U.S.-Russian Partnership for Advancing a Nuclear Security Agenda

Recommendation for U.S.-Russian cooperation in strengthening nuclear security in the former Soviet states and Southeast Asia

Anton Khlopkov and Elena Sokova, Editors

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CNS James Martin Center for Nonproliferation Studies

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VCDNP Vienna Center for Disarmament and Non-Proliferation

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The James Martin Center for Nonproliferation Studies (CNS), the Moscow-based Center for Energy and Security Studies (CENESS), and the Vienna Center for Disarmament and Non-Proliferation (VCDNP) are pleased to offer this research report as the result of our joint work on a project funded by the Nuclear Threat Initiative (NTI). The authors of the report would like to thank the following experts and colleagues for their valuable contributions to the preparation and review of this report: Lina Alexandra, Ferhat Aziz, Robert Berls, Subhes Bhattacharyya, Alexandr Borisenko, John Carlson, Artyom Goncharuk, As Natio Lasman, Le Chi Dung, Le Doan Phac, Le Van Hong, Anya Loukyanova, Lisa Donohoe Luscombe, Indra Mahila, Kenji Murakami, Ngo Taun Kiet, Hooman Peimani, Alexandr Plugarev, Margarita Sevcik, Victor Slipchenko, Page Stoutland, Muhammad Subekti, Vyacheslav Turkin, Thomas Young, and participants in the October 31, 2011 workshop on nuclear security issues in Southeast Asia held in Vienna.

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Executive Summary

The United States and the Russian Federation have engaged in bilateral and multilateral nuclear security work for more than two decades. This cooperation was launched in reaction to the break-up of the Soviet Union and the urgent need to introduce measures to secure nuclear materials and facilities in the former USSR (FSU). Through this cooperation, both countries increased mutual confidence in the nuclear area, established regular contact between Russian and US nuclear government experts and nuclear scientists, and enriched overall nuclear security technologies and procedures—all of which has ultimately led to sustainable progress in nuclear security in Russia and has benefited nuclear security in the United States and globally.

However due to the increase in energy demand and the rapid development of nuclear energy technologies, new nuclear security challenges are emerging in other regions of the world where implementation of sustainable nuclear security measures is largely constrained by limited resources and insufficient domestic capacity. This trend raises the specter of attacks or sabotage on nuclear facilities by non-state actors or the illicit procurement of radioactive or nuclear materials, resulting in the creation of a radiological or nuclear explosive device—all serious threats to global security. This set of conditions creates an imperative to leverage US-Russian expertise and experience in cooperative threat reduction into a new agenda for global nuclear security.

With global nuclear security risks in mind, and the potential role of US-Russian engagement in minimizing these threats, the James Martin Center for Nonproliferation Studies (CNS), the Center for Energy and Security Studies (CENESS), and the Vienna Center for Disarmament and Non-Proliferation (VCDNP) undertook a project to investigate nuclear security challenges in third countries. For this initial review of potential US-Russia cooperation in nuclear security, the focus is on Southeast Asia (SEA) and the former Soviet states of Central Asia.

The US-Russian experience over the past 20 years has been a clear example of how to identify challenges and needs within a domestic nuclear security framework, overcome distrust and cultural and political barriers, and, through cooperative action and relying on the strengths of all stakeholders, establish cooperative programs to dramatically improve nuclear security arrangements. Emulating a number of features universal to successful US-Russia cooperative programs will ensure success and sustainability for potential multilateral cooperation on nuclear security. These features include: reliance on indigenous technology and knowledge, cost-sharing between partners, an infrastructure for human capacity building, and a clear "exit strategy" that would allow for tangible benefits even after initial financing ends. Ultimately, all parties need to recognize the benefits of cooperation.

Following is a set of recommendations for US-Russian cooperation considered most likely to be successful in the regions selected (as well as potential other regions):

Education and Training of Nuclear Security Specialists. Training of regional specialists should take advantage of Russian nuclear security training centers and academic programs that have been established in cooperation with the United States. In addition, joint US-Russian teams of instructors can travel to various countries and regions, allowing for broader

reach. The United States and Russia should also offer their joint expertise in establishing national material protection, control and accounting (MPC&A) programs and nuclear security support centers worldwide.

Legal and Institutional Framework. The United States and Russia should offer their legal expertise and resources to draft national nuclear security legislation and regulations in the target regions. Where appropriate, they should also assist with drafting ratification legislation for key nuclear security conventions, including the Amended Convention on the Physical Protection of Nuclear Material and the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT), as well as assist in strengthening capabilities, resources, and independence of relevant regulatory bodies.

Border Controls. Russia and the United States should expand their cooperation in the area of border controls, particularly in the former Soviet states in Central Asia, where borders remain porous. In Southeast Asia, they could offer a joint initiative to address key nuclear security challenges under a Southeast Asia Second Line of Defense (SEASLD) program. These efforts should include the provision of radiation detection equipment, development of regulations and procedures, and training of specialists.

Strategic Trade Controls. In collaboration with regional partners and organizations, U.S. and Russian experts should facilitate the development of legal frameworks specific to strategic trade controls, as well as a communication infrastructure with appropriate equipment, particularly information technology (IT). In addition, Russia and the United States are well positioned to provide relevant training to export control specialists and personnel, including on "dual-use" commodities.

Radiological Source Control and Management. The Russian Federation and the United States should increase cooperation with other countries aimed at enhancing their legal and regulatory framework for radiological source security and strengthening their capacity to provide sound management for radioactive sources through their entire life cycle, including licensing, monitoring, storage, and final disposal.

As noted throughout this report, many opportunities exist for the United States and Russia to work together on nuclear security projects with third countries or regions. In addition to solving nuclear security problems, such cooperation should become a foundation for transforming the US-Russian relationship into a true partnership and alliance that the two countries continue to seek. They have already worked together on major nuclear security initiatives, including the Global Initiative to Combat Nuclear Terrorism and highly enriched uranium (HEU) repatriation from third countries. Building on the success of these initiatives, Washington and Moscow should take the opportunity to expand their cooperation and direct their combined expertise and resources to address nuclear security needs worldwide.

National governments have primary responsibility for nuclear security,
but international cooperation is vital...
Strengthening nuclear security is not just about spending money on "guns, gates and guards."
Human elements such as training specialist staff and transferring know-how are of equal importance.

IAEA Director General Yukiya Amano
Statement at Nuclear Security Summit
March 27, 2012, Seoul, Republic of Korea

1. Introduction

More than 20 years have passed since the United States and Russia embarked on an unprecedented effort to secure nuclear weapons, fissile materials and relevant facilities in Russia and other Soviet successor states. In late 1991, US Senators Sam Nunn and Richard Lugar authored the Nunn-Lugar Act, establishing the Cooperative Threat Reduction Program (CTR) that over the years has eliminated thousands of warheads and delivery systems and secured tons of weapons-useable material and hundreds of nuclear facilities. Dozens of bilateral and multilateral efforts have followed, focused on upgrades to physical protection systems, material control and accounting measures, capabilities to detect and respond to insecurities, and nuclear smuggling. As a result, in the two decades since the launch of CTR, the most pressing nuclear security challenges in the former Soviet Union—both inside and outside of Russia—have been greatly reduced, although a concerted effort is still required to dispose of weapons-useable materials and strengthen the overall nuclear security framework.

The relationship between the United States and Russia and the nature of these bilateral and multilateral cooperative endeavors have evolved and are no longer based on financial and technical assistance of one country to another. Several of the initial programs have been transformed into true partnerships based on shared resources and equal contribution of expertise and technology. The Second Line of Defense (SLD) program and professional development and training programs at leading Russian nuclear security education and training facilities are clear examples of successful US-Russian cooperation.

Overall, US-Russian nuclear security cooperative efforts and their achievements are remarkable, not only because of their sheer size, scope, diversity, and accomplishments, but also because they paved the way to the development of know-how, expertise, technologies, approaches and concepts of jointly solving nuclear security problems. As CTR and other similar programs, including the G-8 Global Partnership, near completion of their mandates in Russia, it is important to preserve US-Russian cooperation on the bilateral level and to identify a new agenda, which will effectively utilize this wealth of expertise and experience and apply it to nuclear security needs and challenges in other regions. The expiration of CTR in 2013 provides both countries a unique opportunity to transform their foundation of bilateral cooperation into a true partnership with a global reach.

As the number of nuclear energy and other related facilities increases throughout the developing economies of the world, the necessity for viable nuclear security frameworks within these states becomes more apparent. The consequences of illicit trafficking or other lapses in security of sensitive materials cannot be understated. Attacks or sabotage on nuclear facilities by non-state actors or the illicit procurement of radioactive or nuclear materials resulting in the creation of a radiological or, particularly, nuclear explosive device would seriously threaten global security. As regions of the world with high terrorism activity also see an upswing in civilian nuclear programs, the need to ensure that nuclear materials and related items are safe and secure is crucial.

Although a number of significant agreements lay a partial foundation for an international legal regime regarding nuclear security and safety, implementation at the domestic level for many states is stymied by limited financial, technical and human resources. Successful implementation also requires leadership, initiative, and contributions from those states with expertise and capacity, as well as a holistic approach that integrates all indigenous stakeholders. In many countries, including the ones reviewed for this report, the nuclear security infrastructure remains underdeveloped. This issue will become even more acute as states—such as many in Southeast Asia (SEA)—begin to embark on domestic nuclear energy programs. In other states with existing or past nuclear programs, such as the former Soviet states of Central Asia, the legacy of Soviet era facilities remains a problem.

2. Project Goals

The US-Russia experience in cooperating on nuclear security has covered a broad range of issues, including export and border controls, physical protection, and accounting of nuclear materials. Through this cooperation both countries have increased mutual confidence, established regular contacts between Russian and U.S. government experts and nuclear scientists, and enriched overall nuclear security technologies and procedures, all of which has ultimately led to sustainable progress in nuclear security. In recognition of the success of these activities, the James Martin Center for Nonproliferation Studies (CNS), the Center for Energy and Security Studies (CENESS), and the Vienna Center for Disarmament and Non-Proliferation (VCDNP) undertook a project to investigate how and where the unique Russia-U.S. experience can play a critical role in creating sustainable nuclear security frameworks in other parts of the world.

