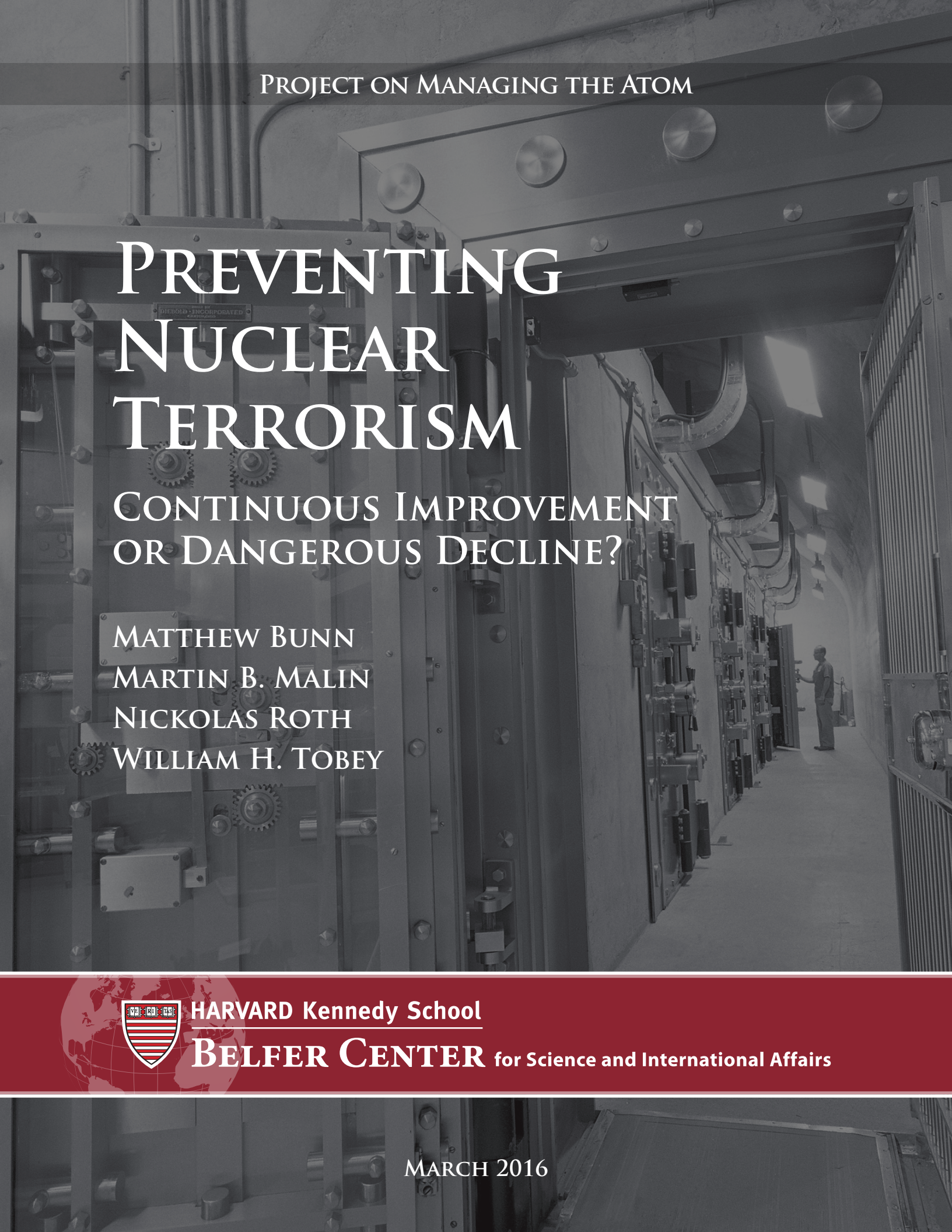

Project on Managing the Atom

Preventing Nuclear Terrorism

Continuous Improvement or Dangerous Decline?

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Project on Managing the Atom
Report

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Cover photo:
The "Tunnel Vault" nuclear materials storage facility at Technical Area 41, Los Alamos National Laboratory, as seen in October, 1964. (Los Alamos Archive).

Committing to Stringent Nuclear Security Principles

To achieve the goal of effectively and sustainably protecting nuclear stocks against the full range of plausible threats, governments and operating organizations must first commit to reaching that objective. Two key indicators could be used to assess progress in that direction:

- The fraction of the sites with nuclear weapons or weapons-usable nuclear materials within countries or managed by organizations that had made a particular commitment; and
- How far toward the goal of effective and sustainable security the commitment would take these stocks, if fulfilled.

National Design Basis Threats

One key way of making such a commitment is for countries to establish a design basis threat (DBT) including a substantial array of potential adversary capabilities and tactics that operators must protect against. Progress in that respect is difficult to judge, as the specifics of DBTs are generally secret—and in some cases, legal arrangements are lacking even to exchange them confidentially between cooperating countries.[39] While the details are not known, it is clear that overall there has been substantial progress in this direction. Since 1999, when the IAEA first recommended that countries require operators to protect against a DBT, most countries have established such regulations. In a recent Harvard survey, experts from all of the 18 participating countries, representing a majority of the nations with HEU or plutonium on their soil, reported that their countries had a regulatory DBT in place, and that formal processes were in place to regularly reassess the threat.[40] The expert from only one participating country judged his country's DBT to be less capable than the published version of the U.S. Nuclear Regulatory Commission's

39 In the case of U.S.-Japanese cooperation, for example, experts on both sides have concluded that a new agreement would be needed to enable the exchange of DBT information.

40 Matthew Bunn and Eben Harrell, *Threat Perceptions and Drivers of Change in Nuclear Security Around the World: Results of a Survey* (Cambridge, MA: Project on Managing the Atom, Belfer Center for Science and International Affairs, Harvard Kennedy School, March 2014), http://belfercenter.ksg.harvard.edu/files/surveypaperfulltext.pdf (accessed January 20, 2016), pp. 20, 26.

(NRC's) DBT for theft.[41] Here, too, however, progress appears to have slowed: the only major steps (of which we are aware) that countries have taken to strengthen their DBTs since the 2014 Nuclear Security Summit are moves to include cyber threats, or to upgrade the kinds of cyber threats that must be considered (described in more detail below).

The Nuclear Security Implementation Initiative

Another means of making such a commitment is to join in making collective commitments with other countries. Here, the most important recent step is the "implementation initiative" agreed to by 35 countries at the 2014 nuclear security summit.[42] This was perhaps the most significant result from that summit. The participating countries pledged to:

- Implement the "intent" of key IAEA nuclear and radiological security recommendations, and "realize or exceed" their objectives. (These recommendations include, among other items, requiring facilities with enough HEU or separated plutonium to be a significant fraction of a bomb to protect against a DBT based on the state's assessment of the threat.)
- Accept peer reviews (such as the International Physical Protection Advisory Service, or IPPAS) "periodically";
- Ensure that "management and personnel with accountability for nuclear security are demonstrably competent"; and
- Take a range of other particular steps, from working to strengthen nuclear security culture to exchanging good practices with other countries to bolstering cybersecurity.

The countries that made this commitment include all of the European and North American participants in the nuclear security summit process, and a number of other countries.

41 Bunn and Harrell, *Threat Perceptions and Drivers of Change*, p. 27. The exception was Australia, but as Australia has only Category II material, which under NRC rules does not need to be protected against any DBT, the Australian rule is actually more stringent than U.S. rules for equivalent material, not less. Experts from several countries judged the question to be too sensitive to answer, and several others argued that their countries' DBT was different in significant respects, but neither more nor less capable overall, when compared with the published version of the NRC DBT for theft.

42 For descriptions, see Jonathan Herbach, "The Nuclear Security Implementation Initiative: A Catalyst to Needed Action," *Arms Control Today,* June 2014, http://www.armscontrol.org/ACTdigital/June_14 (accessed March 16, 2015), pp. 8–12; Bart Dal, Jonathan Herbach, and Kenneth N. Luongo of the Nuclear Security Governance Experts Group, "The Strengthening Nuclear Security Implementation Initiative: Evolution, Status, and Next Steps," (Washington, D.C.: The Asan Institute for Policy Studies, Partnership for Global Security, and the Stanley Foundation, October 2015), https://pgstest.files.wordpress.com/2015/10/nsgeg-snsi-report.pdf (accessed February 4, 2016).

But key countries such as Russia, Pakistan, India, China, and South Africa (among others) did not agree to participate. Thus, while this initiative represents progress:

- A substantial fraction of the world's nuclear weapons and weapons-usable nuclear materials are not covered by the initiative.
- While the initiative addresses many of the elements of an effective nuclear security system, it does not commit countries to secure their stocks against the full spectrum of potential capabilities and tactics nuclear thieves and saboteurs might use.

