GLOBAL DIALOGUE ON NUCLEAR SECURITY PRIORITIES[1]

NON-PAPER: STRENGTHENING THE SECURITY OF RADIOLOGICAL SOURCES

INTRODUCTION

This non-paper highlights the threat and challenges posed by radiological sources, and offers various options for countries to consider adopting at the March 31-April 1, 2016, Nuclear Security Summit (NSS) and beyond to strengthen the security of their radiological sources. The Appendix includes background information on the International Atomic Energy Agency (IAEA) definition of Category I radioactive materials and the International Atomic Energy Agency (IAEA) Code of Conduct on the Safety and Security of Radioactive Sources (Code of Conduct).

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 in recent years through a series of Nuclear Security Summits. During the 2014 NSS in The Hague, 23 countries issued a "Statement on Enhancing Radiological Security"(Joint Statement) and committed to secure their IAEA Category I radioactive sources by 2016. These countries should be commended for their efforts as they are setting an example for other countries to follow.

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[1] Through the Global Dialogue on Nuclear Security Priorities, leading government officials, international experts, and nuclear security practitioners engage in a collaborative process to build consensus about the need for a strengthened global nuclear security system, how it would look, and what actions would be needed at the Nuclear Security Summits and beyond. The Global Dialogue discussions are conducted on a not-for-attribution basis; where individuals and governments are free to use the information obtained during the meeting, but that information should not be attributed to a specific individual or government. For more information: http://www.nti.org/about/projects/global-dialogue-nuclear-security-priorities.

This Joint Statement is particularly important because 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 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 23 out of 167 IAEA member 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.

There are numerous options for countries to implement, either individually or collectively, to further improve the security of radiological sources, such as:

- broaden universal coverage of the Code of Conduct and supplementary IAEA Guidance on the Import and Export of Radioactive Sources (Guidance);
- strengthen the international framework;
- accelerate the development and use of effective alternative technologies, where feasible;
- strengthen the regulatory framework for securing radiological sources;
- strengthen the role the private sector;
- deliver on Nuclear Security Summit commitments;
- strengthen the role of the IAEA in supporting international efforts on radiological security; and
- strengthen voluntary mechanisms for promoting transparency, best practices, and reporting progress.

THE THREAT

Terrorists cannot build an RDD unless they acquire the necessary materials to do so.[2] It is therefore important to effectively secure all high activity radiological sources. While only a limited number of countries maintain stockpiles of fissile material suitable for nuclear weapons—highly enriched uranium (HEU) and plutonium—radioactive materials are routinely stored and used throughout the world. Today, tens of thousands of radiological sources are

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[2] See "Understanding Radiological Materials" in the Appendix.

located in more than 100 countries around the world. Unlike weapons-usable nuclear materials that are present in a relatively small number of countries (24 countries), radioactive sources are almost ubiquitous and found everywhere in the world.

Moreover, the threat environment is worsening, as the world experiences brutal attacks and incidents by terrorist groups such as ISIL, Boko Haram, Al Qaeda, and others. The U.S. intelligence community continues to maintain that terrorist groups have an interest in acquiring radioactive materials to make a dirty bomb and that they would not hesitate to use them, if they were to acquire such materials.[3] Terrorist organizations could also exploit lapses in physical protection and criminal trafficking networks to smuggle radiological materials. The 2014 report on the James Martin Center for Nonproliferation Studies (CNS) Global Incidents and Trafficking Database identified 325 publicly reported incidents in which nuclear or other radioactive material was lost, stolen, or otherwise outside of regulatory control.[4] The vast majority, about 85 percent, of recorded incidents in the database involved non-nuclear radioactive material.

Taken together, the acquisition and use of RDDs by terrorists is a higher probability event than the acquisition and use of a nuclear weapon. As such, the global urgency for protecting these radiological sources (both legally and politically) needs to evolve in conjunction with the growing threat. Accordingly, the prevention of such incidents should be considered a high priority and the international community must work together to ensure that radiological materials, wherever they reside, are subject to the highest levels of protection.

ADDRESSING THE SECURITY OF RADIOLOGICAL SOURCES

Although the 2014 NSS Joint Statement included a specific timeframe for the 23 countries to secure their Category I radioactive sources (i.e., by 2016), there is still significant work that needs to be done to strengthen the global architecture for radiological sources, and progress should be accelerated so that it is commensurate with the increasing threat.

Global efforts to secure radiological sources are impacted by various national challenges in individual states. Some states have national infrastructure shortcomings, such as weaknesses in

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[3] James Clapper, Director of National Intelligence, "Statement for the Record on the Worldwide Threat Assessment of the U.S. Intelligence Community for the Senate Committee on Armed Services," March 10, 2011, p. 4, available at www.au.af.mil/au/awc/awcgate/dni/threat_assessment_10feb11.pdf; Jonathan Medalia, "'Dirty Bombs': Technical Background, Attack Prevention and Response, Issues for Congress," Congressional Research Service, June 24, 2011, available at http://fas.org/sgp/crs/nuke/R41890.pdf; Charles D. Ferguson and William C. Potter, The Four Faces of Nuclear Terrorism, (Monterey, CA: Center for Nonproliferation Studies, Monterey Institute of International Studies, 2004).

[4] CNS Global Incidents and Trafficking Database, April 2015, available at http://www.nti.org/analysis/reports/cns-global-incidents-and-trafficking-database/.

their legal security architecture, insufficient financial or human resources, lack of training, and inadequate physical protection of sources during production, storage, and transport, as well as improper disposal and abandonment. Additional challenges are highlighted below:

- **The legal architecture for radioactive materials is weak.** The Code of Conduct,[5] along with the supplementary IAEA Guidance on the Import and Export of Radioactive Sources[6] is **a non-binding instrument** that contains voluntary provisions implemented by subscribing states. This international framework is considerably less developed compared to the stronger legal underpinnings associated with nuclear materials security. For instance, the Code of Conduct contains basic principles suggesting that states "…take appropriate measures to ensure that the radioactive sources within their territory are safely managed and securely protected during their lifetime." It also calls for effective national legislation and regulatory controls over radioactive sources. However, **the Code of Conduct does not include any specific date or timeframe to secure radiological sources**. The absence of a legally binding framework is quite different from the Convention on the Physical Protection of Nuclear Material (CPPNM), which establishes legal obligations of states parties in the area of physical protection of nuclear material, and the IAEA Nuclear Security Recommendations on the Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225).