This joint project focuses on two regions—Southeast Asia and the former Soviet states (excluding the Baltic States and Russia)—and the challenges facing these two regions. Our work aimed to identify the lessons learned and benefits gained from past US-Russian cooperation in the implementation of CTR and Global Partnership-type programs, with the goal of pinpointing those that could appropriately be applied to nuclear challenges outside of Russia. The two regions were chosen for widely different reasons: the Soviet successor states have existing nuclear and radiological materials, facilities, and expertise of potential interest to terrorists and proliferators; Southeast Asia is a region where anticipated expansion of peaceful nuclear activity would bring such materials and expertise into the region. The project participants were also looking for regions where the United States and Russia each have their own comparative advantages in terms of expertise and established working relationships, and where there is

significant potential for the United States and Russia to cooperate effectively to enhance nuclear security, safeguards, and safety.

In order to construct recommendations for sustainable and effective activities, project researchers undertook comprehensive reviews of the status of nuclear security in individual states and relevant on-going activities in the selected regions. The research and analysis for Southeast Asia, for example, included field research in the region as well as the organization of a workshop held in Vienna entitled "Prospects For Nuclear Security Partnership in Southeast Asia." The presentations and discussions at that workshop contributed significantly to the identification of lasting and effective recommendations for next steps in the region.

With regard to the assessment of former Soviet states, the project researchers completed a comprehensive review of efforts to secure nuclear materials in the region and interviewed relevant US and Russian government and regional experts and officials, nuclear security experts at the IAEA and other relevant parties. The team examined remaining challenges in cleaning up the Soviet nuclear legacy, strengthening export and border controls and regulatory bodies, developing relevant legislation and regulations, increasing radioactive source security, and enhancing human capacity development in these countries to meet these challenges.

In addition to mitigating concrete nuclear threats in these two selected regions, cooperation between the United States and the Russian Federation can have a broader positive impact. In particular, cooperation in the area of nuclear nonproliferation and counterterrorism could help improve the overall relationship between the two countries, including in the area of arms control and disarmament. Despite efforts to "reset" the US-Russian relationship during the early years of the Obama administration, much of the late 2011 and early 2012 bilaterial relationship has been under stress, due in large part to presidential election campaigns in both countries. Finding a new platform for constructive bilateral engagement is of central importance. Despite the sometimes excessively heated rhetoric, both countries appear ready for cooperation based on substantially different principles that would help overcome the post-Cold War asymmetries in their relationship. The timing for such cooperation is ripe. The research team of this project believe that the collaborative efforts proposed below could serve as a starting point for a true partnership between the two countries based on mutual interests, respect, and shared responsibility for nuclear security. These efforts would be benefitical not just for the biletarel relationship, but for overall global security as well.

3. US-Russian Cooperation

US-Russia nuclear security cooperation dates back to 1992. Initially, most activities were in reaction to the break-up of the Soviet Union and related to the need to implement nuclear arms reduction treaties and introduce measures to secure nuclear materials and facilities during deep political and economic crises affecting those countries. The first and most urgent need was to bolster safety and security measures during the removal of nuclear ammunition from former Soviet republics (Belarus, Kazakhstan and Ukraine) to Russia and during the transportation of such ammunition within Russia en route to the facilities where it was to be dismantled. It soon became apparent that nuclear materials and the facilities housing them also required a concerted effort to ensure the security of these materials and facilities. Numerous cooperative programs

(some of which are still under way) covered a broad range of measures, including export and border controls, physical protection, and accounting of nuclear materials.

However, cooperation over the past 20 years has by no means been limited to its primary focus of addressing urgent nuclear security problems in Russia. The effects of that cooperation go much deeper. The two countries have:

- Increased mutual trust in the nuclear area and to some extent have overcome the related suspicions which plagued the relations between Moscow and Washington during the Cold War;
- Established regular contacts not only between relevant government experts and officials but also between nuclear industries and nuclear scientists;
- Enhanced both countries' nuclear security technologies and procedures;
- Laid the foundation for commercial cooperation; and
- Secured financial resources and nuclear expertise from other countries and involved them in various international projects on nuclear security, such as the G8 Global Partnership program launched in Kananaskis (Canada) in 2002.

Nuclear cooperation between Russia and the United States has evolved from its early 1990s focus on assistance to Russia, to full-fledged commercial cooperation in the early 2010s. Previously, the central legal framework of US-Russian nuclear cooperation was the Agreement Concerning the Safe and Secure Transportation, Storage and Destruction of Weapons and the Prevention of Weapons Proliferation. Twenty years on, the Agreement for Cooperation in the Field of Peaceful Uses of Nuclear Energy, also known as the US-Russia 123 Agreement, which entered into force in January 2011, defines the relationship between the two countries. The Soviet Nuclear Threat Reduction Act of 1991 made US$400 million available for financing priority projects to strengthen nuclear security in Russia. By 2011, Russia's Rosatom nuclear corporation and energy companies in the United States had signed US$6 billion dollars worth of commercial contracts.[1] All of these developments have created a favorable climate for sustainable cooperation between the two countries on a broad range of nuclear nonproliferation problems.

An overview of US-Russian cooperation in nuclear security would not be complete without mentioning some setbacks. Virtually every major program experienced at least some legal, political, or technical problems, particularly as programs began to expand in the mid- to late-1990s, and as many new actors, facilities, and areas of cooperation were added to the original focus of the CTR efforts. The majority of these difficulties, however, were successfully resolved.

Nevertheless, it is important to highlight at least some impediments that prevented cooperation from being even more successful and productive. Among these deficiencies were:

- An inability to establish a required legal and institutional framework for cooperation in a timely manner, causing substantial delays in implementation, as remains the case with the plutonium disposition program;

[1] RIA Novosti, "Tekhsnabexport expects record export revenues in 2011," November 7, 2011.

- A failure to negotiate clear parameters and requirements for all stages of the project, including associated verification and access procedures, as was the case with the construction of the fissile material storage facility at Mayak;
- An overreliance on the donor-recipient relationship, as opposed to a gradual transformation into a true partnership that included shared interests, joint management and governance, as well as co-funding—one of the most notorious examples of an inability by both sides to adapt and transform resulted in the withdrawal of the Russian Federation from the International Science and Technology Center (ISTC); and
- An absence of a well-developed implementation plan spanning the entire cycle of the project, not just initial scoping efforts, such as in a recent joint Russian-US feasibility study on the possible conversion of six Russian research reactors from HEU to LEU.

A number of studies and reports examine challenges of US-Russian nuclear security cooperation in greater detail, including a report issued by the U.S. and Russian Academies of Sciences, "Overcoming Impediments to U.S.-Russian Cooperation on Nuclear Non-Proliferation."[2] Rather than reflecting on past failures and challenges, the authors of this report focus on forward-looking developments and opportunities and offer a set of principles and recommendations for future successful cooperation. A June 18, 2012, pledge by presidents Obama and Putin at the G-20 Summit in Mexico "to redouble bilateral efforts to improve nuclear security, counter nuclear smuggling, and combat nuclear terrorism" suggests that nuclear security remains one of the top priority items on the bilateral agenda.[3] This pledge also represents an excellent opportunity for the two countries to demonstrate their joint commitment to strengthening global nuclear security.

Notable Successes

While the overall assessment of various cooperative efforts sometimes differs in the United States and Russia, the individual achievements of several of these programs are viewed as very successful and effective by both sides. Some of the more important achievements include:

- Improvement of border radiation controls in Russia;
- Establishment of a system of training specialists in various aspects of nuclear security in Russia; and
- Conversion of HEU-fueled reactors to low-enriched uranium (LEU) and repatriation of HEU fuel from Soviet-designed reactors in third countries.

[2] U.S National Academies Committee on U.S-Russian Cooperation on Nuclear Non-Proliferation and the Russian Academy of Sciences Committee on U.S-Russian Cooperation on Nuclear Non-Proliferation, Development, Security, and Cooperation, National Research Council, *Overcoming Impediments to U.S-Russian Cooperation on Nuclear Non-Proliferation: Report of a Joint Workshop* (National Academies Press, 2004), http://www.nap.edu/catalog.php?record_id=10928.

[3] Office of the Press Secretary, Joint Statement by the President of the United States of America Barack Obama and the President of the Russian Federation Vladimir Putin, The White House,, June 18, 2012, http://www.whitehouse.gov/the-press-office/2012/06/18/joint-statement-president-united-states-america-barack-obama-and-preside

Improvement of border radiation controls. As part of the Second Line of Defense (SLD) program between the Russian Federal Customs Service and the US Department of Energy, 383 border crossings and international mail exchanges have been equipped with radiation detection systems.[4] This equipment is based on Yantar monitors, a fixed-position system that prevents illegal movement of fissile and radioactive materials through scanning passengers, luggage, international mail, cars, trucks and railway carriages. There are also several man-portable versions of the device that could be used as an element of a comprehensive radiation detection system. Distinctive features contributing to the success of the SLD program are:

- *Use of indigenous technology***.** The SLD relies on Russian-designed and Russian-made technologies and equipment developed in 1995-1996 under a contract with the Russian Customs Service and certified under US standards.
- *50/50 financing throughout the entire term of the program***.** The United States has provided financing for 124 facilities, Russia for 123, with joint financing for another 136 facilities.
- *A clear exit strategy.* A defined exit strategy makes the achievements of bilateral cooperation more sustainable and provides additional guarantees that the money spent on the program by the United States will continue to generate tangible benefits, even after US financing ends. Under an agreement reached in 2006 by the Russian Customs Service and the National Nuclear Security Administration, since 2009 Russia has been contributing the larger share of the money spent on technical maintenance of equipment installed under the cooperation program. Before 2009, these costs were split 50/50. Beginning in 2013, all the costs of maintaining the equipment installed in Russia will be borne by Russia.[5]
- *Benefits for US nuclear security.* Cooperation with Russian specialists as part of the project has enabled US companies making radiation monitors to upgrade their technology.
- *Benefits for third countries.* Technologies developed over the course of the program have been used by various US- and IAEA-sponsored projects in other countries. Russian-made radiation detectors have been installed at border crossings in Albania, Armenia, Egypt, Jordan, Kazakhstan, Lebanon, Qatar, Serbia, South Africa, Ukraine, Uzbekistan, and Vietnam.[6]

Establishment of a system of education and training for security specialists. An education and training infrastructure and programs developed through joint efforts in Russia—mostly at the National Nuclear Research University (MEPhI) University and its branches, training facilities in Obninsk and regional branches of the Customs Academy—constitute a solid basis of regular and sustainable instruction for specialists in different aspects of nuclear security. Among the established programs is the MEPhI master's degree program on MPC&A. This program was developed at MEPhI in cooperation with the Russian Ministry of Atomic Energy (today,

[4] "Outcomes of cooperation under the Second Line of Defense program to equip border checkpoints with radiation detectors," (in Russian), Official Website of the Russian Customs Service, September 22, 2011, http://customs.ru/index.php?option=com_content&view=article&id=14909:-l-r-&catid=40:2011-01-24-15-02-45.