The implementation initiative is built around a structure of previous agreements and initiatives, which also form an important part of the overall effort to build commitment to effective nuclear security. In addition to the nuclear security summit process, particularly important elements of the global framework for nuclear security include: nuclear security recommendations from the IAEA; IAEA-led meetings, reviews, training, and services, such as the IPPAS; multilateral treaties, such as the 1980 Convention on the Physical Protection of Nuclear Material (CPPNM), its 2005 amendment, and the 2005 International Convention on the Suppression of Acts of Nuclear Terrorism (ICSANT); UN Security Council Resolution (UNSCR) 1540 and its successors; and multilateral groupings such as the Global Initiative to Combat Nuclear Terrorism (GICNT), the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction (GP), and Interpol. While none of these agreements or initiatives includes specific commitments to achieve high levels of nuclear security, each of them contributes to the goal of nuclear security. IAEA recommendations and the international treaties and UNSC resolutions are discussed in this section, as key elements of building commitment to nuclear security. Other elements of the global regime are discussed in additional sections below, in the areas where they have their most important effects.

IAEA Recommendations

In 1973, recognizing the need for international nuclear security guidelines, the IAEA published "Recommendations for the Physical Protection of Nuclear Material." This was the IAEA's first foray into the area of nuclear security. The Agency subsequently published a revised version as Information Circular 225 (INFCIRC/225). The fifth revision of INFCIRC/225 appeared in 2011, and over the past decade the IAEA has provided a wide range of other recommendations and guidance related to nuclear security in its "Nuclear Security Series."[43]

43 For a complete listing, see International Atomic Energy Agency, "Nuclear Security Series Publications" (Vienna: IAEA, October 15, 2015), http://www-ns.iaea.org/security/nss-publications.asp (accessed February 7, 2016).

IAEA recommendations have proven to be remarkably influential; because they provide a convenient starting point for regulators and because countries do not wish to be perceived as laggards failing to implement international guidelines, many countries base their nuclear security regulations on IAEA recommendations.

The fifth revision of INFCIRC/225 represented an important strengthening of the document, which:

- Added sections on rapid recovery of nuclear material, and mitigating sabotage;
- Included topics not previously covered, such as security culture, cybersecurity, material control and accounting;
- Strengthened recommendations for insider protection;
- Recommended force-on-force exercises for the first time, as part of evaluating security system effectiveness;[44]
- Significantly bolstered recommendations on security of nuclear material transports, including secure two-way communications and a two-person rule;
- Suggested that countries not downgrade security measures for mildly radioactive material as previously recommended (though not specified, this was based on the realization that radiation doses that would be insufficient to incapacitate nuclear thieves might not deter suicidal thieves); and
- Extended some protections previously reserved for Category I materials to Category II materials as well (such as 24-hour guards).[45]

Countries are still working to incorporate these changes into their national regulations, but there is little doubt that the long-awaited revision of INFIRC/225 represented a

44 Force-on-force exercises are tests of the ability of the protective force for a site or transport to defend against an adversary force. They help assess the overall performance of both the human and technical elements of a nuclear security system in coping with intelligent adversaries trying to find ways to defeat the system.

45 See International Atomic Energy Agency, "Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities," INFCIRC/225/Rev. 5, 2011. For an analysis by the chair of the group that drafted the revision, see Christopher Pryce, "Development of the IAEA Nuclear Security Recommendations on Physical Protection of Nuclear Materials and Nuclear Facilities (INFCIRC/225/Rev.5)," *Journal of Nuclear Materials Management*, Vol. 39, No. 3 (Spring 2011), pp. 11–17.

significant step forward—as does the expanding set of guidance in other elements of the IAEA's Nuclear Security Series.[46]

Nuclear Security Treaties

International treaties are the next key element of building a commitment to effective nuclear security. In 1980, the CPPNM—which includes provisions requiring states to criminalize nuclear theft and vague requirements for securing civilian nuclear material in international transport—was opened for signature. In 2005, the CPPNM was amended to include physical protection requirements for materials in domestic use, storage, and transport and to cover sabotage of nuclear facilities. The amendment does not include specific standards for physical protection, but rather broad "fundamental principles of physical protection," such as the responsibility of the state, and the need for countries to put nuclear security rules in place. The 2005 ICSANT also focuses primarily on criminalizing acts related to nuclear terrorism. It requires parties to "adopt appropriate measures to ensure the physical protection of radioactive materials," but does not include any specifics on what appropriate measures might be.

There has been substantial progress in broadening participation in these treaties since 2009. Only a few of the countries with weapons-usable nuclear material on their soil have not become parties to these treaties (see Table 1).

As of mid-March 2016, there were 153 parties to the CPPNM. Eight of those parties joined since 2009, four of them during the four-year effort. By the same date, 93 states had acceded to the 2005 amendment to the CPPNM; 49 of those countries did so during the four-year nuclear security effort, and 20 more since.

Nevertheless, the amendment has still not gained enough parties to enter into force—despite the participants in the 2012 nuclear security summit calling for it to come into force by 2014, and the participants in the 2014 summit pledging to work to bring it into force later in 2014. Two-thirds of the 153 parties to the convention—nine more than have ratified so far—must ratify before the amendment enters into force. Given the pace of ratifications in recent years, it seems quite plausible that the amendment might enter into force in 2016.

46 Best practice guides from the World Institute for Nuclear Security have also become increasingly important; since these are directed primarily to implementing organizations, they are discussed below in the section on implementing and sustaining effective nuclear security.

Similarly, 40 states ratified ICSANT during the four-year effort, and ten more since then, bringing the total to 102 parties, with 13 additional signatories.[47] ICSANT entered into force in 2007.

Table 1: **States with Weapons-Usable Nuclear Material That Have Not Joined Nuclear Security Treaties**

ICSANT	CPPNM
Argentina	Iran*
Ghana	North Korea*
Iran*	Syria*
Israel	**CPPNM Amendment**
Italy	Belarus
North Korea*	Iran
Pakistan*	North Korea
Syria	Pakistan
	South Africa
	Syria

Source: Based on IAEA and UN Data, January 2016
*Indicates the state has neither signed nor ratified.

In 2015, the United States finally ratified the CPPNM amendment and ICSANT. Our previous report described the years of embarrassing delays in U.S. ratification.[48] While the Senate had given its advice and consent to both treaties in 2008, Congress was unable to resolve disputes over the death penalty and wiretapping in order to pass implementing legislation for seven years thereafter. The U.S. ratifications are a very important element of progress, as some other states may have been looking to the United States, and having ratified will make it easier for the United States to push other states to follow suit. One such case in point is Pakistan, which has been slow to ratify the amendment to the CPPNM. But following a diplomatic push by the United States, Pakistan's National Command Authority has given its approval for ratification.[49]

47 International Convention for the Suppression of Acts of Nuclear Terrorism, July 7, 2007, Status available at https://treaties.un.org/pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XVIII-15&chapter=18&Temp=mtdsg3&lang=en (accessed March 15, 2016).

48 Bunn et al., *Advancing Nuclear Security*,p. 62.

49 "National Command Authority Expresses Satisfaction with Security of Nuclear Programme," *92 News*, February 24, 2016, http://92newshd.tv/national-command-authority-reviews-safety-mechanism-of-nuclear-program/ (accessed February 29, 2016).

UN Security Council Resolution 1540

UNSCR 1540, which was approved unanimously in 2004, obligates all UN member states to provide "appropriate effective" security and accounting for all nuclear weapons or related materials they may have; to criminalize any act that would help non-state actors acquire nuclear, chemical, or biological weapons; to institute a broad range of other nonproliferation controls; and to report to the Security Council on the steps they have taken to implement the resolution.[50] In 2011, the Security Council extended the life of the oversight committee for UNSCR 1540 for another 10 years. The committee's new, broadened mandate includes identifying "effective practices" and providing states with guidance and templates for implementation. At the direction of the Security Council, the committee charged with overseeing implementation of UNSCR 1540 is carrying out a comprehensive review of the resolution and its implementation, to be completed this year.[51]

In principle, by establishing a legal obligation to achieve "appropriate effective" security and accounting, UNSCR 1540 could be a very important tool in building commitment to stringent nuclear security principles. Unfortunately, no agreement has ever been reached on what essential elements must be in place for a nuclear security system to be considered appropriate and effective.[52]

Given its reporting requirements, UNSCR 1540 could also be an important tool for increasing transparency in nuclear security. Unfortunately, however, the quality of states' reporting varies widely, and in many cases it is very difficult to get a clear understanding of a state's approaches to nuclear security from the information presented in its UNSCR 1540 reports. Moreover, there are still a few countries that have never reported, and many more that have not answered the clarifying questions posed by the UNSCR 1540 committee. That committee has only a small staff, with few resources, and has been able to play only a very limited role in ensuring that states fulfill their UNSCR 1540 obligations.

Overall, while there is very significant progress in the area of building commitment to stringent nuclear security principles, there is much more to be done, both in expanding the commitments to additional countries and in strengthening the commitments.

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50 United Nations Security Council Resolution 1540, S/Res/1540, April 28, 2004.