- **A large portion of radioactive materials are outside of radiological security mechanisms.** Although the objectives of the Code of Conduct are broad, its scope on radiological materials is limited.[7] It only covers Categories 1-3 of radioactive sources (discussed in more detail in the Appendix), and its provisions are not applicable to unsealed radioactive materials, radioactive sources used for military purposes, and nuclear materials as defined in the CPPNM.

- **Lack of universal coverage to politically commit to and implement the Code of Conduct.** To date, only 127 of 167 IAEA member states have committed to the Code of Conduct (76 percent) and many of these countries have not met all of their political commitments to follow its provisions. Therefore, a vast number of radiological sources are outside of existing international and national security mechanisms. The key factor to ensuring these materials are secure is effective implementation of the respective standards at the national level in

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[5] http://www-ns.iaea.org/tech-areas/radiation-safety/code-of-conduct.asp.
[6] http://www-pub.iaea.org/books/IAEABooks/8901/Guidance-on-the-Import-and-Export-of-Radioactive-Sources.
[7] The objectives of the IAEA Code of Conduct are to: (1) help states to reach and maintain a high-level of safety and security of radioactive sources including the end of their useful lives; (2) prevent unauthorized access, damage, theft or unauthorized transfer of radioactive sources; (3) prevent malicious use of radioactive sources; mitigate and minimize the consequences of any accident or malevolent act involving radioactive sources; and (4) support states in establishing national legislative and regulatory system of control.

compliance with the Code of Conduct as well as its broader support.

- **Tracking thousands of radiological sources worldwide throughout their lifecycle remains an ongoing challenge.** At the national level, the institutional framework in many countries for the physical control and accounting of radioactive sources is not sufficient. In contrast to nuclear material, which is often stored in government owned and secured facilities, radioactive material is typically used and stored by the private sector in places with minimal or no physical protection. Further, medical, academic, and research sites are open environments that remain accessible to a large number of people. Those open facilities, which typically have no trained on-site security forces, are far more challenging to secure and could be viewed as soft targets by potential adversaries.

- **Cradle to grave controls on radioactive materials remain weak.** Poorly planned chain of custody procedures and a lack of regulatory controls in many countries have led to the loss of control over thousands of radiological sources. Even with regulatory controls, high disposal costs, and a lack of depositories have led some end-users to abandon radioactive sources at the end of their lifecycle (i.e., disused sources). In many countries, the institutional framework for the control of radioactive sources is not sufficient. Therefore, cases of "orphaned" radioactive sources, which are abandoned or simply disposed of illegally, are a serious concern. Abandoned or orphaned sources present both a safety risk and a potentially high security risk.

- **The transfer of radioactive sources is a major challenge.** The use of radioactive sources is widespread in nearly all countries and frequently involves the transboundary movement of sources. There is a constant flow of radioactive materials into and out of countries and it is difficult for states to control the multitude of transfers of radioactive sources. Therefore, radioactive sources are particularly vulnerable to theft during cross-border transport.

Collectively, the security of radioactive sources presents unique challenges that are distinct from the protection of nuclear materials. These challenges will require continued, innovative, and sustained attention and support within the international community.

OPTIONS FOR IMPROVING RADIOLOGICAL SECURITY

There are numerous options for countries to implement either individually or collectively to further improve the security of radiological sources. Below is a list of key options for countries to consider adopting at the 2016 Nuclear Security Summit and beyond.

Broaden Universal Coverage of the Code of Conduct

The Code of Conduct was drawn up to assist states in developing and maintaining high levels of safety and security for radioactive sources. It provides a basic governance framework for radioactive sources composed of key safety and security requirements that states should ensure are addressed in their laws and regulations as well as by their administrative bodies. It does not, however, provide a detailed or exhaustive list of measures. Because the use of radioactive sources frequently involves the transboundary movement of sources, members of the international community also endorsed the first-ever international export control framework for radioactive sources, contained in the non-legally binding IAEA Guidance on the Import and Export of Radioactive Sources. The supplemental Guidance was developed in 2004, and subsequently revised in 2011, to track cross-border movements of sources and to better ensure that the recipient is authorized to possess the sources.

The IAEA has also worked extensively to encourage universalization of the Code of Conduct by all member and non-member states, and to encourage countries to implement (and politically commit to) the Code of Conduct and the associated supplemental Guidance through regional workshops and regular activities within its legislative assistance program. These activities have succeeded in raising global awareness of the need to better protect those potentially dangerous sources.

Over the past decade, the international community has made measurable strides in improving the security of radioactive sources. However, making a political commitment to support the Code of Conduct is only the first step. More targeted efforts will be necessary to focus on what states have done to implement the Code of Conduct within their national legislatures and to strengthen measures to protect radiological materials from theft.[8] To date, only 127 of 167 states (76 percent) have made a political commitment to the IAEA Director General to follow the Code of Conduct, of which only 99 have made a commitment to follow the supplementary Guidance.

This lack of states' commitment illustrates clear gaps in national and international coverage for the Code of Conduct and its provisions. These gaps will require the international community, along with the IAEA, to work together to provide the financial, technical, and political resources to assist states in implementing the Code of Conduct through bilateral and/or regional partnerships, training, and information exchanges as well as convincing other states that complacency undermines the effective protection of high activity radioactive sources in all

[8] Paragraphs 18 and 19 of the Code of Conduct propose elements for a legislative framework for the safety and security of radioactive sources. Paragraphs 20-22 propose elements for a regulatory body, including powers and responsibility.

other states.