[5] Nikolai Kravchenko, "How the Russian Radioactive Materials Customs Control System Was Created," *Nuclear Club Journal* No. 1 (2011), p. 53.

[6] A few thousand Yantar fixed automated radiation detectors have been installed at border checkpoints in Russia and other countries.

Rosatom state nuclear corporation) and the US Department of Energy (DOE). During the period from 1999 to 2011, about 170 students graduated from the program. Sister programs, based on the MEPhI experience, have also been launched at Tomsk Polytechnic University and at the Sevastopol National University of Nuclear Energy and Industry in Ukraine. Since 2006, MEPhI has offered a master's degree program on nuclear nonproliferation and international security, developed in cooperation with Texas A&M University. By the end of 2011, some 50 students had graduated from the program. Hundreds of specialists from the Russian nuclear industry have taken part in training courses, organized as part of US-Russian cooperation, at the Interdepartmental Special Training Center (MSUTs) and Russian Methodological and Training Center (RMTC) in Obninsk.

These centers and programs could be models for Nuclear Security Centers of Excellence now being created across the globe. While the main purpose of MSUTs and RMTC is to train Russian specialists, they also deliver training programs for specialists from abroad, especially from countries that lack their own expertise or that are now building Russian-designed nuclear power plants. However, these centers' expertise goes well beyond Russian-origin technology. Russian training centers are already being used for a number of IAEA- and DOE-sponsored training programs for third country specialists. For example, members of the Pakistan Atomic Energy Commission have expressed interest in initiating MPC&A master's degree programs in their own country, and in gaining expertise through relevant Russian academic and professional development programs.[7]

Some reasons for the success of this effort are:

- Widespread adoption of a "train-the-trainer" model, allowing for a sustainable and cost-effective approach to training;
- Repeated use of the training centers for international training, thus reinforcing their status and importance, and creating a network of cooperation; and
- Robust exchange programs among experts, which provides for exposure to international best practices and reinforces training curricula.

Conversion of reactors and HEU repatriation. More recent cooperative successes are the conversion of research reactors from HEU to LEU and repatriation of fresh and irradiated HEU fuel from third countries. While Russia has been involved in the Russian Research Reactor Fuel Return (RERTR) program for some time, concerted efforts to expedite the removal of HEU fuel and conversion of research reactors to LEU received a major boost with the launch of the US-led Global Threat Reduction Program in 2004 and, later, support from the US-Russian 2005 Bratislava Initiative.

As of January 2012, the program, conducted by the United States and Russia with IAEA participation, has resulted in the removal to Russia of 604 kilograms (kg) of fresh HEU fuel and 986.7 kg of irradiated HEU fuel (in uranium equivalent). All HEU has now been removed from Bulgaria, Latvia, Libya, Serbia, Romania, and Ukraine. The repatriation of HEU from Serbia (the Vinca research reactor) was the first foreign project for which Russia provided part of the

[7] Pakistani government officials, interview with project researchers, Islamabad, March 2011.

financing, in addition to Russian technology and expertise.[8] For the years 2012-2015, the removal of irradiated HEU fuel is scheduled from the Czech Republic, Kazakhstan, Poland, Uzbekistan, and Vietnam.

The first US-Russian nuclear security project in Southeast Asia was the conversion to LEU fuel of the IVV-9 reactor at the Dalat Institute of Nuclear Research in Vietnam. In 2007, with the assistance of specialists from the two countries, the core of the reactor was partially converted, enabling the use of mixed HEU-LEU fuel. A complete conversion was finished in late 2011, and the reactor has since used only LEU fuel. In late 2013, spent HEU fuel from the reactor (enriched to 36 percent) will be repatriated to Russia. Fresh HEU fuel was removed as part of a joint US-Russian operation with the involvement of the IAEA in September 2007.

Russian Deputy Foreign Minister Sergey Ryabkov has described the program as a very good example of cooperation.[9] Igor Bolshinsky, head of the program at the US DOE, believes that the program has provided unique opportunity for coordination between Russia, the United States and third countries.[10] Factors contributing to the success of this program are:

- Political flexibility and coordination, allowing either country to take the lead in negotiating the removal efforts;
- IAEA coordination and participation in the project;
- Clear understanding of the safety and security benefits of the project by all participants.

Principles of Successful Cooperation

The depth of historical and specialized knowledge built through this multi-decade collaboration can serve as a solid foundation to significantly advance and accelerate nuclear security in Southeast Asia and the post-Soviet space. The nature of nonproliferation challenges facing countries in Southeast Asia and the former Soviet states is different from the problems which Russia faced in the early 1990s—such as Russia's sheer size, the scale of its nuclear activities during the Cold War, and a number of other factors. Nevertheless, after 20 years of US-Russian cooperation, some principles for success have emerged. Implementation of these principles will vary from country to country and from region to region, but they are a useful starting point when considering new cooperative projects:

- **Address challenges recognized by all key stakeholders**. Lack of support by participating governments for the project at the implementation level leaves a project more vulnerable to various problems, even if it has the backing from the states' top leadership.
- **Need for host states to provide co-funding in cash or in kind**. Co-funding makes a project more sustainable, not only in the event of the donor's exit, but also in situations when funding is delayed due to domestic legal or other difficulties.

[8] Russia contributed US$3 million.
[9] Russian Deputy Foreign Minister Sergey Ryabkov, remarks at a tabletop nuclear smuggling exercise sponsored by the Nuclear Threat Initiative, Moscow, May 23, 2011.
[10] I. Bolshinsky, "Russian-U.S. Program of Repatriation of Irradiated Nuclear Fuel is Unique," *Safety of Nuclear Technologies and the Environment* No. 1 (2011), p. 17.

- **Use of indigenous technology whenever available**. Using local technology reduces the cost of maintaining the equipment involved and, in some cases, can also contribute to the development of relevant technologies for all participating states.
- **Reliance on local specialists and contractors**. Use of local specialists creates local jobs and generates broad support for the project among the host country's private sector. The private sector, in turn, builds positive goodwill among the general public and relevant officials.
- **Infrastructure for human capacity building.** The sustainability of security projects relies on the availability of adequately trained personnel and the capability of the country to ensure the supply of specialists on a continuing basis. Training programs established under the umbrella of leading universities tend to be the most sustainable.
- **Extraterritorial significance/importance**. A project is more sustainable if it also serves the needs of other countries, especially the neighboring countries and the region as a whole. This principle is especially relevant to projects that focus on training or include equipment and technology development, so that the benefits of the project can be shared with other countries.
- **Sustainment strategy from the start of the project.** At a minimum, a sustainment strategy should address how the project will be managed and funded when the initial funder steps down, and how the project will be modernized or adjusted after a certain period of time.

4. Nuclear Security Needs and Challenges in Southeast Asia

In recent years, Southeast Asian states such as Indonesia, Vietnam, Malaysia, and Thailand have introduced ambitious nuclear energy development plans. Driven by economic growth, corresponding projections of energy needs, and regional competition, these plans feature aggressive timetables for building nuclear power facilities. Based on individual national plans, 16 nuclear energy reactors are slated for construction in Southeast Asia by 2025, including four in Indonesia, two in Malaysia, four in Thailand, and six in Vietnam. While the Fukushima incident in Japan has affected some of these plans, Southeast Asian states continue to view nuclear power as a part of their future energy mix.

The region's nuclear newcomers are engaged with the IAEA and other international partners to assure that their development plans include sufficient infrastructure and capacity to build an effective, viable and safe domestic system. While these countries cooperate with the agency and other organizations on nuclear safety, the issue of nuclear security has only recently been given attention. Due to the relatively recent recognition of the issue, nuclear aspirants in the region continue to have deficiencies in their relevant institutional framework and lack capacity in many spheres relevant to secure handling of nuclear and radiological materials. Spotty border and export controls throughout the region are also a major challenge to creating an effective nuclear security culture. Likewise, the continued activities of terrorist groups in Southeast Asia and the

major challenge of maritime security only further complicate regional efforts for secure nuclear development.

The Association of Southeast Asian Nations (ASEAN) has played a role in strengthening regional disarmament and nonproliferation efforts, especially in light of its promotion of the Bangkok Treaty, which established a nuclear weapons-free zone in Southeast Asia. However, many of ASEAN's efforts are indirect, particularly on issues that require changes in domestic legislation or the development of new legislation. Although ASEAN has worked together on issues related to counterterrorism, and the ASEAN Regional Forum (ARF) has taken up issues related to supporting UNSCR 1540 implementation, neither ASEAN nor ARF have touched on the issue of nuclear security. Regional experts agreed in discussions in October 2011 that many challenges related to nuclear security could be addressed by increased cooperation within these key regional organizations; however, it remains unclear if member states see ASEAN or ARF as having a role in coordination on nuclear security matters.[11]

Underdeveloped legal and institutional frameworks, a lack of nuclear security–relevant equipment, limited human resources and concerns about trafficking in nuclear and related materials and equipment are common throughout Southeast Asia. When these concerns are considered through the lens of experience with similar issues in the Soviet Union of the 1990s, a roadmap for US-Russia cooperation emerges.

