
THE INCENTIVE GAP: REASSESSING U.S. POLICIES TO SECURE NUCLEAR ARSENALS WORLDWIDE

Nuclear terrorism is one of the gravest security threats facing our nation. The detonation of a single, rudimentary nuclear bomb in Times Square would kill nearly half a million people instantly, destroy the heart of New York City, cripple our economy, and paralyze critical rescue operations and other government functions.¹ But could this nightmare scenario ever become a reality? Are terrorists seriously considering a nuclear attack on the United States? Do they have the sophistication and technical knowledge necessary to carry out such an attack?

The short answer, unfortunately, is yes. A survey of available intelligence reveals numerous incidents confirming al Qaeda's nuclear ambitions: in 1993, the group tried to purchase highly enriched uranium (HEU) from a Sudanese group for one and a half million dollars;² in 2001, Osama bin Laden met with senior Pakistani nuclear scientists,³ and U.S. troops later found bomb designs and other documents at an al Qaeda safe house in Afghanistan.⁴ Worse yet, the technical barriers preventing al Qaeda from realizing these ambitions are not as steep as many would like to believe. If al Qaeda managed to acquire weapons-grade plutonium or HEU, some experts predict that it could build a bomb on U.S. soil in about nine months, with a team of nineteen people, at a cost of two million dollars.⁵ Given these sobering facts, the continued security of the United States depends critically on our ability to prevent terrorists from acquiring the nuclear materials — weapons-grade plutonium, HEU, or a completed nuclear weapon itself — that they need to launch a nuclear attack.

This Note considers the questions facing policymakers charged with designing a strategy to secure nuclear weapons and material worldwide from theft and use by terrorists. What is our current strategy for minimizing state behaviors that heighten the risk of nuclear terrorism, and how has it performed? Is there an alternative approach that might better serve American national interests? What incentives are necessary to ensure that states attach sufficient priority to protecting their nuclear weapons and materials?

¹ See GRAHAM ALLISON, *NUCLEAR TERRORISM: THE ULTIMATE PREVENTABLE CATASTROPHE 4* (Owl Books 2005) (2004).

² Peter D. Zimmerman & Jeffrey G. Lewis, *The Bomb in the Backyard*, *FOREIGN POL'Y*, Nov.-Dec. 2006, at 32, 33; see also ALLISON, *supra* note 1, at 26–27.

³ ALLISON, *supra* note 1, at 20.

⁴ Zimmerman & Lewis, *supra* note 2, at 33.

⁵ See *id.* at 38.

In tackling these questions, this Note proceeds in five parts. Part I outlines current U.S. policy for preventing state behaviors that could facilitate nuclear terrorism, suggesting that whereas the United States has relied on the threat of retaliation to deter states from collaborating intentionally with terrorists, its approach to combating negligent security practices relies on the weaker combination of financial subsidies and international legal obligations. Part II assesses the results of this policy, concluding that it has failed to produce adequate levels of fissile material security, leaving thousands of nuclear weapons and large supplies of weapons-grade material vulnerable to acquisition by terrorists. Part III explores the reasons for this lack of progress, arguing that the current policy lacks the incentive structure necessary to convince Russia and other nuclear powers to raise the priority given to nuclear security. Part IV considers a range of potential options for creating stronger incentives for states to secure their nuclear stockpiles, suggesting that the United States should combine a new multilateral alliance committed to stringent nuclear security with a series of unilateral incentives compelling states to participate. Part V concludes.

I. CURRENT U.S. POLICY ON NUCLEAR MATERIAL SECURITY

A. *The Essential Role of States in the Nuclear Terrorism Process*

In order for terrorists to launch a nuclear attack on the United States, they must first acquire a completed nuclear weapon or the fissile material necessary to build a bomb from scratch. Both of these options require some state involvement, whether intentional or unwitting. With respect to completed nuclear weapons, nine countries currently control the entire global arsenal: the United States, Russia, China, Britain, France, Israel, India, Pakistan, and North Korea.⁶ In order to obtain one of these weapons, terrorists would have to steal it from state storage facilities or convince a state government to transfer or sell it to them voluntarily. A similar dynamic applies for terrorist groups seeking to build a bomb from scratch. Nuclear bombs require either HEU or plutonium, neither of which occurs naturally.⁷ There is widespread consensus among experts that even the best funded and most technically advanced terrorists will not be able to produce HEU or plutonium without state assistance. Both the uranium enrichment and plutonium paths to nuclearization require complicated and costly

⁶ See MATTHEW BUNN, SECURING THE BOMB 2007, at 8 (2007).