Strengthen the International Framework

The Code of Conduct is a primary instrument aimed at enhancing the security of radioactive sources, though there is no accountability mechanism to ensure that recommended standards are being met. Political commitments to the Code of Conduct have been instrumental in raising awareness, establishing best practices, and gaining acceptance, but it should be recognized that the Code of Conduct is nevertheless a non-legally binding framework. A stronger international framework for radiological material governance and accountability is needed if the international community is serious about countering the threat posed by radiological materials. The development of an international global standard or convention for radiological security would help to ensure that controls are in place for the lifecycle management of these sources and that all users, exporters, and recipients of sealed sources abide by a harmonized set of standards and legally binding obligations for securing their material. It might be possible for such a development to proceed in parallel with the continued implementation of the Code of Conduct.

A stronger framework for radiological security and control would also fill a gap in international instruments aimed at preventing terrorists' use of chemical, biological, radiological, and nuclear weapons (CBRN). Currently, legal instruments include the Biological Weapons Convention, Chemical Weapons Convention, Treaty on the Nonproliferation of Nuclear Weapons, Convention on the Physical Protection of Nuclear Material, and the International Convention for the Suppression of Acts of Nuclear Terrorism. Multilateral export control regimes include the Nuclear Suppliers Group, Zangger Committee, Wassenaar Arrangement, and Australia Group. None of these are dedicated instruments or regimes for addressing threats posed by radiological materials.

At the upcoming 2016 Nuclear Security Summit, world leaders should consider a mechanism for evaluating the merits of developing global standards, and determine the most appropriate forum to create the necessary political momentum beyond 2016.[9] One possible forum is through a working group established under the IAEA. Member states could examine the advisability of establishing a stronger international instrument for radioactive sources that draws on the success of the Code of Conduct and is legally binding, similar to other CBRN materials of concern. In addition, an International Workshop on the Safety and Security of

[9] One of the findings from the Abu Dhabi 2013 International Conference on the Safety and Security of Radioactive Sources was a recommendation to convene a working group to assess the merits of developing a Convention on the Safety and Security of Radioactive Sources and to make recommendations so that an informed decision can be made by the IAEA.

Radioactive Sources will be held in Berlin, Germany, in September 2016. This workshop, which will be coordinated in cooperation with France, Germany, and the United States, will review the adequacy and sustainability of the Code of Conduct. Recommendations and conclusions will be presented at the December 2016 IAEA Ministerial Conference on Nuclear Security for further action.

Accelerate the Development and Use of Effective Alternative Technologies

Although securing radiological sources is often the highest priority, a better option exists for certain radiological sources that would result in **permanent threat reduction** without impacting the efficacy of medical and research technologies. Over the past several years, there have been significant technological advances in developing alternative technologies (such as x-rays or linear accelerators) that do not use radiological isotopes, and therefore cannot be used by terrorists to make a dirty bomb. As progress in the technical, operational, and economic feasibility of these replacements continues, states and the private sector should transition, where applicable, to alternative technologies, particularly for the use of one of the most dangerous isotopes—cesium-137—used primarily in medical equipment. X-ray technology, which does not require the use of radioactive sources, is the most common alternative to cesium chloride used for blood irradiation. Given the availability of such alternative technologies for blood irradiators, all hospitals should replace these irradiators to reduce their risks and potential liability should their radiological materials be stolen by terrorists.

Such actions would be consistent with the 2008 report by the U.S. National Academy of Sciences study which called for **eliminating all Category I and II cesium chloride sources in the United States and, if possible, elsewhere**. Some countries have taken impressive steps to reduce the threat posed by cesium blood irradiators and are far ahead of efforts in the United States. For example, the Norwegian government required that all cesium-137 blood irradiators be phased out by 2015. As a result, all cesium-137 irradiators in Norway have been removed and shipped back to Canada. This highlights important actions by individual countries to significantly improve security.

Other alternative technologies, such as linear accelerators, can be used to replace Cobalt-60 (Co-60) devices. Radiotherapy (RT) is one of the major modalities of cancer treatment and is commonly used to destroy tumors. An RT device uses Co-60 sources, but can be replaced with a linear accelerator (LINAC), which is an electric device producing high-energy x-rays without any radiological security risk.

While LINACs have replaced nearly all Co-60 teletherapy devices in the United States and other developed countries, Co-60 teletherapy devices remain common throughout the developing world. Replacing these internationally is not so much an issue of technology development as it is an issue of strengthening infrastructure, addressing maintenance and warranty issues, providing training, funding the procurement of expensive LINACs, and providing for the disposition of the disused sources. The international community, in coordination with the IAEA, should develop a program to address these challenges and accelerate the transition from teletherapy to LINACs throughout the developing world.

In parallel with efforts to convert to the use of alternative technologies, where applicable, efforts should be accelerated to develop and promote alternative technologies for a wide-range of medical and industrial applications. The private sector, in close coordination with national research and development efforts, can play a key role in promoting the development, certification, promotion, and demonstration of innovative technologies not requiring the use of high activity radiological sources. Non-isotopic alternative technology has become increasingly available worldwide, and industry should continue to develop and explore applications that, in many cases, are on par with their isotopic counterparts. As progress in the technical, operational, and economic feasibility of alternative technologies continues, industry could take a more active role in supporting and promoting replacement technologies. This effort could be similar to industry's role in promoting the reduction of use of HEU through the conversion of HEU to low enriched uranium (LEU) in research reactors, where technically and economically feasible.[10]

Strengthen the Regulatory Framework for Securing Sources

The establishment of an effective regulatory infrastructure is the basis for effective control of radioactive sources. A legislative and regulatory framework for radiological security ensures that all competent authorities have sufficient legal authority to fulfill their assigned radiological oversight responsibilities and to enforce security at sites (legislation, regulations, inspections, human resource, qualifications, etc.). The Code of Conduct and its supplementary Guidance, together with IAEA safety standards, provide the international requirements and recommendations for the development and harmonization of policies, laws, and regulations on the safety and security of radioactive sources. They provide a basic governance framework for radioactive sources made up of key safety and security requirements that states should ensure are addressed in their laws and regulations as well as by their administrative bodies.