Institutional and Human Resources Capacity

Authorities within Southeast Asian domestic nuclear agencies have recently begun to recognize that strengthening nuclear security and creating a viable nuclear security architecture and culture throughout their domestic system is essential for developing their nuclear programs. However, policy-making and legislative organs in these states do not universally share this recognition, and financial resources as a result are not allotted to nuclear authorities for increasing capacity. For instance, in Indonesia nuclear agencies lack sufficient resources and attention from policy-making organs, including the Foreign Ministry, since these agencies remain skeptical of the need for major changes in nuclear security and related UNSCR 1540 implementation.[12] Foreign Ministry officials perceive nuclear security and 1540-related activities as lower-priority issues relative to other domestic and international security concerns and as potential distractions, taking international focus away from issues like disarmament.[13]

A review of nuclear programs in Southeast Asia clearly evidenced the lack of appropriately trained and compensated technical professionals—and a not unrelated weakness in nuclear regulatory and other relevant institutions in the region. One example of weakness within relevant institutions is Vietnam's lack of an independent regulatory nuclear agency, which is seen as potentially hindering effective regulation of the nuclear industry in the future.[14] Vietnamese

[11] Michael S. Malley, "Bypassing Regionalism? Domestic Politics and Nuclear Energy Security," in Donald K. Emmerson, ed., *Hard Choices: Security, Democracy, and Regionalism in Southeast Asia* (Stanford, CA: Shorenstein Asia-Pacific Research Center, 2008).
[12] Indonesian officials, interview with project researcher, Indonesia, February 2011.
[13] Ibid.
[14] Vietnamese officials, interview with project researcher, Vietnam, March 2011.

nuclear authorities recognize the need to consider a different framework for regulating nuclear development, and various options are being studied as part of their work on the new nuclear energy law. However, how this issue will be dealt with and whether a new system will yield an agency with a sufficient level of authority to form an effective nuclear security framework remains unclear.[15]

During discussions with multiple regional experts, the issue of human capacity and inadequate training was consistently highlighted as a major challenge for nuclear security in the region as well as a potentially important area for cooperation with international partners. Nuclear regulatory and development agencies throughout the region lack trained technical staff with an understanding of nuclear safety and security. In Indonesia, there is a dearth of new technicians entering the field and fears of a lack of technical specialists in the next generation to carry out the nuclear program.[16] Malaysia and Indonesia joined a group of other countries in a statement at the 2012 Seoul Summit expressing their support for the International Network for Nuclear Security Training and Support Centers and efforts focused on human resource development and education and training in nuclear security, nuclear security culture, and technical expertise.[17] Vietnamese officials have also expressed concern about the limited availability of personnel with multiple years of technical experience. Hanoi approved a US$150 million plan in 2010 to train personnel with the goal of 2400 nuclear engineers and 350 postgraduates with MS or Doctor of Science degrees, including 200 engineers and postgraduates trained abroad. However, a major problem has arisen in the Vietnamese government's ability to retain talent—although younger people are being trained in these fields, many are lured away by private industry.[18]

US-Russian cooperation could play a key role in improving human capacity in the region and strengthening relevant domestic institutions and a legal framework. Washington and Moscow have already been active in building capacity; for example, the US government has conducted relevant training for nuclear regulatory officials in numerous countries in the region, while Russian institutes have hosted hundreds of nuclear scientists from Southeast Asia for high-level technical training. By further building on US-Russian experience in training and capacity building, programs could be established that focus on creating the next generation of nuclear specialists.

Legal Framework for Nuclear Security

The implementation of major nuclear security–related conventions and treaties has seen mixed success in Southeast Asia. For example, Vietnam, Malaysia, Thailand and Myanmar have not yet ratified the Convention on Physical Protection of Nuclear Materials, while the Code of Conduct on Safety and Security of Radioactive Sources is only partially in place in most Southeast Asian states. For many of the countries in the region, the effort to turn these conventions and codes into domestic regulation is simply not a major priority for lawmakers faced with legislative backlogs. In addition, as one Indonesian official also pointed out, the sheer number of relevant

[15] Vietnamese officials, interview with project researcher, Hanoi, December 2011.
[16] Indonesian officials, interview with project researcher, Indonesia, February 2011.
[17] Joint Statement on Nuclear Security Training and Support Centers, Seoul Nuclear Security Summit, March 2012, http://www.seoulnss.go.kr/userfiles/Nuclear%20Traning%20Center%20Gift%20Basket%20FINAL.pdf
[18] Vietnamese officials, interview with project researcher, Vietnam, March 2011.

international instruments has made creating domestic legislation a challenge for developing states since integrating all instruments into domestic law requires significant resources.[19]

Regional experts also point to the need for cooperation in developing and updating relevant legislation and regulations related to nuclear security plans. Vietnam, for instance, has not yet harmonized its domestic laws with its international commitments. Hanoi, along with other countries in the region, continues to need technical assistance in building its legal framework, especially as the norm and commitments continue to evolve within the international regime. For Vietnam, which is expected to be the first with a functioning nuclear power plant in the region, a myriad of nuclear regulations still need to be developed, and Vietnam currently lacks experienced specialists to undertake this task. Other Southeast Asian countries are in similar, albeit less urgent, situations.

U.S. and Russian experts, along with other international partners like the IAEA, could work closely with target countries to improve the domestic legal framework for nuclear security. The implementation of major nuclear security–related conventions and treaties is mixed in Southeast Asia and could be significantly strengthened through cooperative efforts. In particular, the two countries could support an Indonesian initiative to draw up "a national legislation implementation kit for nuclear security" with the idea of consolidating the elements of various nuclear security instruments and frameworks that ideally should be reflected in national legislation. At the 2012 Seoul Nuclear Security Summit, Malaysia, the Philippines, Singapore, Thailand and Vietnam (as well as more than a dozen other countries) signed onto a joint statement backing the Indonesian initiative.[20]

Security of Radiological Sources

Southeast Asian countries have seen a major increase in production and use of non-energy–related nuclear technology. Indonesia boasts one of the region's most developed and dynamic radioisotope production industries. Jakarta's production capacity has met its domestic demand, and it is now looking to export radiological materials to other states in the region. The potential customers for Indonesian radioisotope exports include countries like Myanmar, which does not have well-established controls for domestic materials.[21] Vietnam has 220 radiation facilities using 4,275 radioactive sources in 63 provinces for healthcare, industrial, educational, and other purposes.[22] The use of radiological sources can be expected to increase as states in the region continue to enjoy economic growth.

All ASEAN states have some capacity to use or produce radiological sources, whether in medicine, agriculture or various industrial fields. The overall amount of radiological materials in the region raises serious questions about the security of these commodities and the possibility that non-state actors could use such materials in the construction of a radiological dispersal

[19] Indonesian officials, interview with project researcher, Indonesia, February 2011.
[20] Joint Statement on National Legislation Implementation Kit on Nuclear Security, March 27, 2012, available at www.thenuclearsecuritysummit.org.
[21] International Institute for Strategic Studies (IISS), *Preventing Nuclear Dangers in Southeast Asia and Australasia,* IISS Strategic Dossier (London: International Institute for Strategic Studies, September 2008), p. 68.
[22] Vietnamese Delegation, presentation at the International Conference on Safety, Security and Safeguards in Nuclear Energy, Bangkok, Thailand, September 1-2, 2011.

device (RDD). With terrorist groups active in the region, creating an effective framework that hinders non-state actors from gaining access to these sensitive materials is vital to overall regional security.

Promotion of scientific collaboration that focuses on the security of radiological materials in the region is an area where Russia-US cooperation would be beneficial. Laboratories in the United States and Russia should work together with colleagues in Southeast Asia on methods for improved storage, tracking, and accountability, as well as ways of minimizing use of materials. For instance, the countries could help Indonesia further plans to monitor radioactive sources using GPS systems—similar to the way that South Korea plans to share advanced radiological tracking capabilities with Vietnam.[23] Collaboration could also occur in developing appropriate training programs on radiation source security and nuclear forensics to produce end products that would incorporate both the lessons learned in more experienced countries and the nuances of applying them in various localities.

Border and Maritime Controls

Many customs and nuclear authorities in the region agree that their capabilities to control borders and curtail illicit trafficking networks are severely limited due to insufficient training and lack of proper equipment. Some efforts are already underway to increase the level of detection equipment available for ports in Southeast Asia. Ports in Singapore, Malaysia (Klang and Tanjung Pelepas) and Thailand (Laem Chabang) are part of the DOE Megaports Initiative with Malaysia's Penang port and Cebu port in the Philippines slated to join this year.[24] The mission of the initiative in Southeast Asia is to provide equipment, training, and technical support to countries in the region in order to enhance their ability to detect, interdict and deter illicit trafficking of nuclear and other radioactive materials. The efforts of this program can be enhanced by including cooperation with Russia, which has also worked with regional governments to improve portal monitoring at air- and seaports in the region.

Maritime security also plagues a region with tens of thousands of islands, persistent piracy in the Strait of Malacca, and the expansion of terrorist networks, some of which have significant maritime capabilities. Weak maritime security will ultimately have a negative effect on nuclear security due to the inability to provide strong barriers to the illicit transportation of nuclear and radiological materials and nuclear and dual-use equipment and technology. Regional authorities have noted that maritime security is not only pertinent to international transfer of cargo and materials, but also to domestic transfers.[25] In archipelagic countries made up of countless islands—such as Indonesia, the Philippines and Malaysia—the control of maritime transfers within national borders is as critical as that of international transfers.

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[23] See Yonhap News Agency, "S. Korea pushes for radioactive source-tracking system in Vietnam," March 27, 2012, http://english.yonhapnews.co.kr/business/2012/03/27/93/0501000000AEN20120327006100315F.HTML.

[24] Seoul Nuclear Security Summit Preparatory Secretariat, "Highlights and Achievements by Participating States as stated in National Progress Reports and National Statements," http://www.thenuclearsecuritysummit.org/userfiles/Highlights%20of%20the%20Seoul%20Nuclear%20Security%20Summit(120403).pdf.

[25] Comments from the International Workshop on Prospects for Nuclear Security Partnership in Southeast Asia, Vienna, Austria, October 31, 2011.