⁷ MICHAEL LEVI, ON NUCLEAR TERRORISM 15 (2007). Although uranium can be mined from the ground, it must be “processed extensively — enriched — before it can be used in a bomb.” *Id.* Plutonium “must be produced in a nuclear reactor” because it occurs in only “miniscule quantities” naturally. *Id.*

facilities, sophisticated technologies, “a sizable and scientifically knowledgeable labor force, significant industrial resources, and time,” making it “virtually impossible for terrorists to create their own nuclear material, regardless of which ingredient they use.”⁸ Even if weapons expertise becomes widely available and costs fall due to technological advances, terrorists will still need physical space to build reactors and reprocessing facilities, meaning that a state must either fail to notice or acquiesce to its land being used for these illicit activities.

Although the nature of a state’s role in nuclear terrorism could vary considerably in terms of level of intent and extent of culpability,⁹ this Note will classify state involvement as falling into one of two broad categories: intentional collaboration or negligent security. In the case of intentional collaboration, states would actively assist terrorists in obtaining nuclear weapons. This assistance would likely come in the form of deliberately transferring a completed nuclear weapon or the fissile material necessary to build one to a terrorist group. In the case of negligent security, terrorists would acquire a nuclear bomb or material from a state without the consent of its government. Terrorists might launch a direct attack to infiltrate a nuclear facility and steal weapons and material, or they might simply purchase the material from an insider acting without the authorization of his or her government. In this scenario, though states have no active intent to facilitate nuclear terrorism, their failure to adequately secure all nuclear materials allows terrorists to overcome the most difficult hurdle to a nuclear attack: acquiring fissile material.

B. The Current U.S. Approach to Nuclear Terrorism

The distinction between intentional collaboration and negligent security outlined above is critical because the United States has adopted divergent policies for preventing these different types of state involvement in nuclear terrorism. In the case of intentional collaboration, recent statements by the Bush Administration signal that the United States will rely on a punishment-based deterrence model, threatening massive retaliation against any state that willfully transfers nuclear

⁸ Caitlin Talmadge, *Deterring a Nuclear 9/11*, WASH. Q., Spring 2007, at 24; see also LEVI, *supra* note 7, at 15 (“Both [uranium enrichment and plutonium development] capabilities are widely agreed to be beyond the reach of even the most sophisticated terrorists.”).

⁹ Talmadge outlines the following examples of state behavior that might facilitate nuclear terrorism: 1) a direct and deliberate transfer of weapons or weapons-grade material to terrorists; 2) failure to stop or punish members of the military or scientific communities who sell material or weapons to terrorists; 3) failure to take adequate precautions to secure facilities storing weapons or fissile material; 4) failure to alert the international community to suspected thefts of material or weapons; and 5) failure to stop terrorist activities occurring on state territory despite indications that nuclear weapons might be involved. See Talmadge, *supra* note 8, at 24.

weapons to terrorists. Under this “new approach[] to deterrence”¹⁰ outlined in the 2006 National Security Strategy, the United States will consider states that harbor and assist terrorists “equally guilty of murder” as the terrorists themselves hold them to account.¹¹ Addressing the threat of nuclear terrorism more specifically, President Bush responded to the October 9, 2006 North Korean nuclear test by declaring that “[t]he transfer of nuclear weapons or material by North Korea to states or non-state entities would be considered a grave threat to the United States, and we would hold North Korea *fully accountable* of [sic] the consequences of such action.”¹² Such rhetoric strongly suggests that any state that deliberately provides terrorists with the means of launching a nuclear attack against the United States would risk devastating retaliation. The deterrence logic is simple: the United States can convince states that transferring a nuclear weapon to terrorists would be suicide by threatening to respond to such behavior as if the state itself had launched an attack.

In the case of negligent security, however, the United States has not articulated what penalties (if any) it would impose on states if their failure to secure nuclear facilities allowed terrorists to obtain nuclear weapons.¹³ In contrast to the punishment-based deterrence model used for intentional collaboration, the United States has thus far relied

¹⁰ WHITE HOUSE, THE NATIONAL SECURITY STRATEGY OF THE UNITED STATES OF AMERICA 22 (2006), available at <http://www.whitehouse.gov/nsc/nss/2006/nss2006.pdf>.

¹¹ *Id.* at 12.