The Code of Conduct does not, however, provide a prescriptive list of measures. This has resulted in the **lack of uniformity in the interpretation and application of international guidance and standards.** This has also resulted in regulatory gaps in the effective management

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[10] At the March 2014 Nuclear Security Summit, the United States introduced a commitment to "establish an international research effort on the feasibility of replacing high activity radioactive sources with non-isotopic technologies, with a goal of producing a global alternative by 2016."

of radiological sources both at the national and international levels. The establishment of an effective regulatory framework to ensure that states protect the highest activity radiological sources, as well as the development of a strong national regulatory infrastructure for sustaining security of sources over the long term, will require several key regulatory elements.

First, a state's regulatory body must have the necessary independence to perform its radiological security responsibilities and function. This requires standards of professional competence of the regulatory staff, the availability of adequate and independent financial resources, and the establishment of a security culture in both the regulatory body and the licensees. The absence of a dedicated body responsible for both security and safety has the potential to compromise one for the other.

Second, a mature regulatory framework for securing radiological sources requires states to establish a comprehensive lifecycle management of radioactive sources. Such a framework, at a minimum, addresses national source tracking, orphan source identification and recovery capabilities, import and export, and end-of-life management capabilities. A national registry allows the regulatory body to follow transactions of high-risk radioactive sources from origin, through transfer to another licensee, to final disposition. These systems typically ensure that national radioactive source authorization, possession, and transaction information is available to all government agencies that protect the country from radiological threats and alert regulators to track discrepancies if sources become lost, stolen, abandoned, or disused.

Additionally, the establishment of an effective import and export control regime represents the first line of defense in ensuring that only authorized recipients can receive and possess radioactive sources. All states should have the regulatory capacity to authorize imports and exports for Category I and II sources. Similarly, the establishment of a national policy to manage sources at the end of their life cycles should consider the establishment of a dedicated storage facility for radioactive sources, contractual and financial provisions for end-of-life disposal of radioactive sources, treatment of bankruptcy situations, and an emphasis on record keeping and inventory.

Lastly, efforts to enhance the security of radiological materials over the long term cannot be solved by only implementing physical protection upgrades to improve the security of radiological sources. The broader strategy must recognize that indigenous laws, regulations, and authorities need to be a fundamental part of a comprehensive and sustainable strategy. This will require states to acknowledge that a strengthened national regulatory framework contributes to and strengthens the global architecture.

Strengthen the Role of the Private Sector

The Nuclear Industry Summits (NIS) have succeeded in raising awareness of nuclear and radiological security issues among hundreds of senior executives across many industries. Since 2010, these industry summits have been an integral and official side event at the official Nuclear Security Summits. The role of the NIS in previous summits has been to enhance awareness in nuclear security and to establish commitments, worldwide, to improve governance and management arrangements.

The responsibility and accountability to secure sources should be shared by the owners and operators of sources. As radiological materials are mainly used by the private sector and are not under immediate government control (like nuclear material), industry represents the first line of defense to prevent radioactive material from falling into the hands of terrorists. This is why the private sector's role is critical to radiological security efforts—industry is required to translate legislation and regulations into concrete actions that are implemented by users in the private sector. These organizations using radioactive sources are both public and private and may be quite diverse, even for a given application.

The private sector also provides a vital contribution to modern society by supplying essential radioactive materials and sources for industry and tens of millions of patients each year. Similar to the nuclear industry, the radiological industry has a critical role in ensuring security at civilian medical, research, and industrial facilities that they operate, and/or the materials they supply. Supplier states and industry also cooperate between their suppliers and the recipient states to develop common practices on exports and on the management of the end-of-life of high activity sources, especially on the return of disused material to a supplier.[11]

The private sector can play an important role in global radiological security efforts by advocating for best practices and corporate responsibility for radiological security, security culture, training for key personnel, and systems for testing security on a regular basis. Professionals with a role in radiological security should be cultivated through such means as qualification, education, and training programs. The private sector should also be encouraged to promote international exchange of experience on ways to develop, foster, and maintain a robust national radiological security culture, compatible with the state's nuclear security regime. The World Institute for Nuclear Security (WINS), which was established as an international forum for nuclear security professionals to exchange best practices, is just one

[11] The Ad Hoc Group of supplier states, an informal group that meets annually on the margins of the IAEA meeting on the Code of Conduct, can be the appropriate forum to develop such common practices. Discussions have also included harmonizing import and export procedures and communications, repatriation of vulnerable disused radioactive sources, and the development of best practices for import-export.

forum for facilitating dialogue among the nuclear industry worldwide.

The Nuclear Security Summit in 2016 will continue to play an important role in facilitating dialogue among the nuclear industry worldwide. The NIS will emphasize three key priorities: (1) improving corporate governance (and the role of the nuclear industry in the security of its materials and technologies); (2) enhancing cybersecurity; and (3) strengthening control over the use, storage, and transport of strategic nuclear and radiological materials. These objectives will greatly contribute to the security arrangements within national regulatory frameworks and reaffirm industry's role to partner with states to strengthen radiological security.

Deliver on Nuclear Security Summit Commitments

The upcoming Nuclear Security Summit in Washington is the last chance to galvanize political support for radiological security with the unique benefit of a process that includes participants at the head-of-government level. The emphasis at the 2016 Summit should be on implementation, viability, and sustainability of the measures already agreed upon, and bold actions that can be adopted for action beyond 2016.

Regarding implementation of radiological security measures already agreed upon at the last Nuclear Security Summit, it will be particularly important to report progress on implementation of the 2014 Joint Statement on Enhancing Radiological Security. Significant progress in implementing this Joint Statement, which included a commitment by 23 countries to secure their Category 1 sources by 2016, will help emphasize that radiological security improvements are achievable, and will hopefully encourage other countries to take similar steps to secure their highest activity sources by a specific date.

Most importantly, more NSS countries should support and adopt a new joint statement on radiological security at the 2016 NSS, which is being drafted by the French government. This new joint statement should include additional commitments to secure radiological sources, convert to alternative technologies (where feasible), encourage the creation of a working group to assess the merits of a legally binding convention, and other steps to strengthen the global radiological security regime. In addition, NSS countries should consider convening a meeting in the period between the Nuclear Security Summit and the December 2016 IAEA Ministerial Conference on Nuclear Security to further promote radiological security. Recommendations and actions could feed into both the December 2016 Ministerial Conference as well as the IAEA process so as to not lose any momentum on this urgent issue.