Strategic Trade Controls and UNSCR 1540 Compliance

Regional authorities have expressed concern about their countries becoming illicit trafficking hubs. Indeed, the activities of the AQ Khan network, as well as more recent trafficking efforts coordinated from Iran and North Korea, illustrate the weaknesses of regional strategic trade control systems. As nuclear power development continues in the region, so too does the flow of dual-use technologies and the need for controlling their transfer by establishing proper trade and border control enforcement.

Although the passage of UNSCR 1540 in 2004 has raised awareness of the need for stronger customs and trade controls, most countries in the region still lack the basic legal infrastructure for controlling trade in sensitive and dual-use goods. Compliance with UNSRC 1540 has been weak, and international partners, including the 1540 Committee, have focused on Southeast Asia as an area where outreach is crucial.[26] With the exception of Singapore, ASEAN states have historically had nascent and limited export control systems. Recently, Malaysia significantly improved its system with the passage of the Strategic Trade Act in 2010; however Malaysian officials are still struggling to create implementing regulations, and enforcement of the act remains problematic.[27] Other countries in ASEAN are much further behind Malaysia in establishing effective systems, although Vietnam, Thailand and the Philippines have appeared open to partner with other countries and organizations with the aim of improving their domestic systems.

One consistent obstacle is the perception among Southeast Asian officials that they are not manufacturers of dual-use goods with technology sufficient to trigger controls.[28] However, as foreign suppliers begin to construct nuclear facilities in countries such as Vietnam and Indonesia, there will almost certainly be a need to transfer dual-use materials to and from the supplier states. The strengthening of relevant trade security systems, therefore, would benefit from joint international cooperation on training and capacity building, including through a Russian-U.S. partnership. Keeping in mind the tendency for regional authorities to question the need for these controls in their domestic systems, training and outreach efforts related to 1540 implementation and relevant maritime security issues need to be scaled to the realities of the different countries' trading situation in order to highlight the unique challenges faced by each domestic system.

A detailed discussion of nuclear security developments and challenges in Southeast Asia can be found in a report titled "Prospect for Nuclear Security Partnership in Southeast Asia" published by CENESS, CNS, and VCDNP in May 2012.[29]

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[26] Ibid.

[27] Export control officials from Malaysia, discussion with project researchers, Tokyo, Taipei, and Singapore, February, May and June 2011.

[28] Export control officials from Southeast Asia, discussion with project researchers, Tokyo, Jakarta, and Hanoi, February and March 2011.

[29] James Martin Center for Nonproliferation Studies (CNS), the Center for Energy and Security Studies (CENESS), and the Vienna Center for Disarmament and Non-Proliferation (VCDNP), "Prospects for Nuclear Security Partnership in Southeast Asia," (Monterey, Moscow, and Vienna: CNS, CENESS, and VCDNP, May 2012), http://cns.miis.edu/opapers/pdfs/120515_seasia_nuclear_security_partnership.pdf

5. Former Soviet Union Needs and Challenges

Despite more than 20 years of focused CTR efforts in the non-Russian former Soviet states, numerous challenges to the security of radiological sources and nuclear materials remain. Societal and political issues such as corruption, inadequate government resources, and a lack of oversight and accountability, combined with concrete issues of equipment shortages, legislative shortfalls, and unskilled personnel, create a security environment that remains a cause for concern.

At the same time, these states have made real progress in recognizing and prioritizing nuclear security issues. For example, Central Asia formally declared itself a Nuclear Weapons Free Zone in 2009, and in 2010, both Ukraine and Belarus pledged to remove all HEU from their territories. Unfortunately, Minsk suspended the implementation of the agreed HEU removal after relations with the United States and EU countries deteriorated over elections in Belarus. Ukraine, however, has aggressively followed through on its pledge, signing a formal memorandum of understanding with the U.S. in September 2011, and completing the shipments in March 2012.[30]

International efforts aimed at supporting UNSCR 1540 compliance have received broad support in the region, as do training and assistance visits by the IAEA and the Organization for Security and Cooperation in Europe (OSCE). Nonetheless, the following summary of nuclear security needs serves as a reminder of how difficult it is to resolve security issues, and how much work remains.

Security of Nuclear Materials

The former Soviet states have made substantial progress in safeguards and security of nuclear materials. In Central Asia, for example, the IAEA considers Kazakhstan the regional leader in MPC&A, and the country has been actively involved in upgrading physical security at its three research reactors since the mid-2000s. Kazakhstan has transferred 73.7 kg of irradiated HEU fuel from its WWR-K reactor (located in the Institute of Nuclear Physics near Almaty) to Russia and has downblended 33 kg of fresh HEU fuel from the same reactor at the Ulba Metallurgical Plant in Ust-Kamenogorsk. Its two remaining research reactors, however, still contain unranium-235 (U-235) cores enriched to 90 percent. Located near the former test range of Semipalatinsk, the facilities are also reported to house a variety of other highly radioactive materials associated with nuclear testing and research.

Joint efforts to address security issues at Semipalatinsk have been ongoing, and a recent presidential statement on trilateral cooperation[31] acknowledged these activities. In what one

[30] Office of the Press Secretary, "Fact Sheet: Ukraine Highly Enriched Uranium Removal," The White House, March 27, 2012, http://www.whitehouse.gov/the-press-office/2012/03/27/fact-sheet-ukraine-highly-enriched-uranium-removal.

[31] Joint Statement of the Presidents of the Republic of Kazakhstan, the Russian Federation and the United States of America Regarding the Trilateral Cooperation at the Former Semipalatinsk Test Site, Nuclear Security Summit documents, Seoul, March 2012, http://www.thenuclearsecuritysummit.org/userfiles/Trilateral%20Cooperation%20at%20the%20Former%20Semipalatinsk%20Test%20Site.pdf.

analyst dubbed "an extraordinary feat of engineering and international cooperation," U.S., Russian, and Kazakhstani scientists, engineers, and miners cooperated in a secret effort to properly secure a significant amount of fissile material, enough for a dozen nuclear weapons. The materials were stored, vulnerable to theft, in tunnels formerly used by the Soviet Union for underground nuclear weapons tests near the Degelen Mountain site within the Semipalatisk test range.[32]

The VVR-SM research reactor in Uzbekistan, located in the Institute of Nuclear Physics near Tashkent, was converted to LEU in 2009 and currently operates with fuel at less than 20 percent U-235 enrichment. Security upgrades were completed in 2006, including a perimeter fence with detection and alarm systems. The HEU spent nuclear fuel was partially repatriated to Russia in 2006, and the rest will be removed in 2012. The Foton research reactor, which operated in Uzbekistan in the past with about 4.5 kg of 90 percent enriched liquid fuel, could not be converted for various technical reasons and is instead planned for decommissioning as part of Reduced Enrichment for Research and Test Reactors (RERTR) program.

Armenia's Metsamor power plant is the only significant nuclear facility in the Caucasus. The Armenian State Committee on Nuclear Safety manages the nuclear materials and is in full compliance with IAEA safeguards and security standards.

Belarus currently only maintains a research reactor at Sosny but has reportedly signed an agreement with Russia to construct up to two new power reactors by 2018. It is a reasonably active participant in IAEA-sponsored training activities and appears to have an adequate regulatory infrastructure. Questions remain, as noted above, regarding its commitment to eliminate all stocks of weapon-useable material from its territory.

Ukraine maintains 15 nuclear power reactors, which supply more than 45 percent of the country's electricity. It has engaged in an active program to provide physical security, including establishing a Training Center on Physical Protection, Accounting and Control of Nuclear Material in 1998. Upgrades to site physical security are still needed at many facilities, however, especially at Chernobyl. Despite some progress, increased training on the code of conduct for nuclear industry workers remains a high priority.

Security of Radiological Sources

Radiological sources were in common use throughout the Soviet Union for military, medical, power generation, and agricultural purposes. After the Soviet regime collapsed, however, the newly independent states were unable to inventory or track these sources, and authorities are currently unsure about how many of them remain unaccounted for. What is certain is that

[32] William Tobey, "What Lies Beneath," *Foreign Policy* online edition, April 30, 2012, http://www.foreignpolicy.com/articles/2012/04/30/what_lies_beneath?page=0,0; Samat Smagulov, "On the Demilitarization of the Semipalatinsk Nuclear Test Site (in Russian)," *Nuclear Club*, No. 5-6 (2011), pp. 27-30; and "Joint Statement of the Presidents of the Republic of Kazakhstan, the Russian Federation, and the United States of America Regarding the Trilateral Cooperation at the Former Semipalatinsk Test Site," March 27, 2012, http://www.thenuclearsecuritysummit.org/userfiles/Trilateral%20Cooperation%20at%20the%20Former%20Semipalatinsk%20Test%20Site.pdf.

attempts to locate and secure radiological sources have met with uneven success across the region, and much work remains to be done.

Officials in post-Soviet countries point to the lack of records as one of their greatest challenges. Russia has been unable to provide detailed information about the numbers or locations of Soviet era Gamma Kolos agricultural irradiation devices or Radioisotope Thermoelectric Generators (RTGs) outside of Russia. Some experts believe that this deficiency could be corrected by digitizing old paper archives in Moscow and tracking down relevant records [33] or by conducting search operations similar to those implemented in Georgia in the early 2000s.

There have been several international assistance projects to help these countries account for "orphaned" sources, and all have made progress. Most countries have developed source registries and have conducted initial inventories of orphaned sources. Unfortunately, efforts to maintain and update these registries have stalled. All of the countries remain uncertain about the final numbers and disposition of their radioactive sources. In Tajikistan, officials report more than 20 highly radioactive sources known to be missing. Kazakhstan's source registry documents approximately 7,000 sources but has no system in place to maintain or update it, and Uzbekistan has never conducted a full inventory. Turkmenistan did not inherit a Soviet nuclear infrastructure, but it did participate in Soviet seed irradiation projects. Just as in the other countries of the region, local officials do not know what became of the radiological sources used in these projects.

The Caucasus and the western region of the former Soviet Union suffer from the same problems. In Ukraine alone, the state licenses approximately 2,500 operators who own or control some 80,000 radioactive sources. However, this number does not account for medical sources, and is based solely on user declarations.