¹² President George W. Bush, Statement on the North Korea Nuclear Test (Oct. 9, 2006) (emphasis added) (transcript available at <http://www.whitehouse.gov/news/releases/2006/10/20061009.html>). However, it is important to note that, while the United States has implied that it would retaliate against a state that willfully transferred nuclear weapons to terrorist groups, it has not yet articulated a formal doctrine for doing so.

¹³ Today, there are more than two hundred separate sites throughout the world from which terrorists could obtain a nuclear weapon or the fissile material required to build one. ALLISON, *supra* note 1, at 67. According to nuclear expert Matthew Bunn, weapons depots in Russia and Pakistan and the many HEU-fueled research reactors throughout the world are the most likely sources for terrorists seeking to obtain nuclear weapons or material. See Matthew Bunn, *Preventing a Nuclear 9/11*, ISSUES IN SCI. & TECH., Winter 2005, at 56. Russia today houses the world’s largest stockpile of nuclear weapons and weapons-grade material, including massive quantities of completed weapons, “dispersed in hundreds of buildings and bunkers at scores of sites.” *Id.* Although Pakistan’s arsenal of roughly fifty nuclear weapons and the HEU capacity for fifty more is far smaller than the Russian arsenal, it too poses a major threat due to the country’s history of proliferating sensitive technology and nuclear secrets through the A.Q. Khan black market network, the presence of an increasingly active cadre of Islamic extremists within its military and intelligence services, and an unpopular ruling regime at risk of being replaced by a radical Islamist government. ALLISON, *supra* note 1, at 74–78. Finally, there are roughly 135 research reactors fueled with HEU in more than forty countries, and a 2004 Department of Energy study concluded that 128 of these facilities have more than twenty kilograms of weapons-grade material. MATTHEW BUNN & ANTHONY WIER, SECURING THE BOMB 2006, at 19–20 (2006). Many of these research reactors have no more protection than a night watchman and chain link fence. *Id.* at vi, 20.

on financial incentives and multilateral instruments to address the threat posed by inadequately secured nuclear weapons and material. Specifically, the United States has sought to encourage vigilance by offering financial assistance for nuclear security improvements and by attempting to create multilateral legal obligations for states to secure nuclear weapons and materials adequately.

The original cornerstone of this policy was the Nunn-Lugar Cooperative Threat Reduction (Nunn-Lugar) program, launched after the collapse of the Soviet Union in 1991. Fearing that this collapse would leave the extensive Soviet nuclear arsenal vulnerable to unauthorized use, theft, or sale, Senators Sam Nunn and Richard Lugar called for the United States to provide financial assistance to secure Soviet nuclear weapons.¹⁴ The two lawmakers spearheaded the passage of the Soviet Nuclear Threat Reduction Act of 1991,¹⁵ which authorized the use of four-hundred million dollars to assist the Soviet Union and its “successor entities” with efforts to “(1) destroy nuclear weapons, chemical weapons, and other weapons, (2) transport, store, disable, and safeguard weapons in connection with their destruction, and (3) establish verifiable safeguards against the proliferation of such weapons.”¹⁶

The Nunn-Lugar program initially focused on ensuring secure storage, transport, and dismantlement of actual weapons, funding the removal and return to Russia of 22,000 tactical nuclear weapons from fourteen newly independent Soviet states, as well as the deactivation and return of strategic nuclear arsenals left in Ukraine, Kazakhstan, and Belarus.¹⁷ But with the support of the Clinton Administration and continued backing from Congress, the scope of the program quickly expanded to include a variety of other efforts to secure nuclear weapons, safeguard the material needed to build such weapons, and prevent the dispersion of the scientific expertise required for designing and producing them.¹⁸ Accordingly, the United States now provides financial assistance for a wide range of activities, including the following: 1) measures to prevent unauthorized access to nuclear facilities, including the installation of “hardened doors and windows, locks and keys to control access, [and] perimeter fences”;¹⁹ 2) efforts to stop insider theft, including the deployment of “monitoring and detection systems,” central alarms, electronic access controls[,]” and other meas-

¹⁴ AMY F. WOOLF, CONGRESSIONAL RESEARCH SERV., NONPROLIFERATION AND THREAT REDUCTION ASSISTANCE: U.S. PROGRAMS IN THE FORMER SOVIET UNION 3–4 (2008).

¹⁵ 22 U.S.C. § 2551 note (2000).

¹⁶ *Id.* note § 212(b).

¹⁷ ALLISON, *supra* note 1, at 144–45.

¹⁸ WOOLF, *supra* note 14, at 6.