Finally, it is essential to make broad and tangible progress on the IAEA Action Plan commitments and agree on how to sustain and expand these efforts going forward. With regard to the IAEA Action Plan and radiological security, the adoption and implementation of any portion of the action plan will occur through the decision-making processes of the IAEA, and will rely on the ability to attract support from IAEA member states outside the summit process. 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 that can serve as a forum for future progress and accountability. Progress on radiological security should be reviewed at the December 2016 IAEA Ministerial Meeting in Vienna, Austria.

Strengthen the Role of the IAEA

Radiological security is the responsibility of each individual country, but international cooperation is vital to support states in establishing and maintaining effective radiological security regimes. The IAEA's role reflects its broad membership, its mandate, its unique expertise, and its long experience of providing technical assistance and practical guidance to states. The IAEA should continue to play a central role in promoting and strengthening the global radiological security architecture.

The central role of the IAEA in facilitating such cooperation, and providing assistance to states, is well recognized. The IAEA provides guidance in developing and implementing effective nuclear and radiological security measures, and supports national efforts to enhance nuclear security through nuclear and radiological security guidance documents, and associated support and review programs (e.g., assessments through self-assessment and peer review missions).[12] The IAEA can perform assessment missions, but these must be at the request of the specific country.

The IAEA also serves as a coordinating body for nuclear and radiological security, encouraging continued pledges and universalization of the Code of Conduct. States that publicly express their full support and endorsement of the Code of Conduct must undertake to formally support (in writing) their commitment to the IAEA.[13]

The IAEA can continue raising awareness for enhancing the security of radiological sources, develop standards and guidance documents, convene international conferences and workshops, and provide assistance and review services to national infrastructure for radiological sources. This will require 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. To date, the IAEA has relied on extra-budgetary contributions to

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[12] In an effort to support states to establish, maintain, and sustain an effective nuclear security regime, the IAEA has developed the Nuclear Security Information Management System (NUSIMS). NUSIMS is a web-based platform for states and the IAEA to aggregate and maintain country specific information. One of the core operational areas is Radioactive Material and Associated Facilities and Activities.

[13] As per the IAEA General Conference (47)/RES/7.B.

implement, in large part, its nuclear security action plan through the Nuclear Security Fund, and to fulfill requests from member states for radiological security support, including training, equipment, and physical protection upgrades.[14]

In order to ensure that the IAEA continues to grow in strength and effectiveness, the upcoming NSS should also reinforce the IAEA's "essential role" in coordinating global nuclear and radiological efforts. The IAEA ministerial-level nuclear security conference in 2013 sent a strong message that nuclear and radiological security is recognized globally as a priority. The results of the conference also served as important input for the IAEA Nuclear Security Action Plan (2014-2017). The next IAEA ministerial-level conference on nuclear security will take place in December 2016 and radiological security should continue to be a prominent part of the agenda for this meeting.

A core group of like-minded countries should take advantage of this unique opportunity for action, in consultation with the IAEA, on radiological security and not lose momentum. A roadmap of actions could be proposed in the short term to, among other actions, strengthen and expand support for the international framework of conventions and IAEA guidelines relevant to the safety and security of high activity radioactive sources; support the development and use of alternatives to high activity radioactive sources; and enhance the efforts of the Ad hoc Group of States that are major suppliers of radioactive sources and their respective industry to further strengthen and harmonize supplier state activities to improve the safety and security of high activity radioactive sources.

Strengthen Voluntary Mechanisms for Promoting Transparency, Best Practices, and Reporting Progress

Outside of the Nuclear Security Summit process of national reports and statements, a formalized process for information sharing was introduced in 2006 at the IAEA General Conference (GC (49)/RES/9/A9), and provides a forum for the evaluation of progress made by states toward implementing the Code of Conduct. This mechanism was established to encourage annual information exchange meetings and ad hoc regional meetings and triennial international meetings organized by the IAEA Secretariat.[15]

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[14] The elevation of the IAEA Office of Nuclear Security to a Division of Nuclear Security (http://www-ns.iaea.org/security) was a positive political message that nuclear security is a core function of the IAEA and deserves international coordination. This upgrade also raised the status of nuclear security within the IAEA and must now translate into an effort to seek an increase in regular budget funding.

[15] In 2006, the IAEA and member states formalized a process for a periodic exchange of information and lessons learned: (1) an international meeting held every three years to review progress in implementing the Code of Conduct at an international level, including sharing experiences, lessons learned, and good practices and to

One of the key objectives of instituting a formalized process for information sharing is to assist states in their national implementation of the Code of Conduct and supplementary Guidance by enabling them to learn from the experiences of others, and to evaluate their own progress on their implementation. In addition to submitting topical papers, states participating in the international meeting are encouraged to prepare a national report to share their experiences and lessons learned in implementing the Code of Conduct and supplementary Guidance. The next Code of Conduct review meeting is scheduled for May 2016. The IAEA also convenes an International Working Group of Radioactive Source Security (WGRSS) to bring together technical experts on security. To date, four international meetings have been held.

However, in line with the non-legally binding and flexible nature of the Code of Conduct and other technical meetings, both participation from member states and presentations are voluntary in nature and vary in level of attendance and information exchange.[16] The formalized process allows for intergovernmental organizations to attend as observers, but only a handful have attended previous meetings. Moreover, these meetings typically do not engage a broad spectrum of the private sector that have a stake in supporting radiological security.

Another major shortcoming is that, while these annual meetings typically produce a Chairman's summary report that identifies key shortcomings, the report is not formally adopted by participating states, and the IAEA Director General does not submit the report to the IAEA's policy–making organs for information and action. Additionally, support for these meetings and recommended actions are funded through extra-budgetary contributions.

In order to strengthen the current information sharing mechanism post-2016, member states should consider funding the IAEA's formalized process for information sharing through the IAEA's regular budget, and consider submitting the recommendations and findings of the Chairman's report to the IAEA's policy–making organs for information and action. Member states should also amend and finalize guidelines used to provide national reports in order to improve the current structure and promote consistency and more detailed information sharing prior to the May 2016 Code of Conduct Review Meeting.