51 The Security Council adopted UNSCR 1977 in 2011, stating that a review on UNSCR 1540 should be held before December 2016. See, "Comprehensive Review of the Status of Implementation of Resolution 1540," *United Nations,* http://www.un.org/en/sc/1540/comprehensive-review/general-info.shtml (accessed February 18, 2016).

52 Matthew Bunn, "'Appropriate Effective' Nuclear Security and Accounting—What is it?" Paper presented at Global Initiative/UNSCR 1540 Workshop on 'Appropriate Effective Material Accounting and Physical Protection,' Nashville, TN, July 18, 2008, http://belfercenter.ksg.harvard.edu/files/bunn-1540-appropriate-effective50.pdf (accessed June 29, 2015).

(which is more than can be said for comparable U.S. facilities). NNSA has also sponsored in-depth workshops on steps to strengthen nuclear security culture in China, Pakistan, and elsewhere; the U.S. State Department's Partnership for Nuclear Security has made security culture a major part of its programs. The IAEA has established a major nuclear security culture program, with guidance, workshops, and other activities. WINS has been a major promoter of nuclear security culture, also publishing guides for organizations and holding workshops to exchange experience and good practices. Many of the nuclear security Centers of Excellence have made security culture a major part of their programs.

It is difficult to assess, however, how much progress organizations are making toward strong security cultures. Most organizations handling nuclear weapons, HEU, or separated plutonium do not have specific programs focused on strengthening security culture. There is clearly a great deal still to be done to foster such a culture around the world, including better understanding how national and institutional cultures affect security practices in different organizations.

Building Confidence in Effective Nuclear Security

A nuclear weapon or nuclear material stolen in one country could be used on the other side of the world. And nuclear security is only as strong as its weakest link. Hence, every nation on earth has a national interest in making sure that all the countries with nuclear weapons and weapons-usable nuclear material fulfill their responsibility to provide effective protection. Today, however, there are few mechanisms that allow a country to confirm that nuclear security in other countries really is effective.

Here, too, measuring progress is very difficult. Indicators of progress could include:

- The fraction of locations with nuclear weapons, HEU, or separated plutonium covered by initiatives to build confidence that effective security is in place; and

- The degree to which these initiatives actually make it possible to understand and have confidence in a country's approaches to nuclear security. (For example, permitting experts from another country to visit and examine security procedures provides much more confidence than simply asserting that effective security is in place.)

Countries legitimately regard the specifics of how they guard their nuclear stocks as secret, and neither the IAEA nor any other international group has the legal right to inspect what

they do (though some countries voluntarily request an IAEA-led review of their physical protection arrangements.) Hence, no one—not the IAEA, not the U.S. government, and not any other government—has a complete assessment of nuclear security around the world, which really identifies where the strongest and weakest points lie.[156]

There is, however, increasing acceptance that states should provide *some* information about their approaches to nuclear security, since nuclear material stolen in one state could be used to threaten other states. Countries are required to report to a United Nations committee on the steps they have taken to implement the UNSCR 1540 obligation to provide "appropriate effective" security and accounting for nuclear weapons and weapons-usable materials (along with other controls to prevent nuclear, chemical, and biological proliferation); many countries publish progress reports at the nuclear security summits highlighting particular steps they have taken; published regulations, regulators' reports, and conference papers can also provide very useful information. But publications that simply assert all is well with a state's nuclear security, or highlight steps forward without mentioning challenges, do little to build confidence.[157]

The protesters' 2012 intrusion at the Y-12 HEU facility in the United States raises an even more fundamental issue for such international confidence-building: governments themselves may not know about nuclear security weaknesses in their own nuclear complexes. As noted earlier, a week before the intrusion, if you had asked officials managing security in the U.S. nuclear complex where the more secure sites were, Y-12 would have been close to the top of the list.

A variety of existing and proposed approaches offer greater confidence than simple assertions that effective nuclear security is in place. Technical cooperation programs, for example, often include in-depth discussions of existing nuclear security arrangements, and sometimes also include visits to key nuclear facilities to observe implementation on the ground. Some nuclear suppliers (especially the United States) visit locations handling nuclear material they exported to ensure that it has adequate physical protection. The IAEA organizes a number of nuclear security review services, particularly IPPAS,

156 The U.S. government has attempted such an assessment, known as the Nuclear Materials Information Program (NMIP). NMIP has a great deal of useful information (much of it classified), but substantial gaps remain.

157 As one example of public assertions that did not build much confidence, in Pakistan's first report on actions taken under UNSCR 1540, with respect to the requirement for "appropriate effective" security and accounting measures for nuclear weapons and weapons-usable materials, Pakistan simply said: "The Government has put in place effective physical protection measures for the safety and security of its installations, equipment, material, and personnel," without even a general description of what these effective measures might be. See Government of Pakistan, "Pakistan's National Report on National Measures on the Implementation of Security Council Resolution 1540 (2004)," S/AC.44/2004/ (02)/22, November 5, 2004, http://www.nti.org/media/pdfs/pakistan-1540-initial-report.pdf?_=1316804762 (accessed March 15, 2016).

Security Culture Case Study: Clinton Prison, United States, 2015

In early June 2015, David Sweat and Richard Matt—both convicted murderers—escaped from the maximum-security Clinton Correctional Facility in Dannemora, New York. They cut holes in the back of their cells, climbed down several stories, and crawled through a series of tunnels, eventually emerging from a manhole outside the prison. Until this incident, nobody had ever escaped from the maximum-security area, and nobody had escaped from the prison at all in more than 100 years.

In the weeks following the incident, investigations revealed that Sweat and Matt were able to escape because they were assisted by prison employees and because of staggering lapses in facility security, reflecting a very weak security culture. According to current and retired officers, "a sense of complacency had taken hold" among the 1,400 correction officers at the facility, leading to numerous lapses in security.[i]

Security Lapses

During hourly bed checks at night, prison regulations stipulated that officers needed to be able to see skin and detect breathing. Yet, at the time of the breakout, prisoners were frequently allowed to sleep entirely covered, wear hooded sweatshirts, and cover their faces with pillows. Trying to avoid waking up prisoners, guards rarely shined flashlights on prisoners' faces. Corrections officers also allowed inmates to hang sheets across cell bars, frequently for lengthy periods, despite rules prohibiting such actions except when an inmate was using the toilet. Unlike in many other prisons, there were no video cameras in the cellblocks to detect suspicious activities.[ii] These lapses allegedly allowed Sweat and Matt to stuff "dummies" under their blankets and work undetected throughout the night.

Additionally, according to current officers, tunnels beneath the cellblocks and catwalks behind the cells (used by Matt and Sweat to escape) had not been inspected regularly in years. Guards were no longer stationed in two 35-foot guard towers during the night (despite rules requiring the towers to be manned and the catwalks to be inspected). Some have alleged that the inmates may have had access to power tools left on the catwalks by contractors. In addition, one former corrections officer at the facility noted that inmates frequently use power tools to perform maintenance.[iii]

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i Michael Winerip, Michael Schwirtz, and Vivian Yeehune, "Lapses at Prison May Have Aided Killers' Escape," *New York Times*, June 21, 2015, http://www.nytimes.com/2015/06/22/nyregion/new-york-prison-escape-an-array-of-oversights-set-the-stage.html (accessed February 18, 2016).

ii Allie Healy, "FBI launches investigation into Clinton Correctional Facility for possible drug trafficking, more," *Syracuse.com*, June 29, 2015, http://www.syracuse.com/crime/index.ssf/2015/06/fbi_launches_investigation_into_clinton_correctional_facility_for_possible_drug.html (accessed February 18, 2016).

iii Brian Mann, "Inside Clinton Correctional: Power Tools And Barbecue Grills," *National Public Radio*, June 13, 2015, http://www.npr.org/2015/06/13/413914664/inside-clinton-correctional-power-tools-and-tailgate-parties (accessed February 18, 2016).

The prison's location in a small town meant that corrections officers and staff are often related and especially close-knit. Jeff Hall, the prison historian, alleged that this tight web of relationships has often stymied investigations in the past.[iv]

Insider Assistance

Two prison employees aided Sweat and Matt. Joyce Mitchell, a tailor and industrial training supervisor since 2008, reportedly provided the two inmates with a variety of tools that aided their escape, including hacksaw blades, chisels, a punch, and a screwdriver bit.[v] Mitchell had developed a romantic relationship with one of the prisoners and told investigators that she was supposed to pick up the prisoners and, after they killed her husband (Lyle Mitchell, also an employee at the prison), drive them to a destination approximately seven hours away from the prison. At the last minute, however, she claims she had a change of heart. Instead of picking them up, she checked into a hospital seeking treatment for a panic attack.[vi]

The other employee, Gene Palmer, admitted that—in exchange for paintings and drawings from Matt—he provided the inmates with contraband, including a screwdriver and pliers, passed frozen meat to them from Mitchell (which Palmer asserts he did not know contained a hacksaw), and granted Sweat access to the catwalk behind his cell—which he and Matt later used to escape.[vii] Palmer claims, however, that he was trading these favors for useful information on prisoner activities, with no knowledge that he was contributing to an escape plot.