¹⁹ *Id.* at 32.

ures;²⁰ 3) provision of employment opportunities, research grants, and other funding to former Soviet nuclear scientists;²¹ and 4) border security measures that enhance states' abilities to interdict nuclear smuggling.²² With this expansion of activities, annual funding for nonproliferation and threat reduction programs has increased from four hundred million dollars within one agency (the Department of Defense) to over one billion dollars across three agencies (the Departments of Defense, State, and Energy).²³ In total, the United States has appropriated nearly ten billion dollars for these programs since fiscal year 1992.²⁴

In addition to financial assistance under Nunn-Lugar, the United States has tried to improve fissile material security through multilateral instruments that obligate states to provide adequate security for their nuclear stockpiles. Unfortunately, the Nonproliferation Treaty²⁵ (NPT), which has long been the foundation of the global nonproliferation regime, does not provide robust fissile material security obligations. Although the NPT has played an important role in efforts to prevent the spread of nuclear weapons, its direct impact on the nuclear terrorism threat has been limited because its prohibition on the transfer of nuclear weapons and materials applies only to transfers among "States" and does not address nonstate actors.²⁶ In addition, the NPT does not impose any obligations on nuclear weapons states to provide adequate levels of security at facilities that store nuclear weapons or material.²⁷

As a result, the United States has looked outside the NPT to find international law obligations for fissile material security. One potential source is the Convention on the Physical Protection of Nuclear Material²⁸ (CPPNM), which obligates states to provide adequate levels of protection to nuclear material during "international nuclear transport."²⁹ In 2005, a review conference proposed amendments to the Convention that would expand legal obligations beyond transport and require states to provide adequate security for nuclear facilities and

²⁰ *Id.* Additional measures include the relocation of guard forces and consolidation of materials. *Id.*

²¹ *See id.* at 26, 29.

²² *Id.* at 28.

²³ *Id.* "Summary."

²⁴ *Id.* at 1.

²⁵ July 1, 1968, 21 U.S.T. 483, 729 U.N.T.S. 161.

²⁶ *Id.* art. 1.

²⁷ *Id.*

²⁸ Mar. 3, 1980, T.I.A.S. No. 11,080, 1456 U.N.T.S. 124 [hereinafter CPPNM].

²⁹ *Id.* art. 2.

material in peaceful domestic use or storage.³⁰ However, those amendments will not go into effect until two thirds of the state parties to the Convention consent.³¹ More recently, in 2005, the United Nations General Assembly adopted the International Convention for the Suppression of Acts of Nuclear Terrorism.³² This Convention includes a provision requiring states to “make every effort to adopt appropriate measures to ensure the protection of radioactive material, taking into account relevant recommendations and functions of the International Atomic Energy Agency.”³³ With twenty-two state parties and 107 signatories, the treaty went into force on July 7, 2007.³⁴

Perhaps the most important source of international nuclear security obligations is U.N. Security Council Resolution 1540³⁵ (UNSC 1540). Sponsored by the United States and adopted unanimously by the Security Council, UNSC 1540 legally binds “all States”³⁶ to refrain from supporting efforts by nonstate actors to acquire, transfer, or use weapons of mass destruction (WMD), to adopt “appropriate effective”³⁷ laws that prohibit nonstate actors from seeking and using WMD, and to “establish domestic controls to prevent the proliferation” of WMD.³⁸ As part of this third requirement, the Resolution commands states to “establish[] appropriate controls over [WMD-]related materials,”³⁹ meaning that states must “[d]evelop and maintain appropriate effective measures to account for and secure such items in production, use, storage or transport”⁴⁰ and implement “appropriate effective physical protection measures.”⁴¹

This resolution has the potential to have a greater impact than previous multilateral agreements for two reasons. First, unlike the other conventions on physical material protection, UNSC 1540 provides an explicit mechanism for monitoring implementation. It establishes a Committee of the Security Council charged with examining implemen-

³⁰ See Int’l Atomic Energy Agency, *Amendment to the Convention on the Physical Protection of Nuclear Material*, attachment at 5, IAEA Doc. Gov/INF/2005/10-G(49)/INF/6 (Sept. 6, 2005) [hereinafter CPPNM Amendment].

³¹ *Id.* at 2.

³² G.A. Res. 59/290, U.N. Doc. A/RES/59/290 (Apr. 13, 2005) [hereinafter ICSANT].

³³ *Id.* art. 8.

³⁴ INVENTORY OF INT’L NONPROLIFERATION ORGS. AND REGIMES, CTR. FOR NON-PROLIFERATION STUDIES, INTERNATIONAL CONVENTION FOR THE SUPPRESSION OF NUCLEAR TERRORISM 1 (2006), available at <http://cns.miis.edu/pubs/inven/pdfs/nucterr.pdf>.