Additionally, member states should consider expanding support for information exchange through broader stakeholder representation. This could be achieved, in parallel to the current process, by establishing an inaugural conference—akin to the Reduced Enrichment for Research

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identify existing and future challenges with regard to ensuring the safety and security of radioactive sources; and (2) regional meetings to share information on experiences on implementing the Code of Conduct and supplementary guidance held on an as-needed basis.

[16] The IAEA annual meetings on the Code of Conduct routinely draw experts from roughly 80 countries. However, only a limited number of NGO's attend as they may only attend as observers.

and Test Reactors (RERTR) conferences for minimizing HEU use in research and test reactors—for radiological sources, looking at securing radiological sources, repatriation of sources, exploring their replacement with non-isotopic alternatives, removal of disused sources, etc. This conference could encourage a broader range of stakeholders (e.g., government, industry, end users, academia, non-governmental organizations) and be a major international annual conference to share best practices, technology solutions, and catalyze actions to discuss radiological terrorism and bring high-level political attention to the problem.

Promoting the establishment of such a conference with a wider stakeholder base would also establish a stronger "norm" for national reporting on radiological progress as well as recognize industry and the non-governmental community as an integral supporter and contributor to global radiological security efforts. Consideration should be given to holding such a conference on the margins of the IAEA Ministerial Meeting in December 2016.

CONCLUSION

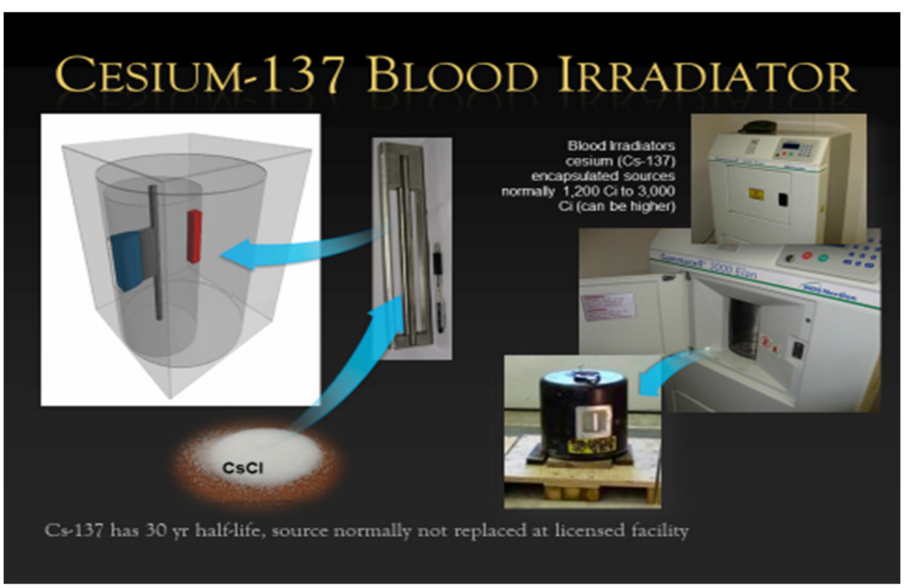
Unlike nuclear material, which is only located in 24 countries around the world, tens of thousands of radioactive sources exist worldwide in more than 100 countries. Some of these radiological sources are poorly secured and vulnerable to theft by terrorists seeking to detonate a dirty bomb. At the same 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 upcoming 2016 Nuclear Security Summit and the December 2016 IAEA Ministerial on Nuclear Security offer two near-term opportunities to implement numerous options to further improve global radiological security.

APPENDIX

What is a Sealed Radioactive Source?

According to the IAEA, a sealed radioactive source is a container of encapsulated radioactive material, which typically has the appearance of a small, harmless piece of metal. The capsule or material of a sealed source is strong enough to maintain leak tightness under the conditions of use for which the source was designed. The source is designed to contain the radioactive material under normal operating conditions and has a high concentration of radioactive material in a small volume. These high activity sources, which are a few centimeters in length, are put in various large devices depending on the purpose for which they will be used. These devices provide the shielding that protects the operators, but also allows the radiation beam to leave the device and enter the targeted area or object.

Various Cs-137 and Co-60 sources. Maximum length: 16 mm, maximum diameter: 8 mm / Credit: Eckert & Ziegler.



What are IAEA Category I Radioactive Materials?

The IAEA has established Safety Guidelines for ranking radioactive sources in five categories. This grouping shows the relative risk of their potential to cause harm to human health, and as a means to assist regulatory bodies in establishing regulatory requirements that ensure an appropriate level of control for each authorized source as well as to provide an internationally harmonized basis for risk informed decision making. The lower category number indicates a greater potential hazard, if the source is not used properly. Within this categorization system, sources in Category I are considered to be the most dangerous because they can pose a very high risk to human health if not managed safely and securely. An exposure of only a few minutes to an unshielded Category I source may be fatal. At the lower end of the categorization system, sources in Category V are the least dangerous; however, even these sources could give rise to doses in excess of the dose limits if not properly controlled. It is important to note that the IAEA Categorization System is based on safety concerns, not RDD “area denial” consequences.