The implications of this incident are important for any organization that is trying to foster an effective security culture, but particularly for those that protect against the theft of nuclear material.[viii] The central mission of a prison is to keep prisoners locked up. Moreover, prison employees face the very likely possibility that, if they are not vigilant, prisoners might try to escape. Yet, the incident at the Clinton Correctional Facility shows that even when the threat is ever-present, complacency can dramatically undermine security, with devastating results.

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iv Brian Mann, "A Dozen Officials Suspended As Probe Into N.Y. Prison Break Widens," *National Public Radio*, June 30, 2015, http://www.npr.org/2015/06/30/418915785/a-dozen-officials-suspended-as-probe-into-n-y-prison-break-widens (February 18, 2016).

v Faith Karimi, "New York prison worker Joyce Mitchell charged with helping inmates escape," *CNN*, June 13, 2015, http://www.cnn.com/2015/06/13/us/new-york-prison-break/ (accessed February 18, 2016).

vi Susanne Craig, William K. Rashbaum, and Benhamin Mueller, "New York Prison Escapee Traded Art for Favors From a Guard," *New York Times*, June 25, 2015, http://www.nytimes.com/2015/06/26/nyregion/corrections-officer-new-york-prison-escape.html?_r=0 (accessed February 18, 2016).

vii "Gene Palmer's Sworn Statement to New York State Police," *New York Times*, June 25, 2015, http://www.nytimes.com/interactive/2015/06/25/nyregion/document-gene-palmer-statement-to-new-york-state-police.html (accessed February 18, 2016).

viii For an excellent analysis of nuclear security lessons learned from the prison break, see Kate Miller, "The Dannemora Prison Break: Lessons for Nuclear Facilities," *Nuclear Security Matters,* September 9, 2015, http://nuclearsecuritymatters.belfercenter.org/blog/dannemora-prison-break-lessons-nuclear-facilities (accessed March 15, 2016).

which contribute to confidence and to spreading good practices at the same time. The information from both IPPAS missions and technical cooperation visits remains confidential, however, so the degree of confidence others can have in the results depends on their confidence in the IAEA or the countries participating in the technical cooperation. Some countries publish sufficiently detailed information about their approaches to contribute significantly to confidence building. The U.K. regulator of civilian nuclear security, for example, used to publish detailed annual reports outlining the issues facing nuclear security in the United Kingdom and the steps being taken to address them (unfortunately, these reports did not continue after the regulator was folded into the broader U.K. nuclear regulatory agency.) The United States publishes a great deal of information on its nuclear security arrangements, and has several times, for example, allowed experts from other countries to observe force-on-force exercises testing the effectiveness of U.S. nuclear security systems. Overall, however, for most countries, the information available either to other states or to the public is insufficient to offer much confidence in the effectiveness and sustainability of nuclear security implementation.

Continuing an Effective Nuclear Security Dialogue After the Summits

Forums where states can discuss nuclear security and decide on next steps are also an essential element of an effective and sustainable nuclear security system. The nuclear security summit process has provided a very important forum for such discussions that had not existed before. The summits have helped to raise the issue to a high political level, increase awareness of the terrorism threat, provide a regular forum for high-level dialogue on next steps, create moments for action, and provoke new interagency discussions within governments.[158] The end of the nuclear security summit process with the 2016 meeting will leave a substantial gap that will be difficult to fill.

Nuclear Security Summits

The nuclear security summit process has transformed the international nuclear security discussion. The issue is now far more broadly recognized as an important element of the international security agenda; the threat of nuclear terrorism is far more broadly understood and accepted as a concern; the IAEA's role in nuclear security has been strengthened

158 See Bunn *et al., Advancing Nuclear Security,* p. 58.

and is now overwhelmingly endorsed by its member states; and many actions by individual states or groups of states, from eliminating particular stocks of HEU to putting in place new protections against cyberattack on nuclear facilities, have been driven or at least accelerated by the summit process.

The summits have included several key institutional elements. First, the summits themselves focused the attention of dozens of presidents and prime ministers from around the world on nuclear security, often leading to action on issues that had been delayed or blocked before. Second, the summit dates served as deadlines that accelerated action, as leaders often wanted something to be done so they could announce it at the summit. Third, the summits focused narrowly on nuclear security and not on nonproliferation, disarmament, or broader political issues. Remarkably, this made it possible for Israeli and Arab leaders, Pakistani and Indian leaders, and leaders from nuclear weapon states, non-nuclear-weapon states, and states outside the NPT to sit down together and discuss initiatives that could serve all their interests.[159] The Sherpa process to prepare for each summit allowed regular private discussions of nuclear security among a group of senior officials from dozens of countries, making it possible to float new ideas, hash out disagreements, and build consensus. Fourth, the summits established a tradition of participants making pledges to strengthen their nuclear security, known as "house gifts." Unlike the communiqués, which required all the participating states to agree, a single country's decision was enough in the case of a house gift—so many of these were more meaningful and far-reaching than the actions pledged in the communiqués. Fifth, the second summit established the new tradition of "gift baskets"—groups of states making pledges together. This made it possible to build group commitments even if some of the states participating in the summit did not want to join them.

There were noteworthy house gifts and "gift baskets" announced at each of the nuclear security summits. For example, at the 2010 Nuclear Security Summit Ukraine pledged to have all of its HEU removed by the end of the year. At the 2012 Summit, more than two-dozen nations supported an initiative to strengthen national legislation related to nuclear security. At the 2014 summit, 35 nations launched the nuclear security implementation initiative, discussed above. Each of the summits resulted in a communiqué generated by consensus, reaffirming the participants' support for strengthening nuclear security.

159 A number of countries, however, resented the exclusion of disarmament issues, seeing it as yet another attempt by the nuclear weapon states to evade their disarmament responsibilities. See, for example, the joint statement from Algeria, Argentina, Brazil, Chile, Egypt, Indonesia, Kazakhstan, Malaysia, Mexico, New Zealand, the Philippines, Singapore, South Africa, Ukraine, and Vietnam: "In Larger Security: A Comprehensive Approach to Nuclear Security" Statement at the Hague Nuclear Security Summit, March 25, 2014, http://www.state.gov/documents/organization/235496.pdf (accessed March 13, 2016).

One of the key questions that will be addressed at the 2016 Nuclear Security Summit will be how to sustain momentum and continue an effective dialogue in the absence of continuing meetings. At the summit, suggested plans will be presented to strengthen the nuclear security role of five organizations—the International Atomic Energy Agency, the United Nations, the GICNT, the GP, and Interpol. The potential role of each of these organizations—and particularly their role in continuing the dialogue—will be discussed below, along with other potential venues for a continuing dialogue.

The International Atomic Energy Agency

There is no doubt that the IAEA will continue to play a central role in nuclear security in the future, providing all the services described above. Moreover, with its series of international nuclear security meetings, the IAEA will clearly be one of the key elements of maintaining a high-level nuclear security dialogue. Discussions at the IAEA, open to all member states, carry a political legitimacy and acceptance that the invitation-only nuclear security summit process does not. At the same time, however, the consensus processes typically found at IAEA meetings tend toward least-common-denominator outcomes, making it difficult to reach agreement on substantial new nuclear security steps.

In 2013, the IAEA held the first of its international meetings on nuclear security that included both presentations by technical experts and a gathering at the level of government ministers. The statement from the ministerial part of the meeting, however, said little: it called on states to provide effective nuclear security, endorsed the role of the IAEA in nuclear security (something that was not broadly supported among member states a few years before), and called on states to join relevant treaties, but did little more. Because of the politics of the IAEA, it did not even explicitly mention initiatives ranging from the nuclear security summits to the GICNT to the World Institute for Nuclear Security (WINS), saying only that "initiatives" and "summits" could play a role if they were "inclusive."[160] The question for the future is whether IAEA meetings can become a more effective forum for high-level dialogue without sacrificing their advantages of political legitimacy and inclusiveness.[161]

160 "Ministerial Declaration" (International Conference on Nuclear Security: Enhancing Global Efforts, July 1–5 2013), http://www-pub.iaea.org/MTCD/Meetings/PDFplus/2013/cn203/cn203MinisterialDeclaration.pdf (accessed March 8, 2014).

161 See, for example, Trevor Findlay, "Beyond Nuclear Summitry: The Role of the IAEA in Nuclear Security Diplomacy after 2016" (Cambridge, MA: Project on Managing the Atom, Belfer Center for Science and International Affairs Harvard University, March, 2014), http://belfercenter.hks.harvard.edu/files/beyondnuclearsummitryfullpaper.pdf (accessed February 10, 2016).

The United Nations

To date, the United Nations has played only a modest role in nuclear security. As noted earlier, UNSCR 1540 legally obligates all UN member states to provide "appropriate effective" security for any stocks of nuclear weapons and weapons-usable material they have. The committee established to monitor implementation of UNSCR 1540 now has a mandate to identify "effective practices" in the various areas covered by the resolution, and is undertaking a comprehensive review of approaches to implementation. But the committee's small staff and modest expertise in nuclear security, coupled with the limited role it has played so far, suggest that significant changes in approach would be needed for the UN to be a major focus of effective dialogue on next steps in nuclear security in the future.

