The last Triennial Meeting to Review the Code of Conduct (May 2016) was attended by 190 experts from 102 Member States of the IAEA and two non-Member States of the IAEA (Comoros and Saint Kitts and Nevis). The meeting was also attended by observers from the Food and Agriculture Organization, the International Source Suppliers and Producers Association, NTI, and the World Institute for Nuclear Security (WINS). This represents an increase in participation from past review conferences. See <http://www-ns.iaea.org/downloads/rw/code-conduct/info-exchange/chairman-report-may2016.pdf>.

States should fund the IAEA's Formalized Process for Information Sharing through the IAEA's regular budget, submit the recommendations and findings of the Report of the Chairman to the IAEA's policy-making organs for adoption and action, and submit for approval the IAEA's proposed Guidelines for National Reports. These Guidelines, once adopted, will improve the current structure of reporting by promoting consistency, facilitate comparisons between states' National Papers, identify trends, and provide more guidance on detailed information sharing.¹⁸ Member States should also make it a priority to attend the IAEA Code Review Meeting every three years and submit a national paper on the status of their progress.

In addition to the CoC's formalized process for information sharing, there are other existing reporting mechanisms that directly support information sharing, transparency, and benchmarking. The IAEA's self-assessment and peer review missions, for example, serve as an important tool for building confidence in the effectiveness of a state's security. Several states also noted that they had completed or requested the Nuclear Security Information Management System (NUSIMS), Radiation Safety Information Management System (RASIMS), Self-Assessment of the Regulatory Infrastructure for Safety (SARIS) tool, and the International Physical Protection Advisory Service (IPPAS) Module 4. More states should volunteer for these IAEA tools and services and share their results with other interested states. Additionally, more resources should also be provided to the IAEA to meet additional demands for these advisory missions.

External to the CoC process, a Joint Statement on Sustainability in Reporting and Information Sharing was put forward during the 2016 NSS to offer a consolidated report that would integrate related elements of treaty-based reporting requirements and voluntary reporting mechanisms into a single consolidated document, which includes the CoC.¹⁹ If states do not have the dedicated capacity to compile national reports, they should, at a minimum, consider consolidated reporting to provide national information to both fulfill their reporting requirements and to demonstrate the effectiveness of their radiological security regime.

Accelerate the Development and Use of Alternative Technologies

International interest in, and support for, replacing high-risk radioactive sources has also been increasing. As long as these dangerous materials exist, the threat of radiological terrorism will persist. The only way to permanently reduce risk is to minimize, and where feasible, eliminate these materials.

Multilateral instruments and international norms have also played a significant role. The 2014 and 2016 NSS's heightened awareness of radioactive source security and the promotion of alternative technologies.²⁰ At the 2016 NSS, France led a Gift Basket on Strengthening the Security of High Activity Sealed Radioactive Sources that was signed by 28 countries and Interpol. This Gift Basket contributed to raising political awareness on actions needed to

¹⁸ Another major shortcoming is that the formalized process does not have established benchmarking or implementation indicators to assess the impact of measures taken in achieving the provisions in the CoC, the mandate for data analysis, or peer review. More should be done to address these areas.

¹⁹ The NSS's provided from 2010 to 2016 further opportunities of exchanges and improvements through national reports and statements; see <http://www.nss2016.org/document-center-docs/2016/4/1/joint-statement-on-consolidated-reporting>.

²⁰ See <http://nis2016.org/wp-content/uploads/2016/03/NIS-Leaders-Present-2016-Joint-Statement-to-the-2016-Nuclear-Security-Summit-1.pdf>.

promote the exchange of information on alternative technologies through many forums as well as through the auspices of the IAEA,²¹ and the establishment of a Technical Working Group with the United States.²²

While alternative technologies cannot currently replace the complete spectrum of radioactive sources, for certain applications they represent a mature technology that can also offer better operational, economic, and healthcare benefits. Several states have advanced well beyond advocacy for alternative technologies and are undertaking implementation efforts to switch to non-isotopic alternatives. France, in its national statement to the 2016 NSS, called for “minimizing the use of high activity sealed sources where it is technically and economically feasible,” citing its use of x-rays rather than cesium chloride for blood irradiation as an example and pledged to phase out all blood irradiators by the end of 2016. Norway and Japan have taken similar steps to phase out the use of cesium chloride in blood irradiators.²³ Alternative technologies (such as x-rays for the replacement of cesium irradiators and linear accelerators for the replacement of teletherapy devices) are replacing radioactive sources in certain countries, resulting in permanent risk reduction. States should work with their public and private sectors, in close coordination with national research and development efforts, in promoting the development, certification, promotion, and demonstration of innovative technologies that do not require the use of high-activity radiological sources. Non-isotopic alternative technology has become increasingly available worldwide, and countries should continue to develop and explore applications that are on par with their isotopic counterparts. This could be done in partnership with and tailored to meet the unique needs of developing countries.²⁴