Belarusian authorities stumbled upon a box containing abandoned Soviet-era radioactive sources in 2010 but could offer no explanation about its origin. In Moldova, bankrupt enterprises cannot afford proper disposal or security for their sources. Poor financial conditions create similar problems in the Caucasus, and governments cannot secure and dispose of some known radioactive sources because they are located in the middle of disputed territories.

Border Controls

Seizures in 2011 of smuggled HEU in Moldova exemplify the inadequate border security in a number of former Soviet Union countries. Frozen conflicts and disputed territories hamper standard border checkpoint procedures, while longstanding traditions of semi-nomadic cross-border trade and ambiguous border demarcations complicate customs inspection and enforcement.

Most of the states studied in the report would benefit from greater access to radiation detection equipment and training, including the installation of portal monitors at every major border crossing. Belarus, Ukraine, and Moldova are strong candidates for continued efforts in this area,

[33] International Atomic Energy Agency (IAEA) experts, discussions with project researchers, Vienna, April 2011.

especially at railroad border crossings. In Central Asia, the situation with major border crossings varies from country to country. While in Uzbekistan all major border-crossing points are already equipped with detection monitors with the Russian Yantar system through funding from the US Department of Defense, in other countries like Turkmenistan, this work has not yet begun. Assistance in securing and monitoring green border areas would be particularly valuable to Central Asian states. Blue border efforts, chiefly in heavily trafficked Black Sea ports, should also not be neglected.

One of the benefits of US-Russian cooperation has been the widespread introduction of Russian-designed and manufactured detection equipment at FSU border crossing points. The US DOE selected the Yantar portal monitoring system after successful testing in Russian and US nuclear laboratories partially to ease maintenance as part of its early Second Line of Defense efforts within the Russian Federation. In field use, including under difficult climate conditions, the Yantar quickly earned a reputation for reliability and technical capability on par with other international manufacturers, with the added benefit of Russian language technical documentation and a local supply chain. To the extent possible, efforts to equip border crossing points with Russian-produced detection equipment and reliance on training personnel in Russia should continue to sustain this positive development.

Human Resources Capacity

All of the major threat reduction programs in the former Soviet states contain human capacity–building elements, and progress in this area has been noteworthy. The IAEA has used Ukraine's previously mentioned MPC&A training center to host its own training events. Kazakhstan frequently hosts nuclear security training events and conferences and has offered to assist other Central Asian states in border management training. Belarus was recently recognized by the IAEA as one of only six countries to voluntarily participate in a complete nuclear emergency preparedness review.

These successes, however, are overshadowed by longstanding gaps in comprehensive and sustainable personnel education, training, and capability; and human capacity building is likely to remain a challenge in the region for the foreseeable future. The poorest countries of the region struggle to fund basic physical security requirements and cannot afford to devote their limited resources to systematic personnel training. Historical reliance on education and training services in Russia could be revitalized, particularly as younger generations of specialists need to be fostered. As MPC&A and other technical experts retire or reach retirement age across the former Soviet republics, their replacement with qualified and properly trained specialists is not guaranteed. In addition to training nuclear engineers, physicists and chemists, efforts need to be made to put in place exchange programs for faculty and graduate students that involve US and Russian universities and research centers. This strategy would help to establish cadres of regional specialists with robust technical skills and utmost nonproliferation and security values. Whenever possible, "train-the-trainer" methods should be used to aid in institutionalizing training. Incorporating anti-corruption training programs into this curriculum would be highly beneficial as well.

Strategic Trade Controls and UNSCR 1540 Compliance

Finally, compliance with and implementation of UNSCR 1540 vary across the region. Central Asia has had mixed success at best, with Kazakhstan and Kyrgyzstan making seeming good-faith efforts to improve this situation. Their reports provide details and descriptions of their export control systems and overall compliance with the provisions of the mandate. Tajikistan, Turkmenistan, and Uzbekistan, however, lag behind both on implementation and reporting and have simply issued brief excerpts of applicable criminal statutes for WMD-related crimes.

Rather than reflecting resistance to the mandate, however, this situation likely indicates the need for legal and legislative assistance to create an appropriate regulatory infrastructure in these three nations. On the whole, UNSCR 1540 nuclear security efforts are seen as a positive development by observers both inside and outside of the post-Soviet countries.

In the Caucasus, Georgia seems to have the most developed export control regime. Azerbaijan and Armenia have both formally requested compliance assistance from the 1540 Committee, although their requests focus on detection equipment and security and inspection training for personnel. Despite ongoing efforts to develop an adequate regulatory framework, all three countries are in need of further improvements in this area.

Belarus has declared itself in compliance with UNSCR 1540 and does seem to have a fairly well developed legal and regulatory basis for dealing with nuclear materials and export compliance. Moldova's willingness to be considered a candidate for EU membership and its agreement to the 2004 EU-Moldova Action Plan[34] has greatly helped to improve its legal infrastructure. Ukraine's regulatory structure is robust and well developed, having benefited substantially from cooperative efforts with the US and EU to create an appropriate legal framework for dealing with a range of WMD-related issues.

Russia will continue to play an outsized role in the development and implementation of strategic trade controls in the post-Soviet space. It remains a dominant trading partner for all of the countries in the region, a position which is likely to be enhanced with Russia's recent accession to the World Trade Organization, and has taken the lead in efforts to harmonize trade and export legislation and procedures with the countries of the new Eurasian Economic Community. Of particular note is the January 2012 decision to move forward with a common economic space between Russia, Kazakhstan, and Belarus. This decision creates an opportunity for Russia to demonstrate leadership in efforts aimed at improving export control processes in these three countries and harmonization of strategic trade control regulations and procedures in the region. It could also encourage greater regional cooperation on the issue.

[34] The EU-Moldova ENP Action Plan was developed jointly by the EU and Moldova as the main instrument to implement the European Neighborhood Policy in the first part of 2004 and jointly adopted at the Cooperation Council on 22 February 2005.

6. Compelling Areas for US-Russian Cooperation

The two regions that are part of the project are quite distinct and different, yet as the research team reviewed nuclear security needs and challenges in these regions, as well as opportunities for U.S.-Russian collaboration, it become apparent that the majority of recommendations are relevant to both regions, are likely to have wide application and can be applied to other geographical regions.

Shared U.S. and Russian Interests and Priorities

In order to identify projects in which the United States and Russia might cooperate, it is best to look first at each country's strategic priorities in global nuclear security and determine how these might lead to appropriate programmatic responses. The table below indicates that there are quite a few areas of overlap between US and Russian strategic priorities. The establishment of robust nuclear export controls in all of the former Soviet states is a common interest—for Russia as nuclear supplier, and for the United States as a country that considers the prevention of illegal transfer of nuclear materials and technologies as one of its key nonproliferation and nuclear security priorities. Indonesia, which is located on a strategic trade route, could represent a new nuclear market for Russia. Both Russia and United States are interested in strengthening export controls in Indonesia and the Southeast Asia to prevent the emergence of another A.Q. Khan illicit trafficking network. In the majority of countries and regions, however, varied interests of Russia and the United States could lead them to focus on different programmatic responses within individual countries, thus complementing each other's efforts according to their respective advantages in expertise, technology, or relationship with the host country.

The table below shows regional and focus areas where the Russian Federation and the United States are very compatible and where priorities overlap. More broadly, it would be safe to say that the recommendations from this report for joint cooperation fall well within jointly shared interests and priorities.

	Priority States/Areas for Nuclear Security Cooperation	Preferred Responses to Nuclear Security Challenges
Russia	Bordering and other nearby states	Equipping border crossings with radiation detectors, training specialists and developing adequate response procedures
	Current and past nuclear customers	Cleaning up and redeveloping territories affected by Soviet nuclear activities
	Future markets for nuclear trade	Putting in place the legal and regulatory framework for nuclear industry development, training specialists, and establishing adequate export controls
US	"Weak links" in the efforts to combat nuclear and radiological terrorism	Securing all vulnerable fissile materials and creating capabilities to prevent, detect and interdict nuclear and radiological materials smuggling
	States located in strategic global trade routes	Implementing effective export controls for preventing the spread of sensitive nuclear and dual-use technology
	Future markets for nuclear trade	Putting in place legal and regulatory frameworks for nuclear industry development and training for relevant specialists

Other Important Considerations

Interest and Support of the Beneficiary Country. In order to be successful, joint US-Russian projects must be in line not only with their own key priorities, but also with those of the host country or region. For example, Vietnam, which has ambitious plans for developing a nuclear energy industry, urgently needs trained specialists, as well as a legal and regulatory framework. The main requirement of the Central Asian states, which used to be a source of uranium for the Soviet nuclear weapons program, is the clean-up and redevelopment of the abandoned uranium mining operations, especially the tailing dumps. Many states also need border crossings equipped with radiation monitors.

Cost-Sharing. Sharing costs between all stakeholders is essential to creating lasting frameworks within target countries. The United States has contributed substantial financial and other resources to projects relevant to nuclear security in the former Soviet states and globally, and, in recent years, Russia has significantly increased its contributions for these efforts. For instance, in late 2010 Moscow announced that it would contribute US$6.5 million to the IAEA Nuclear Security Fund over the period of 2010-2015. Moscow likewise contributed US$3 million to the removal of irradiated HEU fuel from the Vinca research reactor in Serbia and noted recently that it would spend about US$40 million for the rehabilitation of uranium mining sites in Central Asian states. In this regard, the US and Russian contributions to the IAEA Nuclear Security Fund could be one of the funding mechanisms for joint US-Russian efforts in third countries. The IAEA Office of Nuclear Security could also serve as a coordinating platform.

While the contributions of outside partners like Russia and the United States are important, the input of the host country (or countries) is equally crucial. Taking the example of past US-Russian collaboration, projects with the highest chance at succeeding in the long term where those in which the direct beneficiary of the project's activities made a direct contribution, either financial or material, such as the provision of indigenous technologies and knowledge. The involvement of the IAEA is another important element for success. In addition to its own activities, the agency would be an important provider of independent expertise and impartiality. The IAEA could also coordinate project implementation and ensure that projects do not overlap. Given the obvious sensitivities of nuclear security issues, for political reasons some countries might be more open to cooperation under IAEA auspices as opposed to bilateral or trilateral programs. The agency's role can be especially important for US-Russian projects in countries that are not members of the Nuclear Nonproliferation Treaty.