The Global Initiative to Combat Nuclear Terrorism

The United States and Russia, both of whom remain the co-chairs, established the GICNT in 2006. As of early 2016, GICNT had 86 participating states, including eight of the nine states that possess nuclear weapons (all but North Korea) and all but a few of the other states with weapons-usable nuclear material on their soil. GICNT is open to any state willing to commit to its principles. It also includes five observer organizations. GICNT's flexible approaches have made it possible to reach agreement in various areas, from strengthening emergency preparedness to developing guidance on nuclear forensics. (The forensics guidance developed in GICNT was later largely adopted by the IAEA, giving it increased political legitimacy—an interesting example of a strategy that could combine the advantages of flexibility in developing new ideas with political legitimacy in approving them.)

GICNT's statement of principles includes improving "accounting, control, and protection of nuclear material" and enhancing "security of civilian nuclear facilities." To date, however, GICNT has focused primarily on responses to the threat of nuclear terrorism other than security for nuclear weapons and materials—radiation detection, emergency response, nuclear forensics, law enforcement, and more. GICNT's work takes place primarily in working groups on particular topics, and there is no working group on improving security for nuclear materials. In essence, those who established the initiative concluded that there was already a range of international cooperative efforts targeted on improving security for nuclear weapons and weapons-usable nuclear material, and focused the new initiative in other areas. "Multilateral conferences, workshops, and

exercises" are GICNT's primary activities, rather than contributing directly to upgrading security at particular nuclear sites; only a handful of these activities have focused on discussing approaches to security for weapons-usable nuclear materials, and there is no working group on that topic.[162] Clearly, significant changes—such as establishing a nuclear security working group—would be needed for GICNT to play a major part in sustaining effective dialogue on nuclear security after the summit process comes to an end.

Nevertheless, by pulling together a large number of states for regular meetings examining the threat of nuclear terrorism and specific steps that can be taken to address the problem, it seems very likely that GICNT has increased many countries' perception of the threat of nuclear terrorism. That increased threat perception may well have contributed to improvements in their rules and procedures for securing their weapons-usable nuclear material.

The Global Partnership Against the Spread of Weapons and Materials of Mass Destruction and G7 Summits

In 2002, partly in reaction to the 9/11 attacks, the Group of Eight (G8) industrialized democracies established the GP, pledging a total of $20 billion over ten years to efforts to dismantle and control nuclear, chemical, and biological weapons and materials.[163] Half of the total was to come from the United States, and half from the other participating countries.

In 2008, the G8 agreed to extend the focus from projects in Russia and Ukraine to countries around the world that may need help in implementing the effective nonproliferation controls mandated by UNSCR 1540. In 2011, the G8 agreed to extend the effort beyond its original 2012 end date, and to focus it on improving nuclear security and other nonproliferation controls around the world.[164] While the effort began with the G8, more than a dozen other donor states are now participating, and a number of important developing

162 See "Global Initiative to Combat Nuclear Terrorism" (U.S. Department of State, 2013), http://www.state.gov/t/isn/c18406.htm (accessed July 7, 2015). For a list of GICNT activities, see "Global Initiative to Combat Nuclear Terrorism: Key Multilateral Workshops and Exercises" U.S. Department of State, 2012, http://www.gicnt.org/download/iag/Running_List_of_All_GICNT_Events_-_December_2013.pdf (accessed July 7, 2015).

163 See "Global Partnership Against the Spread of Weapons and Materials of Mass Destruction," Nuclear Threat Initiative, online, http://www.nti.org/treaties-and-regimes/global-partnership-against-spread-weapons-and-materials-mass-destruction-10-plus-10-over-10-program/ (accessed March 8, 2014).

164 See, for example, "Global Partnership Against the Spread of Weapons and Materials of Mass Destruction ('10 Plus 10 Over 10 Program')," James Martin Center for Nonproliferation Studies, (Washington, D.C.: Nuclear Threat Initiative, 2013), http://www.nti.org/treaties-and-regimes/global-partnership-against-spread-weapons-and-materials-mass-destruction-10-plus-10-over-10-program/ (accessed July 7, 2015). See also Bonnie Jenkins, "The Future Role of the G8 Global Partnership: Combating Weapons of Mass Destruction" (Muscatine, IA: Stanley Foundation, June 2010), http://www.state.gov/documents/organization/184789.pdf (accessed July 7, 2015).

countries are often invited to relevant discussions.[165] To date, however, only a small amount of non-U.S. funds have gone to improving security for nuclear weapons and weapons-usable nuclear materials, as opposed to other projects.

In 2014, the G8 became the G7 when Russia was kicked out of the group because of actions in Ukraine. Traditionally, G7 summits include an extensive statement on nonproliferation, including, in recent years, nuclear security issues; these statements are drafted by a group of senior nonproliferation officials from the G7 countries, which meets between the summits. The idea of the GP originally came out of that process, and it is conceivable that discussions in that context could contribute in a modest way to ongoing nuclear security dialogue. With Russia excluded, however, with the world's largest nuclear stockpile, the G7 will have even less coverage and less legitimacy for its nuclear security initiatives than it had as the G8.[166]

Interpol

Interpol, the international police agency, has a sub-directorate focused on nuclear, chemical, biological, and radioactive crime and terrorism. Its efforts primarily focus on stopping nuclear smuggling and responding to incidents, not on preventing theft of nuclear material in the first place. Interpol provides:[167]

- Information on incidents related to nuclear and radiological materials. This includes Project Geiger, which combines data from the IAEA, law enforcement agencies, and open sources; Operation Fail Safe, which collects information on people known or suspected of being involved in nuclear or radioactive smuggling; and the *CBRNE Monthly Digest*, which summarizes open-source reporting on incidents around the world involving these materials.

- Training, workshops, and exercises focused on stopping nuclear smuggling and responding to or investigating nuclear and radiological incidents.

165 See Nuclear Threat Initiative, "Global Partnership Against the Spread of Weapons and Materials of Mass Destruction."

166 In 2015, for example, the G7 affirmed "the need for a robust and comprehensive international security architecture"; supported the outcomes of the Nuclear Security Summits; and pledged to "draw" on the "momentum" from the summits to "achieve sustainability of results and ideas created, developed, and implemented" in the summit process. See "G7 Statement on Nonproliferation and Disarmament," G7 Summit, Germany, April 15, 2015, http://www.auswaertiges-amt.de/sid_18514F1CEBD77EB51BCA26992A2DCFF7/DE/Infoservice/Presse/Meldungen/2015/150415_G7_NPDG.html?nn=546272 (accessed February 10, 2016).

167 See Interpol, "CBRNE," http://www.interpol.int/fr/Crime-areas/Terrorism/CBRNE/Radiological-and-nuclear-terrorism, (accessed February 8, 2015).

In January 2016, Interpol hosted a global meeting on countering nuclear smuggling, as part of the lead-up to the 2016 Nuclear Security Summit.[168] There is a good deal Interpol can do to support law enforcement aspects of preventing nuclear smuggling and nuclear terrorism. So far, though, its effort in this area has been small, and virtually none of it is focused on security for nuclear weapons and materials. Given its law enforcement emphasis, it seems unlikely that Interpol will be a major part of the dialogue on security for such stocks after the summit process ends.

Bilateral Dialogues

Some of the most effective international discussions of nuclear security take place between two states. As already discussed, in the past the United States and Russia had extensive nuclear security cooperation, overseen by a joint steering committee. The United States has ongoing cooperation, including in-depth discussions of nuclear security issues, with states such as Pakistan and China, as well as with U.S. allies such as the United Kingdom and France. In recent years, the United States has also had ongoing nuclear security dialogues with Japan and South Korea.[169]

Other Proposals

As discussed in more detail below, other institutions could also play a role in sustaining an effective international nuclear security dialogue. These mechanisms have not yet been put in place, so assessment of what they have accomplished so far is not possible, but those that are defined in treaties or the subject of major public proposals are worth mentioning:

- *CPPNM review conferences.* The amendment to the CPPNM calls for a review conference to be held after the amendment enters into force; if a majority of parties want further review conferences, they can be held at five-year intervals thereafter.[170]

168 "INTERPOL nuclear trafficking conference looks ahead to 2016 Nuclear Summit," *Interpol Media Center*, January 29, 2016, http://www.interpol.int/fr/News-and-media/News/2016/N2016-015 (accessed February 10, 2016).

169 See "United States-Japan Nuclear Security Working Group" (The White House, Office of the Press Secretary, March 24, 2014), https://www.whitehouse.gov/the-press-office/2014/03/24/fact-sheet-united-states-japan-nuclear-security-working-group (accessed March 6, 2016) and "The United States-Republic of Korea Alliance: Shared Values, New Frontiers" (The White House, Office of the Press Secretary, October 16, 2015), https://www.whitehouse.gov/the-press-office/2015/10/16/joint-fact-sheet-united-states-republic-korea-alliance-shared-values-new (accessed March 6, 2016).