In order to support international engagement on alternative technologies, the IAEA should consider formally adopting alternative technologies as part of its program mandate and play a coordination role in defining standards, guidance, and assistance (i.e., TECDOC on the status of commercially available technologies for Category 1-5; incorporate considerations for alternative technologies in the ongoing revisions of IAEA publications), and support the establishment of a Coordinated Research Project (CRP). The IAEA should also develop a program plan on alternative technologies and establish a lead office to coordinate such an effort. Several IAEA offices may have a contributing role (e.g., Nuclear Fuel Cycle & Waste Technology, Division of Nuclear Security (DNS), Nuclear Applications (NA), Technical Cooperation (TC), and Program of Action for Cancer Treatment (PACT)).

²¹ The Gift Basket on Strengthening the Security of High Activity Sealed Radioactive Sources recommends international engagement in support of alternative technologies and calls on the IAEA to focus on three key areas: Encouraging the IAEA and Member States to promote and support research efforts on the development of technically and economically realistic and acceptable non-high activity sealed source (HASS) technologies, incorporating in these efforts the manufacturers, end-users, standards-setting bodies, and technical experts; Encouraging the IAEA and Member States to initiate discussions on how to take into consideration radiological security implications in their regulatory arrangements for HASS-based technologies; Encouraging the IAEA and Member States to exchange information on the barriers that limit or could limit the spread of non-HASS technologies and on possible ways to tackle them. See http://static1.squarespace.com/static/568be36505f8e2af8023adf7/t/56fееeb94d088e7781f9e41c/1459547833689/Action+Plan+-+IAEA_FINAL.pdf.

²² France committed to co-chair with the United States an ad hoc working group of stakeholders involved with alternative technologies. Although the working group has no official mandate, it has served as a technical platform for building an international roadmap on alternative technologies.

²³ NTI will be publishing a paper that reviews national efforts to phase out cesium chloride in blood sterilization with key recommendations for other governments to consider in their national approaches.

²⁴ Lower and middle income states are exploring the availability and affordability of alternative technologies while struggling to increase access to cancer care.

Strengthen the Role of the Private Sector and Key Stakeholders

The private sector and key stakeholders can play an important role in global radiological security efforts by advocating for best practices and ensuring corporate responsibility for radiological security, security culture, training for key personnel, and systems for testing security on a regular basis. However, while the private sector remains an integral partner in national and international efforts to strengthen radiological security, there are *no* formal dedicated interactions between nuclear industry and the IAEA as many fora are designed for government officials, not for other stakeholders.²⁵ Key stakeholders (e.g., government, industry, end users, academia, non-governmental organizations, law enforcement, professional associations, etc.) are, often times, left outside of government-to-government fora with no direct channels for communicating. This will require active engagement, preferably earlier in the process. **In order to ensure key stakeholder involvement in global radiological security efforts, a *dedicated* forum should be established through an annual conference (with the inaugural meeting in October 2017) that will bring a diverse community together to share experiences, technology solutions, and support for safeguarding radiological sources during their entire lifecycle.** Such a forum will also recognize industry and the non-governmental community as integral supporters and contributors to global radiological security efforts.

Additionally, the private sector plays an important role in global radiological security efforts by advocating for best practices and ensuring corporate responsibility for radiological security, security culture, training for key personnel, and systems for testing security on a regular basis.²⁶ Professionals with a role in radiological security should be cultivated through such means as qualification, education, and training programs. These stakeholders should have a forum for input and exchanges, and be encouraged to promote the international exchange of experiences on ways to develop, foster, and maintain a robust national radiological security culture compatible with the state's radiological security regime. This will require motivation, knowledge, and the allocation of resources. All stakeholders should continue to invest in training and qualification resources to ensure a culture of excellence for management and personnel with accountability for radiological security.

In parallel with these efforts, education and training programs in the specific area of radiological source security should be promoted through relevant forums such as the IAEA, the International Nuclear Security Education Network (INSEN), WINS, and national and regional Nuclear Security Centers of Excellence (COE). WINS recently established an Academy which provides an online certification program in all aspects of nuclear and radiological security, including a specific module on radiological security. Through their work on the International Best Practice Guides (BPGs) and numerous interactions with practitioners across the nuclear spectrum over the last five years, WINS has created the

²⁵ It is of critical importance to involve all stakeholders in the process and to stress the need for further engaging industry and end-users in the forums of exchanges. The typical absence of law enforcement agencies in many forums, for example, is an information gap that has significant impact on states' capacities to demonstrate that effective radiological security has been achieved.