IAEA Categorization of Rad Materials

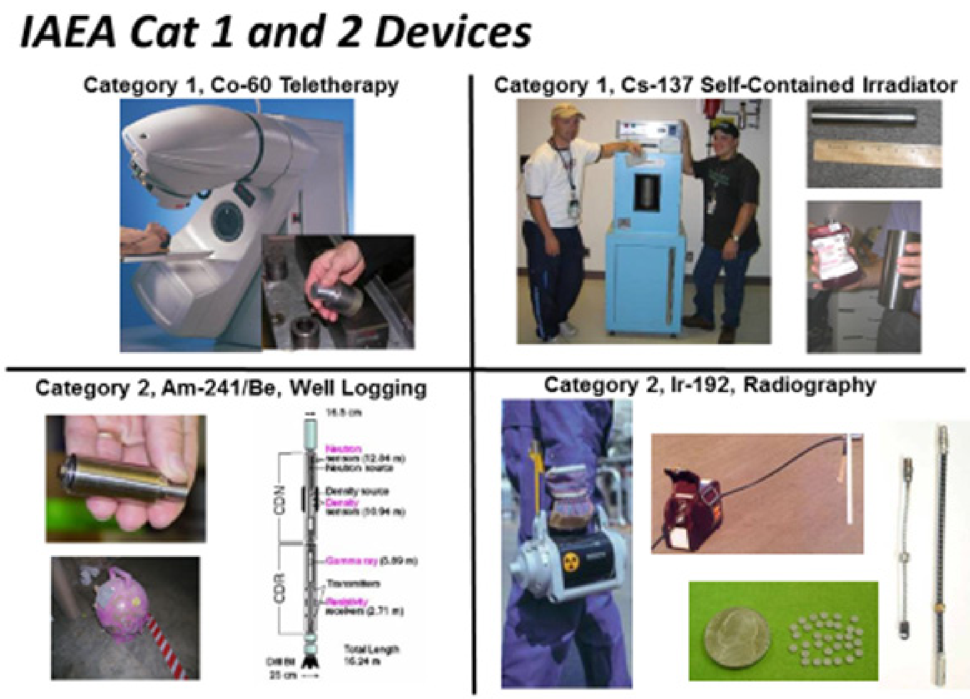
The IAEA Categorization system is based on safety concerns, not RDD “Area Denial” Consequences.

Radionuclide	IAEA Category 1 (Curies, Ci)	IAEA Category 2 (Ci)	IAEA Category 3 (Ci)
^{60}Co	810	8.1	0.81
^{137}Cs	2,700	27	2.7
^{192}Ir	2,200	22	2.2
^{241}Am	1,600	16	1.6

Radionuclide Properties

Radionuclide and emission	Half-life	Chemical Form (typical)	Power to Contaminate* (Ci/km^2)	Typical Use and Activity
Co-60 (β,γ)	5.3 yr	Metal	10	Irradiators (≥1000 Ci)
Cs-137 (β,γ)	30 yr	Salt Powder	40	Irradiators (≥1000 Ci)
Ir-192 (β,γ)	74 d	Metal	100	Radiography (~100 Ci)
Am-241 (α,γ)	433 yr	Oxide Powder	< 10	Well Logging (~ 10 Ci)

*Radionuclide ground contamination level in Curies, uniformly spread over 1 sq. km, that would trigger EPA Relocation Protective Action Guide (PAG) of 2 rem/yr in the first year after the incident. Approximate values.



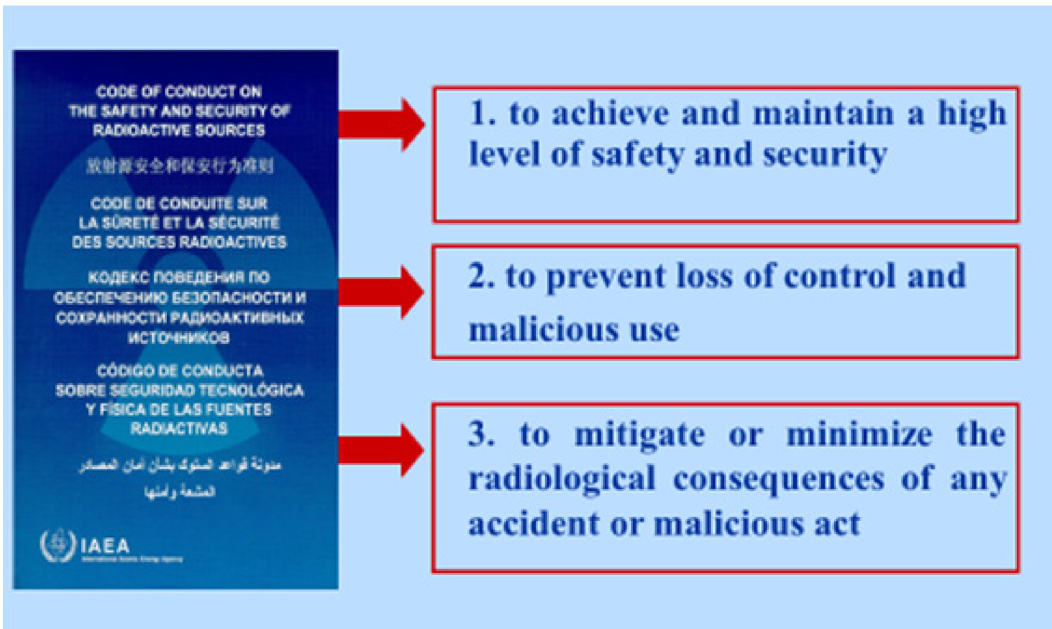
What is the IAEA Code of Conduct on the Safety and Security of Radioactive Sources?

Ensuring safety in the use of radiation sources and operation of related facilities is of paramount importance for the protection of people and the environment from any associated radiation risks. The Code of Conduct and its supplementary Guidance on the Import and Export of Radioactive Sources are voluntary in nature and not legally binding. However, the Code of Conduct and its Guidance together with IAEA safety standards, provide the international requirements and recommendations for the development and harmonization of policies, laws, and regulations on the safety and security of radioactive sources.

The Code of Conduct was drawn up to assist states and their regulatory bodies in developing and maintaining high levels of safety and security of radioactive sources. It provides a basic governance framework for radioactive sources made up of key safety and security requirements that states should ensure are addressed in their laws and regulations as well as by their administrative bodies. It does not, however, provide a detailed or exhaustive list of measures.

Paragraphs 7-22 of the IAEA Code of Conduct propose elements for a legislative framework for the safety and security of radioactive sources and elements for a regulatory body, including its powers and responsibilities.

The Guidance on the Import and Export of Radioactive Sources, which is supplementary to Paragraphs 23 to 29 of the Code of Conduct, provides non-legally binding guidance for states on how to regulate imports and exports of certain radioactive sources. It is intended to establish a “common framework” that states may apply to Category I and II radioactive sources, as well as to other types. However, Paragraph 5 of the Guidance cautions that it “should not be construed to amend or supersede applicable guidance under other multilateral import and export arrangements.”