Finally, given the current economic situation, it appears that some of the countries in the region could increase their own spending on projects in this area. That is especially true of Kazakhstan, the world's largest producer of raw uranium by quite a margin and a beneficiary of high oil prices. Nevertheless, only about half of the country's border crossings are equipped with radiation detectors, and the country still relies on international assistance to furnish equipment for the remaining crossing points.

Internal Coordination and Allocation of Resources. Lack of interagency coordination is an overarching problem that impedes the effective implementation of security upgrades in many countries in Southeast Asia and the former Soviet Union. Very often policy-making organs do not coordinate activities with technical agencies. Encouraging interagency cooperation on relevant issues should be a key objective of all engagement in the region.

Principal Areas for US-Russian Cooperation

Based on an examination of challenges, mechanisms and opportunities for cooperation specific to nuclear security development in Southeast Asia and in the former Soviet states, US-Russian cooperation is likely to be most beneficial on specific projects aimed at: **building human resource capacity, improving domestic legal frameworks, and strengthening nuclear and radiological material controls** (both at domestic facilities and while in transit, including export and border controls.) Specific recommendations based on our research for joint US-Russian efforts are set out in the table below.

Building Human Resource Capacity

Education and Training of Nuclear Security Specialists

Relevant experts from former Soviet states and SEA countries would benefit from training related to building infrastructure and expertise. The training could take place in Russia, for instance at the MEPhI University or at training facilities in Obninsk (the Interdepartmental Special Training Center (MSUTs) and Russian Methodological and Training Center (RMTC)). These facilities are already being used for a number of IAEA- and US DOE–sponsored training programs for third country specialists. This practice could be expanded and include both academic and professional development training. Many specialists from the former Soviet republics and Southeast Asian countries already received some of their higher education in Russia, so their knowledge of the Russian language is an additional advantage for these training programs. The Russian contribution to the IAEA Nuclear Security Fund could be used as one of the sources of financing for these training programs.

In addition, instructors and specialists from relevant training facilities and nuclear experts from the United States and Russia could be dispatched to the region to organize training programs in host countries, allowing for larger reach. They could also help establish national or regional nuclear security support centers or programs and work with the IAEA and other regional nuclear security centers of excellence to build a national cadre of experts. In the academic sphere, MEPhI's master's program on MPC&A, jointly developed by Russia and the United States, could be a basis for establishing similar programs in countries and regions of need. It was widely used to establish such a program in Ukraine; Pakistan officials have expressed interest in launching a similar program in Islamabad and have already visited Ukraine to learn about Ukraine's experience in adapting the program. These efforts would also benefit from close cooperation and coordination with the IAEA, particularly in light of the concerted efforts the Agency made in 2010-2011 to support the development of nuclear security curricula and train-the-trainer programs in different regions.

Strengthening the Legal and Institutional Framework

Building Nuclear Security Norms and Infrastructure

Southeast Asia and the former Soviet states have a mixed record of implementing major nuclear security-related conventions. Full and effective implementation of international agreements—including the Amended Convention on the Physical Protection of Nuclear Material, the Convention on the Prevention of Nuclear Terrorism, the Code of Conduct on Safety and Security of Radioactive Sources, the related Guidance on Import and Export or Radioactive Sources, and physical protection recommendations contained in the INFCIRC 225/Rev 5 (where applicable)—is essential for the establishment of domestic nuclear security frameworks and for an overall security culture in the target regions.

The United States and Russia, along with the IAEA and other international partners, should work closely with relevant authorities in the target regions to draft national legislation and regulations that mirror the standards set forth in the international agreements, and, where necessary, assist government officials with drafting necessary ratification legislation. Moscow and Washington have previously worked together on drafting MPC&A bylaws and regulations for Russia and should be able to assist other countries in this task. They should also encourage and assist with the strengthening of capabilities, resources, and independence of relevant regulatory bodies.

Controls on Materials and Technology

Border Controls

Russia and the United States could offer Southeast Asian countries a joint initiative to address key nuclear security challenges under a Southeast Asia Second Line of Defense (SEASLD) program. The aim would be to secure national borders to prevent illicit trafficking of nuclear and radioactive materials, including through the provision of radiation detection equipment at border areas. Russia and the United States should also step up their cooperation under the SLD program in the former Soviet states, especially Kazakhstan, Kyrgyzstan and Tajikistan, where borders remain porous. This issue is especially pressing for Russia in view of the entry into force of the Customs Union agreement, which opens internal borders between the Customs Union participants. Security of the external borders therefore becomes even more important.

Strategic Trade Controls

One common problem in the both regions is weak strategic trade management. The relevant trade security systems in the region would benefit from international cooperation, including through Russian-U.S. partnership and with the involvement of the 1540 Committee and other donor countries. In collaboration with regional partners and regional organizations, international experts could facilitate the development of legal frameworks specific to strategic trade controls, as well as the development of a communication infrastructure and appropriate equipment, particularly IT. In addition, Russia and the United States are well positioned to provide training to export control specialists and personnel. Russia is particularly suited for providing such training to experts from the former Soviet Union republics and from those Southeast Asian countries whose experts studied in Russia (Myanmar and Vietnam in particular). These efforts should aim to promote a better understanding of the concept of "dual-use goods" at the operational level. Such work is particularly important for countries with developing nuclear power programs.

Improving Radiological Source Security

The Russian Federation, the United States and other international partners should increase cooperation with target countries to enhance their legal and regulatory capacity for radiological source security and to strengthen their capacity to provide sound management for radioactive sources through their entire life cycle, including licensing, monitoring, storage, and final disposal. They could also team up in search and disposition efforts to locate orphaned radioactive sources in former Soviet states, as well as assist with strengthening radioactive waste and disused radioactive sources disposal in both regions considered in this study.

In addition to implementing these forward-looking recommendations, the United States and Russia should continue their efforts to eliminate remaining proliferation and security risks associated with their own earlier exports to both regions. Most notably, U.S. and Russian authorities should complete the conversion of research reactors and other installations from HEU to LEU and subsequent removal of the remaining fresh and irradiated HEU fuel or cores from critical and subcritical assemblies. The majority of these programs are on track. However, in some cases, a better-coordinated joint policy, as in case of Belarus, or accelerated technical or financial support, as in case of Kazakhstan, might be required to complete these tasks.

Another area related to Soviet nuclear legacy is the clean-up and redevelopment of former uranium sites, including uranium tailings, in Central Asian states. Russia has already expressed its willingness to finance such projects (to the tune of about US$40 million) through Eurasian Economic Community mechanisms. The cleaning of these sites would also provide radiological security benefits, as a large number of discarded radioactive sources used in mining operations are believed buried in these tailings.

In addition, it would be highly desirable to restore and update, where possible, archival information on the distribution to former Soviet states of the most dangerous radioactive devices, including RTGs and other high-risk radioactive sources. The location and disposal of these highly radioactive devices is largely hampered by the absence of accurate records about their transfer to these states during the Soviet years.

Sample Model for a Russian-U.S. Project

Enhancing Radiation Monitoring and Detection of Nuclear and Radiological Materials at Borders

The proposed project aims to strengthen the technical, regulatory, and personnel capacity of third countries in radiation monitoring activities at main border crossing points (airports, sea ports, and mainland borders).

The US and Russia undertake the project in partnership with the IAEA or G-8 Global Partnership. Funding for the project comes from the United States, Russia and other countries directly and/or from the IAEA Nuclear Security Fund or G-8 Global Partnership.

The project involves several phases and steps. Russia and the United States choose individual steps or projects to carry out and identify joint efforts for others to implement.

A. Assessment of needs and development of implementation plan

- Assess detection and monitoring equipment and development requirements at borders and key crossing points
- Identify personnel, equipment, regulatory and other needs to address the problem
- Develop an implementation plan based on the identified needs, including a timetable and possible sources of funding for each step and individual components

B. Implementation

- **Acquisition, delivery, and installation of equipment**

  As part of the acquisition strategy, Russian-produced Yantar monitors form the basis of the technical solution. Yantars are already being utilized in the FSU and other countries. Eight Yantar units are being installed by the IAEA at the Noi Bai Airport in Hanoi, Vietnam.

- **Procedures for response to alarms**

  Based on vast Russian and US experience on developing such regulations, technology is matched with effective response when radiation alarms are triggered. Procedures take into account local regulations and practices, including coordination among various local and regional authorities and response services.

- **Human resources development**

  The bilateral project provides training programs for border guards and other relevant personnel at the borders, as well as for response teams and regulatory authorities on the use of the equipment and on procedures.

- **System testing**

  The team conducts exercises to a) assess the system and b) make the necessary changes to the response system.

- **Maintenance and sustainability of the system**

  One of the key sustainability components is the capacity to provide training to new personnel at border crossing and response units. Train-the-trainers programs prepare local instructors to develop indigenous capacity to sustain such training on a regular basis.

7. Conclusion: Next Steps

Project researchers developed the recommendations above with the needs of the former Soviet states or Southeast Asia in view. However, as the project drew to conclusion, the research team became convinced that the proposals developed have a much broader geographic application. Indeed, many of the proposed recommendations and specific mechanisms for their implementation should be considered under a broader umbrella of US-Russian cooperation in advancing the global nuclear security agenda. They are also likely relevant for overall multilateral cooperation and global initiatives for nuclear security.

Experience has shown that sustainable progress in improving nuclear and radioactive security is a substantial endeavor that requires significant political and institutional commitment and considerable financial, technical, human and other resources, as well as effective utilization of those resources. Through two decades of cooperation in enhancing nuclear security in the former Soviet Union, Russia and the United States have demonstrated their capacity to work together to tackle this challenge. Moreover, as their national nuclear terrorism threat perceptions have converged in recent years,[35] Moscow and Washington have shown a willingness to go beyond the conversion of former Soviet-supplied research reactors to LEU and the repatriation of HEU; more recent cooperation has included the formation of global partnerships and leadership in joint initiatives, such as the Global Initiative to Combat Nuclear Terrorism (GICNT).