³⁵ S.C. Res. 1540, U.N. Doc. S/RES/1540 (Apr. 28, 2004) [hereinafter UNSC 1540].

³⁶ *Id.* para. 5. This broad language is important because it presumably includes states that are not parties to the NPT.

³⁷ *Id.* ¶ 2.

³⁸ *Id.* ¶ 3.

³⁹ *Id.*

⁴⁰ *Id.* ¶ 3(a).

⁴¹ *Id.* ¶ 3(b).

tation progress and creates a reporting requirement that all States provide the Committee with a summary of the “steps they have taken or intend to take to implement [the] resolution.”⁴² Second, because the Security Council passed the Resolution under its Chapter VII authority, it can theoretically respond to violations with a wide range of military and nonmilitary actions⁴³ to “restore international peace and security.”⁴⁴ This distinguishes UNSC 1540 from the multilateral instruments discussed above, which create legal obligations without explicitly providing for any enforcement mechanisms.

II. RESULTS OF THE CURRENT POLICY

The U.S. policy of encouraging security improvements through financial incentives and international law obligations has achieved some important successes in reducing the risk of nuclear terrorism. In their comprehensive account of global nuclear security, Matthew Bunn and Anthony Wier conclude that nuclear security in Russia has “improved substantially over the last dozen years” due in large part to cooperation between Russia and the United States.⁴⁵ They assert that the most egregious security breaches of the 1990s have largely been rectified:

It is unlikely that there are any remaining facilities in Russia that are not adequately protected against the minimal theft threats that succeeded in the mid-1990s — a single outsider walking through a gaping hole in a fence, snapping a padlock on a shed, stealing HEU, and retracing his steps without being noticed for hours, or a single insider with no particular plan repeatedly removing small amounts of HEU and walking out without detection.⁴⁶

Despite these successes, however, Bunn and Wier conclude that there is “far too much bad news” regarding Russian nuclear security and that “significant threats of nuclear theft remain.”⁴⁷ In 2004, Professor Graham Allison wrote that even after thirteen years of U.S. efforts to secure fissile material in Russia, “the job of securing Russia’s nuclear weapons and material remain[ed] only half done, leaving 44,000 potential nuclear weapons’ worth of HEU and plutonium vul-

⁴² *Id.* § 4.

⁴³ U.N. Charter arts. 41–42. Nonmilitary actions include “complete or partial interruption of economic relations and of rail, sea, air, postal, telegraphic, radio, and other means of communication, and the severance of diplomatic relations.” *Id.* art. 41. Military actions include “demonstrations, blockade, and other operations by air, sea, or land forces of Members of the United Nations.” *Id.* art. 42.

⁴⁴ *Id.* art. 39.

⁴⁵ BUNN & WIER, *supra* note 13, at 12–13.

⁴⁶ *Id.* at 13.

⁴⁷ *Id.* at v.

nerable to theft.”⁴⁸ More recent data show that effective security upgrades have been completed on only 55% of former Soviet buildings holding nuclear material, 50% of sites containing warheads, and 20% of global HEU research reactors.⁴⁹ Also worrisome is the fact that 65% of former Soviet nuclear scientists and workers lack sustainable civilian jobs.⁵⁰ Even in facilities that have installed security upgrades, theft remains a major concern because criminals and terrorists in Russia can pose far greater threats than the modest groups of armed forces these upgraded facilities are equipped to handle.⁵¹ Moreover, the ability of the upgrades to provide adequate security depends largely on the quality of the personnel on the ground at these facilities. The effectiveness of security guards around Russian facilities leaves much to be desired, due in part to low wages, weak morale, poor conditions, and brutal hazing incidents.⁵² Stories abound of guards patrolling without ammunition in their guns and propping access doors open for convenience.⁵³ In one almost comical 2005 incident, guards allowed a civilian dressed in combat fatigues using a forged identification card bearing the name and picture of a major Chechen terrorist leader to pass through three guarded checkpoints and gain access to a large nuclear complex.⁵⁴

If the continued insecurity of Russian nuclear weapons and materials is the “bad news,” the state of fissile material security in the rest of the world may be even worse. Despite the existence of more than a thousand nuclear weapons outside Russia and the United States, and hundreds of buildings with separated plutonium and HEU stocks scattered across forty countries, there are no binding global security standards, and many of these stockpiles remain vulnerable to terrorists.⁵⁵ U.S. attempts to cooperate with other nuclear powers on security have been limited at best: only one Chinese civilian facility with HEU had been upgraded by the end of fiscal year 2005; no upgrades of Indian facilities have been accomplished despite the recent civil nuclear cooperation deal; and, to public knowledge, the United States and Israel do not work together on nuclear security.⁵⁶ Although nuclear security cooperation with Pakistan appears to be underway, the Pakistani government refuses to allow the United States access to sensitive facili-

⁴⁸ ALLISON, *supra* note 1, at 147.