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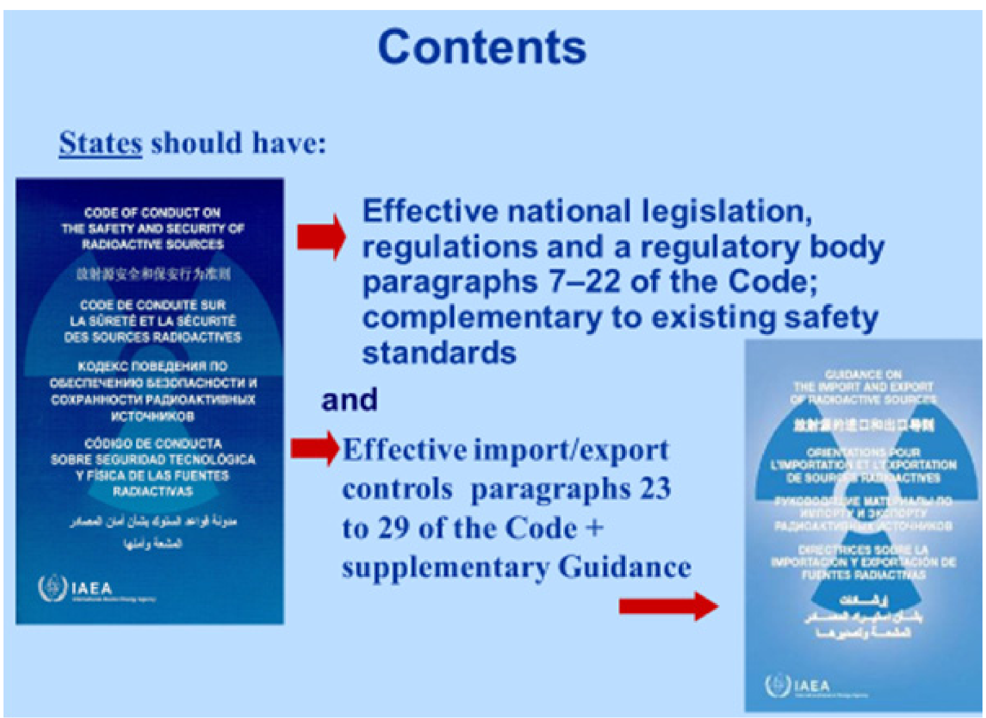
IAEA
Based on existing International Safety Standards,
And used as a reference for the nuclear security guidelines
safety series
SAFETY STANDARDS
IAEA SAFETY STANDARDS SERIES
Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety
REQUIREMENTS
Provides guidance on:
Legislation
Regulations
Regulatory body
Import/export controls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CODE OF CONDUCT ON THE SAFETY AND SECURITY OF RADIOACTIVE SOURCES
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IAEA
Effective national legislation, regulations and a regulatory body paragraphs 7–22 of the Code; complementary to existing safety standards
and
Effective import/export controls paragraphs 23 to 29 of the Code + supplementary Guidance
GUIDANCE ON THE IMPORT AND EXPORT OF RADIOACTIVE SOURCES
IAEA

Understanding Radiological Materials

Radiological Dispersal Device vs. Improvised Nuclear Device

The terms dirty bomb and radiological dispersal device (RDD) are often used interchangeably in the media. According to the Nuclear Regulatory Commission, a dirty bomb combines a conventional explosive, such as dynamite, with radioactive material that may disperse when the device explodes.[17]

Often referred to as a **"weapon of mass disruption,"** the effects of an RDD can vary depending on what type of radioactive material is used and how effectively it is dispersed. If there are casualties, they will likely be caused by the initial blast of the conventional explosive. In most plausible scenarios, the radioactive material would not result in acutely harmful radiation doses, and the public health concern from the radioactive materials would likely focus on the chronic risk of developing cancer among exposed individuals. The consequences of an RDD may range from a small, localized area (e.g., a street, single building, or city block) to large areas, conceivably several square miles. However, the economic impact of an RDD could result in economic losses in the billions of dollars in remediation and relocation costs, depending on the chemistry and form of the radioactive material, means of dispersion, and location of the event.

An Improvised Nuclear Device (IND) is very different from an RDD. An IND is a device that uses highly enriched uranium or plutonium to provide a nuclear explosion and create hundreds of thousands of casualties over a much larger area. It also produces potentially lethal radioactive fallout, which may spread far downwind and deposit over very large areas (potentially hundreds of kilometers). An IND would result in catastrophic loss of life, destruction of infrastructure, and contamination of a very large area. If nuclear yield were not achieved, the result would likely resemble an RDD in which fissile weapons material was dispersed locally.

While not as deadly as an IND, an RDD is technically much easier to construct and the materials required to assemble the device are much more prevalent in civilian use than those needed for an IND. In evaluating the risk (probability multiplied by consequences) of an IND versus RDD incident, most experts have concluded that the risk of an RDD attack is much higher than that of an IND attack.

[17] http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-dirty-bombs.html.

Improvised Nuclear Device (IND): An illicit nuclear weapon bought, stolen, or otherwise originating from a nuclear state, or a weapon fabricated by a terrorist group from illegally obtained fissile nuclear weapons material that produces a nuclear yield.

Radiological Dispersal Device (RDD): An improvised assembly or process other than a nuclear explosive device, designed to disseminate radioactive material (e.g. aerosol, explosive, etc.) in order to cause destruction , disruption, damage, or injury.

	IND	Explosive RDD
Yield	Thousands of lbs of TNT equivalent from ***nuclear reaction***	Hundreds of lbs of TNT equivalent from ***chemical reaction***
Primary effects	Wide Area • Blast • Thermal • Ionizing radiation	Mostly Localized • Blast • Thermal • Ionizing radiation
Secondary effects	• Widespread contamination • Electromagnetic pulse	• Limited to widespread contamination
Casualties	Tens of thousands or higher	Tens to hundreds (from blast)
Primary consequence	Massive casualties	Economic disruption