In addition to the recommended activities identified in this report, the two countries can better leverage their roles as nuclear suppliers to shape global nuclear security standards. For example, the congressional watchdog Government Accountability Office (GAO) reported last year that most US nuclear cooperation agreements require both partners to provide adequate nuclear security frameworks and to subject physical protection measures to review and consultation by the other party.[36] Nonetheless, the text of the agreements generally does not specify what constitutes adequate physical protection nor does it provide access rights to verify that appropriate measures are in force. The result has been an ad hoc system that includes a few visits to some (but not all) high-priority sites and has led to the discovery that many of these sites did not meet IAEA security guidelines.

Russia and the United States should require, when negotiating the supply of either nuclear materials or technology to a third country, that the receiving entity or state adhere, at a minimum, to current IAEA physical protection recommendations (INFCIRC 225/Rev 5) and permit either the supplier or the IAEA to verify that they are doing so on a regular basis. These new efforts should be part of a global campaign to persuade states to publicly commit to adhering to IAEA

[35] See a detailed discussion of this issue in Belfer Center for Science and International Affairs and Institute for U.S. and Canadian Studies, *The US-Russia Joint Threat Assessment of Nuclear Terrorism*, (Cambridge, MA: Harvard College, May 2011).

[36] U.S. Government Accountability Office, "Nuclear Nonproliferation: U.S. Agencies Have a Limited Ability to Account for, Monitor, and Evaluate the Security of Nuclear Material Overseas," September 8, 2011, http://gao.gov/products/GAO-11-920.

standards, attempt to define stronger global requirements, and adhere to the principle of peer review, already a staple of the nuclear safety arena.[37]

In addition, the United States and Russia could spearhead the development of a set of international standards based on their extensive joint experience in securing materials and facilities in Russia. As suggested in the recent report by William Tobey, the two countries could record their empirical practices and summarize the approaches they used in constructing design basis threat assessments, identifying relevant equipment, procedures, and other elements in countering threats.[38]

A number of additional strategies can and should be employed to preserve and potentially expand US-Russian cooperation on pressing nuclear security problems worldwide. These include:

- *Expand global HEU conversion and repatriation efforts.* In moving forward, it is important not to forget existing arrangements that are crucial for nuclear security—for example, assuring that the December 2010 Belarus-US agreement to rid Belarus of HEU is back on track. At the same time, the United States and Russia should expand the scope of their efforts to include more difficult conversion cases as well as pulse reactors, critical assemblies, and propulsion reactors in third countries (and domestically).

- *Enhance human resource capacity.* Cooperative efforts should ensure that third countries receive relevant technical and nuclear security education and training and that nuclear operators and officials develop a strong security culture. Particular emphasis should be placed on taking advantage of the facilities established in Russia to train MPC&A personnel and to educate future nuclear specialists in nuclear security. These centers and academic programs should also be more broadly integrated (along with similar US programs) into the effort advanced by the United States at the Nuclear Security Summit to develop Centers of Excellence in Nuclear Security in several critical regions.

- *Bolster the legal and regulatory nuclear security framework and nuclear security standards.* In some states, ratification of a whole series of relevant conventions and treaties is still needed, along with their subsequent incorporation into national legislation and regulations. The 2012 Nuclear Security Summit endorsed the goal of having the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM) enter into force by 2014, a goal which first requires ratification by two-thirds of the more than 140 parties that have ratified the underlying convention.[39] The United States has been one of the laggards in this regard because of congressional concerns that the implementing legislation will expand the list of crimes punishable by death. Despite pledging at the 2010 nuclear security summit to accelerate efforts toward ratification, the

[37] Kenneth Luongo, Sharon Squassoni, and Joel Wit, "Integrating Nuclear Safety and Security: Policy Recommendations," *Policy Perspectives* (December 13, 2011).
[38] William Tobey, "Building a Better International Nuclear Security Standard," *USKI Working Paper Series* (US-Korea Institute at SAIS: Johns Hopkins University, 2012).
[39] Seoul Communiqué, 2012 Seoul Nuclear Security Summit, March 27, 2012, http://www.thenuclearsecuritysummit.org/userfiles/Seoul%20Communique_FINAL.pdf.

United States still needs to complete this process. Russia, which has already ratified the convention, should lead a campaign aimed at both bringing CPPNM in its amended form into force and increasing implementation of INFCIRC 225/Rev 5.

- *Enhance radioactive sources security and regulations globally.* The 2012 Nuclear Security Summit encouraged countries to take several steps to better secure radioactive sources. These included: reflect IAEA guidelines, the Code of Conduct on the Safety and Security of Radioactive Sources and related import-export guidance in domestic frameworks; establish national inventories of high-activity radioactive sources; share technologies and relevant best practices; and initiate domestic efforts and engage in international cooperation to recover lost, missing or stolen sources and to maintain control over disused sources. Given their previous experience working on these issues, the two countries should work together to help better account for orphan sources in the former Soviet states and elsewhere and provide better disposal pathways for disused sources. In addition, given their scientific capacity, the two governments should convene an international scientific panel of experts to explore potential alternatives to high-risk radioactive sources. Additionally, as detailed in a November 2011 NTI-sponsored report, based on a joint US-Russian tabletop exercise, the two countries should take a number of steps to improve their ability to avoid or manage a nuclear security crisis, whether it be in third countries or their homelands.[40]

- *Increase funding for nuclear security activities.* The two countries, among the leading contributors to the IAEA Nuclear Security Fund (NSF), should convince others to follow their lead and seek opportunities to commit more of their own funds. They should also seek the increase of allocations for nuclear security in the regular IAEA budget.

Mechanisms for Advancing the Agenda: Expanding US-Russian Nuclear Cooperation beyond Its Current Scope

A September 2011 Joint Statement by U.S. Energy Secretary Stephen Chu and Rosatom Director Sergei Kiriyenko provides a strategic map for Russian-US nuclear cooperation and joint projects.[41] This joint statement was made possible by the 2011 entry into force of a bilateral nuclear cooperation agreement between the two countries. In the statement, the parties point to a number of activities related to enhancing nuclear security, including: feasibility studies for converting Russian and US HEU research reactors, joint efforts to convert third-country research reactors, collaborative work on technical nuclear forensics, joint emergency response exercises, and nuclear safety research (which can often have applications to nuclear security). The two countries should expand this agenda to include a number of critical areas, including the recommendations detailed in this report that address:

- Growth of global and regional human resource capacity and a nuclear security culture;
- Enhancement of border and export controls;

[40] Nuclear Threat Initiative, "Avoiding Catastrophic Terrorism, Lessons Learned in a Tabletop Exercise," NTI website, November 2011, http://www.nti.org/media/pdfs/NTI_Tabletop_Report_FINAL.pdf?_=1323380823.
[41] "Joint Statement by the U.S. Department of Energy and State Atomic Energy Corporation ROSATOM on Strategic Directions of U.S.-Russian Nuclear Cooperation," US DOE website, September 20, 2011, Vienna, http://nnsa.energy.gov/sites/default/files/Joint%20Statement.pdf.

- Development of detection and response capabilities;
- Adoption and implementation of nuclear security–related international treaties and guidelines; and
- Reinforcement of relevant regulatory and other institutional capabilities.

As the Nunn-Lugar programs wind down in Russia and the international community increases its attention to global nuclear security—reflected in initiatives such as the Nuclear Security Summits, UNSCR 1540, GICNT, and others—the two countries have an opportunity to expand their cooperation in states with which the United States or the Russian Federation have historical ties, have formed new partnerships, or have concluded contracts for the construction of nuclear power plants or other nuclear infrastructure. Virtually all of these international mechanisms and initiatives, working with the IAEA and G8 Global Partnership, could serve as international instruments and arrangements to facilitate the two countries' joint work in third countries and regions. Entry into force of the US-Russian Agreement for Cooperation in the Field of Peaceful Uses of Nuclear Energy, also known as the 123 Agreement of January 2011, provides a solid bilateral foundation for these efforts.

Joint High-Level Political Commitments and Subsequent Implementation Steps

Several years ago, the United States and Russia took an important step toward fostering cooperation on nuclear security issues by establishing a bilateral Nuclear Energy and Nuclear Security Working Group, with a working subgroup on nuclear security. The working group includes, from the US side, representatives of the departments of Energy, State, Defense, Commerce, and Homeland Security; the National Nuclear Security Administration (NNSA); and the Nuclear Regulatory Commission (NRC), and from the Russian side, the Russian State Atomic Energy Corporation (Rosatom), the ministries of Foreign Affairs and Defense, and the Federal Customs Service of Russia. Making the most of this opportunity, however, will require the two countries to develop a much more ambitious roadmap with a broader agenda for working in other countries and regions to advance nuclear security internationally.

To amplify the achievements of this group and demonstrate its commitment to nuclear security, steps could be taken to conduct a series of jointly developed and implemented international exercises along the lines of bilateral US-Russian exercises related to nuclear security emergencies, to jointly develop curriculum materials and implement training programs at the IAEA and regional centers of excellence, and to identify other projects with clearly demonstrated benefits.

The establishment of Track 1.5 or Track 2 working groups involving both governmental and nongovernmental experts would help to develop such roadmaps and specific projects. Among the tasks for this group could be the development of a framework to track and assist with the implementation of individual and collective pledges and action items decided upon at the March 2012 Nuclear Security Summit in Seoul. The presentation of a joint report on a US-Russian contribution to the implementation of decisions at the 2014 Nuclear Security Summit would send a very strong message regarding the nature of the US-Russia partnership and its commitment to global nuclear security.

As this report demonstrates, regional and global needs in and challenges of nuclear and radioactive security are vast, as are opportunities for meeting them. The United States and Russia, countries with the world's largest nuclear programs and 20 years of collaboration on nuclear security projects, should take full advantage of their transformed relations to ensure nuclear security for all. This joint work by the two states promises a greater effect and deeper value than the sum of their individual contributions. Moreover, it has the potential to shape a new paradigm of partnership, mutual trust, and shared responsibility in US-Russian cooperation.