²⁶ During the 2016 Code Review Meeting, it was noted that the interface between safety and security still presents challenges to a fully integrated safety-security culture, threat awareness, and the sustainability of training and knowledge at all levels (national, regulatory, operator, and users/industry), and more qualification and refresher training programs are needed. See <http://www-ns.iaea.org/downloads/rw/code-conduct/info-exchange/chairman-report-may2016.pdf>.

Academy to improve the quality and practice of nuclear security programs through professional development and training.²⁷

To date, efforts in professional training and development have been largely focused on supporting the development of security courses for nuclear materials and facilities. More should be done to fully integrate safety-security culture, threat awareness, and the sustainability of training and knowledge at all levels. Targeting the next generation of stakeholders to embed security matters, reporting practices, and transparency attitude as early as possible should also be encouraged to sustain progress.

Make and Sustain New Commitments at the 2016 Nuclear Security Summit and Beyond

At the 2016 NSS, participating states presented many joint statements (also known as “gift baskets”) that outlined their contributions to voluntary multilateral efforts. The 2016 Joint Statement on Strengthening the Security of High Activity Sealed Radioactive Sources (HASS), led by France and signed by 28 States and Interpol, focused on actions to prevent the theft of radiological sources by supporting their replacement with technologies that do not use radioactive sources, increasing cooperation among source supplier and recipient states, and assessing the international framework on HASS, especially regarding the management of sources that are no longer in use. This new pledge built on the 2012 Gift Basket on the Security of Radioactive Sources (sponsored by Germany) and the 2014 Gift Basket on Enhancing Radiological Security (sponsored by the United States). Although these radiological gift baskets have different goals and member support, they all highlight the importance of radiological security and measures that can be taken to ensure that they do not fall out of regulatory control.²⁸

The 2016 NSS also established a means of sustaining momentum and high-level political attention on nuclear and radiological security, providing a bridge beyond the Summits to track implementation of commitments and continue the work of strengthening the global system through a Nuclear Security Contact Group. Originally signed by 39 participating states and two international organizations (United Nations and Interpol), the Contact Group will meet annually and is open to any interested party. More states should join the Contact Group to maintain the network of senior officials and experts that supported the success of the Summits and synchronize national actions and commitments expressed in the NSS communiqués, action plans, and gift baskets.

However, long-term and sustained high-level attention on radiological security will require a regular structured mechanism within the IAEA or from a core group of states (e.g., Contact Group) that can drive future progress and accountability. Ultimately, in order to align the priorities of the four Summits within the IAEA’s framework, new and modified priorities of Member States need to be reflected in the IAEA Nuclear Security Plan for 2018 and beyond. This plan builds on General Conference resolutions, the Ministerial Declaration and, where

²⁷ The WINS Academy provides accredited courses for personnel with accountabilities for nuclear security and a specific module on radiological security.

²⁸ For example, Finland, Indonesia, Malaysia, Philippines, Poland, Singapore, Spain, Switzerland, and Thailand signed in 2012 but not in 2014. Seven countries that signed the 2014 Joint Statement on Enhancing Radiological Security did not sign up to the 2016 Statement (Algeria, Armenia, Georgia, Japan, New Zealand, Turkey, and the UAE). Twelve new countries and 1 international organization signed up to the 2016 Joint Statement on Strengthening the Security of High Activity Sealed Radioactive Sources (Belgium, Chile, Finland, France, Israel, Philippines, Poland, Romania, Singapore, Spain, Switzerland, and Thailand, plus Interpol).

appropriate, the conclusions and recommendations from the International Conference on Nuclear Security.

4. Conclusion

Unlike nuclear material, which is only located in 24 countries around the world, tens of thousands of radioactive sources exist worldwide in more than 100 countries. Some of these radiological sources are poorly secured and vulnerable to theft by terrorists seeking to detonate a dirty bomb. At the same time, the threat environment is worsening and the widespread availability of radiological sources makes the probability of an RDD attack higher than that of an improvised nuclear device. Urgent action is needed to meet the worsening threat environment. The 2016 IAEA International Conference on Nuclear Security offers a near-term opportunity to implement numerous options to further discuss and improve global radiological security. However, a new political initiative on radiological security is needed to bring high-level attention and countries together to spur needed and timely action.