⁴⁹ BUNN, *supra* note 6, at 93 fig.2.4.

⁵⁰ See BUNN & WIER, *supra* note 13, at vii.

⁵¹ *Id.* at 16.

⁵² See *id.* at 11.

⁵³ *Id.* at 15.

⁵⁴ *Id.* at 11–12.

⁵⁵ *Id.* at 19.

⁵⁶ *Id.* at 21. For more details on the nuclear cooperation deal between the United States and India, see Recent Legislation, 120 HARV. L. REV. 2020 (2007).

ties.⁵⁷ Based on the current state of relations between the United States and North Korea, collaboration on nuclear security anytime soon seems unlikely.⁵⁸ As for civilian nuclear establishments, only 30% of HEU reactor sites outside the former Soviet Union and the United States have removed the HEU or installed security upgrades.⁵⁹ Given that these facilities store roughly thirty metric tons of HEU (enough for hundreds of bombs) in typically minimum-security environments, they can be attractive targets for terrorists or criminals.⁶⁰

In sum, despite the limited successes achieved by the current policy, the overall rate of progress is insufficient to contain the potential terrorist threat posed by loose nuclear weapons and fissile material. As the recent "Report Card" on U.S. nonproliferation programs issued by an official Department of Energy task force concluded, "the existing scope, pace, and operation of the programs leave an unacceptable risk of failure and the potential for catastrophic consequences."⁶¹

III. DRIVERS OF THE CURRENT LACK OF PROGRESS

Developing strategies to improve the dire situation outlined above requires understanding the causes of the current insufficient progress in improving nuclear security. Although it might be tempting to attribute these problems solely to an overall lack of funding, the most astute analysts in the field have rejected this approach. Bunn and Wier have argued that although some additional funding increases and a more efficient allocation of resources across different priorities would be beneficial, "[m]ost programs to secure, monitor, and reduce nuclear stockpiles around the world are currently more cooperation-constrained than funding-constrained, more in need of high-level leadership to overcome the obstacles than of larger checks."⁶² Indeed, the "single most essential ingredient of success" in securing fissile material will be "convincing political leaders and nuclear managers around the world that . . . improvements in nuclear security are critical to their own national security and deserving of their own resources."⁶³ Until this change occurs, leaders will not devote sufficient resources, impose costly security measures, endure the political risks of nuclear cooperation with potential adversaries, or take other necessary steps to ensure

⁵⁷ See BUNN, *supra* note 6, at viii.

⁵⁸ *Id.* at 39.

⁵⁹ BUNN & WIER, *supra* note 13, at 103 fig.3-8.

⁶⁰ See *id.* at 19.

⁶¹ RUSSIA TASK FORCE, SEC'Y OF ENERGY ADVISORY BD., U.S. DEP'T OF ENERGY, A REPORT CARD ON THE DEPARTMENT OF ENERGY'S NONPROLIFERATION PROGRAMS WITH RUSSIA, at iii (2001), available at <http://www.seab.energy.gov/publications/rusrpt.pdf>.

⁶² BUNN & WIER, *supra* note 13, at 105-06.

⁶³ *Id.* at 137.

the security of their nuclear arsenals.⁶⁴ Unfortunately, as this Part demonstrates, neither component of the current policy combining financial assistance programs and multilateral legal instruments is likely to inculcate sufficient levels of urgency in other countries for dealing with the nuclear terrorism threat.