170 Jonathan Herbach and Samantha Pitts-Kiefer, "More Work to Do: A Pathway for Future Progress on Strengthening Nuclear Security," *Arms Control Today,* October 2015, https://www.armscontrol.org/ACT/2015_10/Features/More-Work-to-Do-A-Pathway-for-Future-Progress-on-Strengthening-Nuclear-Security (accessed February 11, 2016).

1. Commit to Stringent Nuclear Security Principles

The time has come to seek to build a common understanding that wherever nuclear weapons, HEU, or plutonium exist, certain key security and accounting elements are needed.[194] There should not be a "one size fits all" approach, as countries legitimately have somewhat different approaches to implementing and regulating nuclear security, and face different adversary threats to their nuclear stocks. A nuclear security system capable of reducing the risk of nuclear theft to a very low level in Canada might not be remotely adequate in Pakistan, where both outsider and insider threats are far more substantial. Hence, what is needed is a set of principles specific enough to be meaningful, but broad and flexible enough to permit each country to implement nuclear security in its own way.

Governments will not negotiate a treaty establishing stringent nuclear security principles in the near term. But it is quite possible that a group of like-minded states with substantial stocks of nuclear materials could work together to draft a political commitment to a set of principles that they were each willing to implement. They could invite all other states with plutonium and HEU on their soil to join them in the commitment, and offer help to those countries wishing to implement the principles but needing technical or financial help to do so. Such a commitment could potentially be worked out in experts' meetings of the permanent five members of the UN Security Council, within a new working group of GICNT, or in a grouping established for this purpose.

The initial participants in such a commitment will have to work out what the specific principles would be.[195] One approach would be to look to the goals in areas such as physical protection, material control, and material accounting that Russian and U.S. experts agreed to work toward in their technical cooperation.[196] We suggest that such an arrangement include commitments to:

194 We use the terms "key elements" and "principles" here, rather than "standards," as many countries interpret the word "standard" to mean that the implementation should be identical, as in a technical standard for high-definition television or something of that kind.

195 Such an initiative would be a substantial complement to the nuclear security implementation initiative announced at the 2014 Nuclear Security Summit, offering substantially stronger nuclear security commitments, and clearly extending to both military and civilian stocks.

196 William Tobey, Building a Better International Nuclear Security Standard (Cambridge, MA.: Project on Managing the Atom, Belfer Center for Science and International Affairs, Harvard Kennedy School, March 2012), http://uskoreainstitute.org/wp-content/uploads/2012/03/USKI_NSS2012_Tobey.pdf (accessed March 17, 2016). For other ideas on approaches to building stronger commitments on military stockpiles in particular, see Des Browne, Richard Lugar, and Sam Nunn, co-chairs, *Bridging the Military Nuclear Materials Gap* (Washington, D.C.: Nuclear Threat Initiative, November 2015), http://www.nti.org/media/pdfs/NTI_report_2015_e_version.pdf (accessed March 17, 2016); and Fissile Materials Working Group, *The Results We Need in 2016: Policy Recommendations for the Nuclear Security Summit* (Washington, D.C.: FMWG, June 2105), http://www.fmwg.org/FMWG_Results_We_Need_in_2016.pdf (accessed March 17, 2016).

- Require facility operators and transporters to protect nuclear weapons, HEU, and separated plutonium against the full range of plausible adversary capabilities and tactics—including, at a minimum, a modest group of well-armed and well-trained outsiders; a well-placed insider; and both outsiders and an insider working together.[197] Given the global reach that terrorists have demonstrated, it seems clear that such a baseline level of security is essential wherever nuclear weapons and their essential ingredients exist, even in the safest countries.
- Accept that national leaders have a responsibility they cannot delegate to others to ensure effective and continually improving security for all nuclear weapons or weapons-usable nuclear materials under their country's control.
- Provide on-site armed guard forces that are well equipped, well trained, professional, and have sufficient capabilities to defeat adversary threats.
- Put in place a comprehensive suite of measures to protect against insider threats.
- Implement material control and accounting systems adequate to detect and localize any theft of weapons-usable nuclear material.
- Ensure that protection against cyber threats is strong and fully integrated with other nuclear security measures.
- Require facility operators and transporters to institute programs to assess and improve security culture, and to exchange and learn from security best practices.
- Put in place effective nuclear security and accounting rules, and give regulators the authority, independence, expertise, and resources to ensure that operators implement them effectively.
- Carry out regular, realistic tests of the performance of nuclear security systems, including force-on-force exercises.
- Ensure that all facility operators and transporters have the resources and plans to sustain effective nuclear security and accounting for as long as they are handling these items and materials.
- Review each site where stocks of nuclear weapons or weapons-usable materials exist and remove these items from any site where the costs and risks of their presence outweigh the continuing benefits.

197 For a more detailed rationale for this suggestion, see Matthew Bunn and Evgeniy P. Maslin, "All Stocks of Weapons-Usable Nuclear Materials Worldwide Must be Protected Against Global Terrorist Threats," *Journal of Nuclear Materials Management*, Vol. 39, No. 2 (Winter 2011), pp. 21–27.

- Regularly host international nuclear security peer reviews, such as the IPPAS reviews led by the IAEA.
- Regularly review and update nuclear security requirements and approaches in the face of changing technology, accumulating experience, and the evolving threat.

Such a commitment would be, in effect, the strongest nuclear security "gift basket" yet—a joint commitment entered into by a substantial group of countries. Assuming that no such commitment emerges from the upcoming summit, it could be developed later, in forums for ongoing nuclear security discussion, discussed below.

Beyond these commitments focused on protecting nuclear weapons, HEU, and separated plutonium, the initiative (or parallel initiatives) could also include pledges to develop similar measures to protect nuclear power reactors and other major nuclear facilities from sabotage, and to provide effective security for radiological sources that might be used in a "dirty bomb." It could also include agreements to work together to stop nuclear smuggling and bring such smugglers to justice, along with expanded cooperation among law enforcement and intelligence agencies.

The participating states should agree to have experts and senior officials meet regularly, with the participation of the IAEA, to review progress in implementing these principles, and to discuss ways in which the initial principles should be modified or expanded, based on evolving threats, experiences with implementation, changing technology, and more. They should also agree to have experts work together to develop means to build confidence between states that these commitments are being fulfilled, without compromising secret information.

Finally, the participants should commit to work together to strengthen the nuclear security role of the IAEA and ensure that it has sufficient, predictable funds to implement its nuclear security activities.

Steps Along the Path

There are other sets of existing commitments that are quite important, though they do not include the stringent nuclear security principles just discussed. States interested in promoting stronger nuclear security around the world should use their diplomatic efforts to encourage more countries to:

- Ratify the 2005 amendment to the Convention on Physical Protection of Nuclear Materials (CPPNM) and the International Convention on the Suppression of Acts of Nuclear Terrorism (ICSANT).
- Participate in the nuclear security "implementation initiative" announced at the 2014 Nuclear Security Summit, in which states commit to meet the objectives of IAEA nuclear security recommendations and accept regular peer review of their nuclear security arrangements. Participation by key holders of substantial stocks who are not yet participating, such as Russia, China, Pakistan, and India, would be particularly important.
- Participate in other important nuclear security "gift baskets" developed in the nuclear security summit process.
- Provide funding, experts, and political support to strengthen the IAEA's nuclear security role.
- Participate in and support the best practice exchanges and other activities of WINS.

Some nuclear security experts have advocated expressing such commitments in a new treaty on nuclear security, arguing that such an agreement could provide an overarching framework for the many elements of global nuclear security governance and plug the holes in the existing nuclear security framework.[198] Unfortunately, it appears very unlikely that states would be able to reach agreement on a convention that really imposed stringent security requirements in the near term. The experience of the amendment to the CPPNM is instructive. The amendment was first proposed by the United States in 1998, and it took seven years to negotiate an agreed text. Even though most of those negotiations occurred after the 9/11 attacks, the negotiators firmly rejected including any requirements that states implement specific nuclear security measures, any verification provisions, or even requirements for national reporting on implementation. Even so, as of early 2016, 18 years after it was first proposed, the amendment had still not entered into force.

198 See, for example, Kenneth C. Brill and John H. Bernhard, "A Convention on Nuclear Security: A Needed Step Against Nuclear Terrorism," *Arms Control Today,* June 2015. For a proposed text of such a convention, with explanatory material, see John H. Bernhard, Kenneth C. Brill, Anita Nilsson, and Shin Chang-Hoon, *International Convention on Nuclear Security* (Washington, D.C.: Nuclear Security Governance Experts Group, March 2015), http://www.nsgeg.org/ICNSReport315.pdf (accessed March 15, 2016).