*A. Financial Assistance Programs Unlikely
To Alter States' Cost-Benefit Calculus*

Although U.S. support and financial assistance has materially improved the physical protection of nuclear weapons and material in Russia, the overall level of nuclear security remains inadequate.⁶⁵ A principal driver of these problems seems to be the inability of financial assistance alone to convince Russia to elevate nuclear security over competing priorities. One prime example of this issue is Russia's refusal to grant the United States access to certain nuclear sites, making it difficult to install new security upgrades or verify that existing ones are being maintained.⁶⁶ In this case, the Russian military establishment has legitimate concerns about the national security risks associated with granting its former Cold War rival access to sensitive weapons facilities. In turn, the Russian government has allowed these objections to trump the critical need for security at two sites believed to hold hundreds of metric tons of weapons-grade material.⁶⁷ Despite the fact that the United States offered "numerous alternative access proposals" such as "remote video monitoring" and even granted Russian officials access to "some of the most sensitive sites in the U.S. nuclear weapons complex" to allay Moscow's national security concerns, Russia not only refused to grant access, but also rejected American offers of assistance without access.⁶⁸

Russia's failure to provide sufficient funding for key threat reduction initiatives also reflects an unwillingness to prioritize nuclear security. In May 2005, the head of the main physical protection firm used by the Russian atomic energy agency estimated that Russia meets only

⁶⁴ *Id.*

⁶⁵ Despite substantial U.S. financial assistance, forty-five percent of Russian nuclear facilities still lack comprehensive security upgrades. See BUNN, *supra* note 6, at 66. Moreover, substantial concerns remain regarding the sustainability of security equipment in buildings where upgrades have already been installed. See U.S. GOV'T ACCOUNTABILITY OFFICE, NUCLEAR NON-PROLIFERATION: PROGRESS MADE IN IMPROVING SECURITY AT RUSSIAN NUCLEAR SITES, BUT THE LONG-TERM SUSTAINABILITY OF U.S.-FUNDED SECURITY UPGRADES IS UNCERTAIN 8-9 (2007) [hereinafter GAO REPORT 2007].

⁶⁶ For more background on these access problems, see U.S. GEN. ACCOUNTING OFFICE, WEAPONS OF MASS DESTRUCTION: ADDITIONAL RUSSIAN COOPERATION NEEDED TO FACILITATE U.S. EFFORTS TO IMPROVE SECURITY AT RUSSIAN SITES 4 (2003). See also GAO REPORT 2007, *supra* note 65, at 8-9, 15-16.

⁶⁷ GAO REPORT 2007, *supra* note 65, at 15-16.

⁶⁸ *Id.* at 15.

thirty percent of its nuclear security funding needs.⁶⁹ According to officials at two Russian sites, if funding levels do not increase after U.S. assistance ceases, the expensive security upgrades funded by the United States will last for only five years due to inadequate maintenance.⁷⁰ Although it might be tempting to assume that Russia simply cannot afford to spend more, the lack of Russian spending cannot be traced to any real state economic difficulties. On the contrary, the recent boom in international oil prices has left the country “flush with revenues” and capable of funding security upgrades on its own.⁷¹ Instead, it appears that Russia simply prefers to allocate state funds to other policy priorities.

Moscow’s failure to prioritize nuclear security may be the product of a rational cost-benefit calculus on the part of Russian leaders. In their assessment, the national security risks of allowing the United States access to sensitive sites and the opportunity cost of devoting funds to nuclear security that could be deployed elsewhere simply exceed the costs of continued failure to secure fissile material adequately. In order to reverse this outcome, the United States must succeed in convincing Russian leaders that the costs of noncompliance with nuclear security initiatives are much higher than the Russians currently believe. Unfortunately, Nunn-Lugar and other financial assistance programs lack the influence levers necessary to alter this cost-benefit calculus. Under the current policy, the only potential negative consequence associated with noncompliance is that the United States might cease funding until Russia cooperates fully. Given that cutting off funding would only prolong or exacerbate the nuclear insecurity that Nunn-Lugar seeks to prevent, following through on this threat would be contrary to American interests. Accordingly, unless the United States develops some other recourse for increasing the costs associated with maintaining insecure nuclear arsenals, Russia’s lack of urgency will likely continue to stymie progress on fissile material security.

B. Multilateral Agreements as “Paper Tigers”

Unfortunately, the multilateral instruments that the United States has utilized to supplement its Nunn-Lugar program are unlikely to ameliorate the lack of urgency problem detailed above. Both the Convention on the Physical Protection of Nuclear Material and the International Convention on the Suppression of Nuclear Terrorism fail to create clear obligations or provide for any form of enforcement. Though UNSC 1540 creates binding legal obligations and contem-

⁶⁹ BUNN & WIER, *supra* note 13, at 12.

⁷⁰ *Id.*

⁷¹ *Id.*

plates enforcement, the nature of these obligations remains too vague, and enforcement action will occur only in those rare cases when all five permanent members of the Security Council agree.