Military Stocks

At the same time, the United States, Russia, and other interested countries should expand cooperative efforts to consolidate military stocks of nuclear weapons, separated plutonium, and HEU. Russia and the United States, in particular, as the countries whose nuclear stockpiles are dispersed at the largest number of buildings and bunkers with nuclear weapons or weapons-usable material, should each develop a national-level plan for accomplishing their military and civilian nuclear objectives with the smallest practicable number of locations with nuclear weapons or weapons-usable material.[227]

Recommendations for the Next U.S. President

The next U.S. president should:

- Launch a comprehensive consolidation effort, covering bulk-processing facilities, civil HEU, civil plutonium, and military stocks, as described above.
- Make consolidation a major priority of the U.S. nuclear security program.
- Work with Congress to ensure that efforts to consolidate nuclear weapons and weapons-usable nuclear materials are not slowed by lack of funds.

5. Develop Approaches to Confirm That Effective Nuclear Security Is in Place

Insecure nuclear material anywhere is a threat to everyone, everywhere—and all countries have a national security interest in seeing that all countries with nuclear weapons or weapons-usable nuclear materials protect them effectively. Today, however, few mechanisms are in place to give countries confidence that such effective protection really is in place.

The United States and other interested states should establish an experts group to work out approaches to providing assurances that would build real confidence without unduly compromising sensitive information. For example, states could:

227 The United States has already gone much farther in consolidating its stocks than Russia, but may have more to do. In the 1990s, Russia's Ministry of Atomic Energy committed to developing a consolidation plan for civilian nuclear material, but this was never accomplished.

- Invite review of their nuclear security arrangements by international teams, whether led by the IAEA, by a state partner in technical cooperation, by a nuclear supplier, or by others. Actual visits to facilities, including discussions with the people there, can provide insights not available by another means. Review and advice from experts outside the group that designed and is implementing nuclear security systems can often be extremely helpful in finding areas for improvement. In particular, states should request IPPAS missions to review security for their civilian infrastructure.
- Publish at least general information about the kinds of threats operators are required to protect nuclear weapons, HEU, or separated plutonium against—for example, confirming that these threats include a group of well-armed and well-trained outsiders, an insider, and a broad range of possible tactics and approaches.
- Publish regulations (as many states do already), and expert analyses of what they mean.
- Publish detailed descriptions of how the state inspects and tests to ensure security is meeting requirements. This could be supplemented by allowing representatives from other countries to take part in or observe some of these inspections or tests.[228] Publish at least general information about how well its operators performed on these inspections and tests (for example, for years, DOE published the percentage of its sites that had been rated in the highest category in its security inspections, with fairly detailed descriptions of what items were included in these inspections).
- Publish detailed information about how weaknesses or problems were found and fixed, along with lessons learned and steps taken to ensure the weaknesses did not arise again.

If other countries knew that a country required operators to protect nuclear weapons, HEU, and separated plutonium against a robust range of potential adversary threats; understood the inspection and testing program used to confirm that operators were meeting these requirements; knew that a large fraction of the facilities had been shown in inspections to meet these standards; and understood that thorough and effective corrective actions were taken in response to any weaknesses identified, this could increase confidence in nuclear security substantially.

228 The United States, for example, has on several occasions allowed representatives from other countries to observe force-on-force exercises at U.S. facilities, and U.S. experts have observed nuclear security exercises in a number of other countries. In the 1990s, in some of the non-Russian states of the former Soviet Union, U.S. adversary teams carried out such tests at nuclear facilities. Technical cooperation programs sometimes include observers from another country taking part in nuclear security and accounting inspections.

There is also likely to be information that countries might be willing to exchange with one or a few other states, or with the IAEA, that they are not willing to make public. As discussed earlier, for example, states should work out ways to exchange information about the kinds of threats their nuclear security systems are designed to protect against, most of which should not be made public (to avoid giving information to adversaries about the kind of security measures they would have to defeat at nuclear sites).

There are a variety of particular forums where such information could be published or exchanged. If a group of countries joins in a nuclear security commitment such as that described earlier, for example, the participating countries (or subsets of them) could exchange such information amongst each other. Although the CPPNM and its 2005 amendment do not require national reporting of implementation steps, there would be nothing preventing a group of states from publishing detailed national reports (as states are obligated to do for the nuclear safety convention), and encouraging other states to do likewise. If a group of leading countries began providing such reports regularly, it could increase the pressure on others to do the same. Another approach would be for the IAEA to establish a Nuclear Security Register on its website for states to voluntarily register their achievements (along the lines of the Agency's Nuclear Safety Dashboard and the UN's Arms Trade Register).[229] Another possibility would be for states to include some of the information described above as part of their UNSCR 1540 reports. Whatever the particular forum, donor states and international organizations should be prepared to provide assistance in drafting these detailed reports to states with limited capacity. The IAEA or the WINS could provide guides that would suggest a common format and categories of information that might be included.

There may be a need for alternative measures for stocks that states judge to be particularly sensitive. In particular, it is unlikely that states will invite IAEA-led reviews of security for their nuclear weapons or military nuclear materials (and given the IAEA's civilian mandate, there is some doubt about whether it could realistically respond to such a request). States that have such stocks should work together to develop ways to provide assurance that they are protecting them effectively, including developing approaches to exchanging peer reviews of defense-oriented sites.

Operators need to build confidence with local communities and other stakeholders, just as they need to build confidence in safety. Nuclear operators should engage with a full spectrum of stakeholders to build confidence, address concerns, and gain ideas for strengthening their security programs. They should protect genuinely sensitive

229 Findlay, "Beyond Summitry."

information as needed, but share other information with key stakeholders to build confidence in the effectiveness of security implementation.

Recommendations for the Next U.S. President

The next U.S. president should:

- Establish a policy of the United States providing sufficient information about nuclear security to give other states a good understanding of the strengths of the U.S. nuclear security system, and the challenges still to be addressed.
- Request an IPPAS mission at a substantial U.S. nuclear facility (more substantial than the research reactor that the first U.S.-hosted IPPAS mission reviewed), such as the plutonium storage area at the Savannah River Site.
- Work with other countries to develop approaches to building confidence in states' nuclear security arrangements, as discussed above, and then work to get them broadly adopted.
- Work with countries holding U.S.-origin material to ensure that U.S. experts regularly visit all locations with U.S.-origin HEU or separated plutonium.[230] Continue an effective nuclear security dialogue after the summits end.

6. Continue an Effective Nuclear Security Dialogue After the Summits End

It is essential that nations come together and establish an effective ongoing dialogue on nuclear security after the summits come to an end. The end of the nuclear security summits will leave a serious gap, as there is no other forum at present to discuss next steps in nuclear security at the highest levels. Realistically, no forum can fully replace the three key things the nuclear security summits provided: attention from the highest levels of government; a decision-forcing schedule; and ongoing senior dialogue between meetings.

But a number of forums will continue to exist that may be able to fill parts of the gap, and the United States and other interested countries should work to ensure that they grow into

230 As the Government Accountability Office has noted, some 3.5 tons of U.S.-origin HEU, including 2.3 tons of material that has never been irradiated (the majority of the unirradiated U.S.-origin HEU) is located at sites U.S. teams have not visited in over 20 years. GAO, *DOE Made Progress,* p. 25.

truly effective forums for nuclear security decision-making. The 2016 summit is expected to lay out suggested "action plans" for five international organizations or coalitions: the IAEA; the UN and its UNSCR 1540 committee; GICNT; the GP; and Interpol. Each of these will clearly have their role to play, most prominently the IAEA. In each case, there is more to be done to strengthen the forum as a place where governments can come together for serious discussions and decisions. And there are other forums that may be able to contribute as well.

- *IAEA nuclear security meetings.* The IAEA's nuclear security meetings—planned every three years—are likely to be the most prominent regular international meeting focused on nuclear security. Countries should work together to turn these into working meetings intended to reach decisions on particular actions, as well as opportunities for technical exchange. A process similar to the Sherpas meeting between summits could be used to hash out initiatives to be agreed on—or announced by subgroups of states, as in the summit "gift basket" process—at the next IAEA meeting.[231] In addition, a subgroup of "friends of nuclear security" could meet to hash out recommendations more informally, which could then be acted on in the larger group. States interested in promoting new steps on nuclear security could use these meetings as occasions for announcing new steps they had taken—creating at least a part of the schedule-driving effect of the nuclear security summit process.

- *Physical protection convention reviews.* Once the amendment to the physical protection convention enters into force—which may finally occur in 2016—there will be a requirement to hold a review conference of the convention, and if a majority of parties wants them, such conferences could be held every five years. This would be another international forum focused specifically on nuclear security, with considerable political legitimacy. And such conferences, too, could be an occasion for announcing new nuclear security commitments.[232]

- *An expanded Global Initiative.* The participants in the GICNT could create an additional working group focused specifically on nuclear security. Remarkably, although security for nuclear materials is one of the Global Initiative principles, it has never been a major focus of the group. But that could change, especially if the summit participants, who are a majority of Global Initiative members, decided they needed

231 Findlay, "Beyond Summitry," p. 22. The United States has proposed that interested states work together to develop proposals to strengthen the IAEA's role and the international nuclear security framework. By allowing proposals to be discussed and developed in what would probably be a like-minded group of relatively modest size, this could increase the efficiency of concept development—and those ideas could then be addressed by the full IAEA membership.

232 Herbach and Pitts-Kiefer, "More Work to Do."

an ongoing forum to replace part of what the summits did. The Global Initiative is still co-chaired by the United States and Russia, and despite their tense relationship—and the breakdown of most U.S.-Russian nuclear security cooperation—both counties still take the Global Initiative seriously. Such a group would provide a working forum with flexible procedures that enable them to make decisions, which could focus on working out commitments to key nuclear security principles, exchanging best practices, working with states to help put particular security measures in place, and more. Plenary meetings of the Global Initiative often take place at the level known as Undersecretaries in the United States, roughly equivalent to deputy ministers in other countries—high enough to bring some political clout, but low enough to home in on specific action.

- *G7 and G20 summits.* Most of the world's weapons-usable nuclear material is in G7 countries, and the G7 has for many years included statements on nonproliferation, disarmament, and nuclear security at each summit—including the launch of the GP at the 2002 summit. The G7 summits could be an occasion for leaders to approve work done in an experts group, and to announce new initiatives and commitments.[233] The exclusion of Russia from the group, however, with its vast stocks of nuclear weapons and materials, would undermine the G7's promise as a forum for nuclear security progress. Nevertheless, the G7 summits could be another occasion for new commitments and announcements on nuclear security. Russia, China, India, and other important states are included in the G20, but to date the G20 has remained a forum focused almost exclusively on economic issues, rather than political and security issues.[234]

Recommendations for the Next U.S. President

The next U.S. president should:

- Work with other countries to ensure that an active, high-level dialogue on nuclear security, structured in a way that allows it to be effective in discussing and adopting

233 The G7 already makes an annual statement on nonproliferation, disarmament, and nuclear security, put together by the G7 Nonproliferation Directors. In 2015, this statement was issued well before the summit, in advance of the NPT Review Conference. See "G7 Statement on Nonproliferation and Disarmament." The G7 also has a Nuclear Safety and Security Group, but this group is not widely known or strongly influential, and in recent years it has focused primarily on safety. See, for example, "Report of the G7 Nuclear Safety and Security Group (NSSG) During the German Presidency in 2014/2015" (Schloss Elmau, Germany, June 7–8, 2015), http://www.g8.utoronto.ca/summit/2015elmau/2015-G7-nssg-report.pdf (accessed January 23, 2016).

234 See David Shorr, "A Bigger Table, A Broader Agenda," in John Kirton and Madeleine Koch, eds: *G8 & G20: The 2010 Canadian Summits* (Toronto: University of Toronto, 2010), http://www.g8.utoronto.ca/newsdesk/g8g20/g8g20-shorr.html (accessed March 6, 2016).

Preventing Nuclear Terrorism: Tools Beyond Nuclear Security

Preventing nuclear theft is the most important, but not the only, step that must be taken to reduce the risk of nuclear terrorism. Nuclear security will never be perfect, and there may well already be nuclear material that has been stolen and not recovered. A multifaceted international effort to reduce the risk of nuclear terrorism is essential.[i] Whatever other disagreements they may have, countries should be able to agree that terrorist groups must never be permitted to gain access to nuclear weapons or their essential ingredients.

Countries—and in particular the United States and Russia—should expand police and intelligence cooperation targeted on identifying and countering groups with nuclear aspirations and intercepting nuclear smuggling. The United States, in particular, should expand its intelligence collection and analysis focused on terrorist nuclear, chemical, and biological efforts to the kind of focused, well-resourced effort that existed in the years after the 9/11 attacks.

Countries should ensure that their legal systems impose significant penalties for participating in theft or smuggling of nuclear material or any assistance to nuclear terrorists—and that states have national police or intelligence units trained and equipped to deal with nuclear smuggling cases. States should establish a tip line and reward system to encourage people to blow the whistle on nuclear thieves or smugglers. (Such tips have led to some of the most important past seizures of plutonium and HEU.)

While it is extremely unlikely that states would intentionally transfer nuclear weapons or materials to terrorists, the United States and its international partners should attempt to reduce the likelihood of such an act even further by creating international packages of incentives and disincentives with enough impact and credibility to convince North Korea, in particular, that it should cap its nuclear program and that the consequences of ever transferring nuclear material or technology to non-state actors would be severe.

Much of this work is already happening, though there is more to be done. The killing of Osama Bin Laden and other members of the leadership of "core" al Qaeda has reduced the risk that al Qaeda would again attempt a nuclear bomb program. At the same time, as discussed earlier in this report, despite an international coalition attacking the IS, the group still has worrisome resources and capabilities should it ever turn seriously to seeking nuclear weapons. As noted elsewhere in this report, other terrorist groups have pursued nuclear weapons in the past and

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i For a list of the steps along a terrorist pathway to the bomb, and recommendations for the steps beyond improved nuclear security, see Mathew Bunn, *Securing the Bomb 2010*, pp. 8, 106–109. For a useful effort to think through a systems approach to reducing the risk, see Michael Levi, *On Nuclear Terrorism* (Cambridge, MA: Harvard University Press, 2009). For a joint U.S.-Russian description of next steps that should be taken, see Matthew Bunn *et al*, *Steps to Prevent Nuclear Terrorism: Recommendations Based on the U.S.-Russia Joint Threat Assessment.*

may do so in the future. Focused efforts to scan for signs of nuclear, chemical, or biological ambitions and activities—and to take action when such signs are found—are needed.

Many countries are also strengthening their ability to deter and interdict nuclear smuggling. Following up on UNSCR 1540, countries have put in place stronger criminal laws imposing severe penalties for crimes related to nuclear theft, smuggling, and terrorism. National nuclear forensics programs—designed to contribute to identifying the source of nuclear material—have also been strengthened, though there is a great deal still to be done. Many countries have installed radiation detectors at key ports, airports, and border crossings, often with U.S. help and financing.

Unfortunately, however, the vast length of national borders, the immense legitimate traffic across them, the pervasive smuggling of many other types of contraband that exists worldwide, the corruption of some border officials, and the difficulty of detecting nuclear bomb material make intercepting nuclear smuggling an enormous challenge. Uranium and plutonium, while radioactive, are not radioactive enough to be difficult to carry or easy to detect. Most of the detectors that have been installed around the world would have a good chance of detecting plutonium or gamma-emitting radiological sources, but would not be likely to detect well-shielded HEU.

Moreover, the news on interdicting nuclear smuggling has not all been positive. Genuine cooperation among intelligence agencies of different countries—particularly between Russia and the United States—on the nuclear smuggling threat remains scarce. Some very important borders—such as those of Afghanistan and Pakistan—are effectively impossible to control in current circumstances. Russia and the United States worked together to complete the installation of radiation detectors at all of Russia's official border crossings, but Russia's customs union with Kazakhstan and Belarus made many of those border crossings effectively irrelevant. That pushes the real border out to the edges of Kazakhstan and Belarus, and not all of their border crossings yet have radiation detectors. The freeze in US-Russian relations makes it more difficult to address these gaps.

Radiation detection is only one of many tools for reducing the risk of nuclear terrorism, and not the most effective one—but at sites where there is good reason to believe nuclear smuggling is a real risk and the geography suggests it would be difficult for smugglers to go around the official border crossing, it makes sense to install effective radiation detection. At areas with broad border areas through which smugglers might pass, or within countries, mobile detectors may be more effective. Such radiation detection programs should always be designed for sustainability—and must also address the corruption so often found in border control agencies. Ultimately, radiation detection should be only one part of a broader effort to counter nuclear smuggling that includes targeted police and intelligence efforts, nuclear forensics, and a strong component of international cooperation.

next steps to strengthen nuclear security, continues after the summit process comes to an end.

Making Nuclear Security a Priority

Together, these steps could help the international community get onto the upward nuclear security path envisioned earlier in this report, building a commitment to continuous improvement in the never-ending search for nuclear security excellence. To achieve that goal, the next U.S. president and the leaders of other interested states will have to continue to make nuclear security a priority, ensuring that their governments are continuing to find and fix weaknesses and overcoming obstacles to progress.

In particular, the next U.S. president should make clear that effective security for nuclear weapons and weapons-usable materials remains a top priority of the U.S. government, and take steps to back that rhetoric with action. Such steps should include:

- Designating a senior director on the National Security Council staff to lead efforts to strengthen nuclear security and prevent nuclear terrorism.
- Developing a clear strategic plan for nuclear security for the entire presidential term, integrating the actions of all relevant departments in a whole-of-government approach.
- Putting nuclear security high on the diplomatic agenda, as an item to be raised with every relevant country, at every level, whenever it would contribute to progress toward the nuclear security goal.
- Working with Congress to ensure that no effort that could significantly reduce the danger of nuclear terrorism is slowed by lack of funds.