The inability of the Convention on Physical Protection of Nuclear Material to create adequate incentives for states to prioritize nuclear security stems from a number of factors. First, in its current form, the Convention requires states only to safeguard nuclear material in “international nuclear transport,” not in storage or domestic use.⁷² This means that there is no obligation for countries to provide adequate security at nonmobile facilities that store nuclear weapons or materials. Moreover, although the recently negotiated amendment to the Convention addresses this gaping hole by extending coverage to “nuclear facilities” and nuclear materials in “use [or] storage,”⁷³ the impact of these new provisions will likely be limited. In addition to the facts that the amendment remains unsigned by many countries and may not enter into force for years, its obligations are “extraordinarily general.”⁷⁴ Although the amendment requires states to “establish[] and maintain[] a legislative and regulatory framework” aimed at “protecting against theft and other unlawful taking of nuclear material in use, storage, or transport,”⁷⁵ it provides virtually no guidance as to the appropriate content of such a framework and fails to specify a minimum level of effectiveness.⁷⁶ As a result, states could presumably fulfill their obligations by establishing rules that provide merely a modicum of physical protection, even if these measures did not substantially reduce the likelihood of theft. And even in the rare case where a state clearly violated the Convention, the likelihood of any kind of enforcement seems quite low given that the agreement leaves implementation to the individual states and does not provide for inspections or any other monitoring mechanisms.⁷⁷

The International Convention on the Suppression of Acts of Nuclear Terrorism suffers from similar problems of excessive generality. Article 8 of the Convention requires states to “make every effort to adopt appropriate measures to ensure the protection of radioactive material, taking into account relevant recommendations and functions of the International Atomic Energy Agency.”⁷⁸ Carefully parsing this

⁷² CPPNM, *supra* note 28, art. 2.

⁷³ CPPNM Amendment, *supra* note 30, attachment at 4–5.

⁷⁴ BUNN, *supra* note 6, at 15.

⁷⁵ CPPNM Amendment, *supra* note 30, attachment at 5–7.

⁷⁶ *See id.* The amendment does enumerate a set of principles that the framework should follow, including the use of multiple layers of defense, implementation of quality control programs, and management by a “competent authority.” *Id.* However, these principles are so broad that a near-infinite variety of programs of vastly differing levels of quality would fit under them.

⁷⁷ *Id.*

⁷⁸ ICSANT, *supra* note 32, art. 8

language shows that it is unclear what, if anything, states are obligated to do to protect their nuclear materials. By including the qualifier “make every effort,” the Convention seems to suggest that states would fulfill their duties merely by *trying* to implement security measures, even if they failed miserably at the attempt. Furthermore, the Convention requires states to “tak[e] into account” IAEA recommendations, but never compels countries actually to implement them. This attenuated language, coupled with the failure to define what constitutes “appropriate” measures, means that states have virtually unlimited latitude in deciding the nature and extent of security necessary to fulfill their duties under the Convention. Given the wide range of acceptable behaviors, it seems that the Convention itself will not incite states to take nuclear security more seriously because their existing efforts likely qualify as compliance.

Despite being more comprehensive than the two conventions discussed above, UNSC 1540 has similarly failed to convince states to ascribe higher levels of urgency to nuclear security. Although the Resolution creates a binding obligation for states to provide “appropriate effective” security⁷⁹ for all nuclear weapons and materials, “no one has yet defined what the essential elements of an effective system required by this resolution might be.”⁸⁰ This failure to define the meaning of the “appropriate effective” standard, in turn, allows states to determine for themselves what minimum level of nuclear security is required to comply with the Resolution. Not surprisingly, many states given this choice prefer a low minimum threshold because it permits maximum flexibility and allows them to avoid expending limited resources on nuclear security. More broadly, this lack of clarity means that “what is considered to be an appropriate and effective legal mechanism varies between states,” making it difficult for the Resolution’s monitoring committee to judge compliance.⁸¹

In addition to the problems posed by this lack of clarity, the enforcement capabilities provided for in the Resolution have proved largely useless. As outlined above, the lack of consistent criteria for what constitutes a violation hampers the Security Council’s ability to identify the states for which enforcement action is needed. To further complicate matters, the breadth and universal application of obligations further complicates enforcement. Given that the Resolution applies to all 191 U.N. member states and that the vast majority of them have not fully met their obligations, it would be very difficult politically for the Security Council to single out a few states for punishment

⁷⁹ UNSC 1540, *supra* note 35, § 3.

⁸⁰ BUNN, *supra* note 6, at 15.

⁸¹ Peter Crail, *Implementing UN Security Council Resolution 1540: A Risk-Based Approach*, 13 NONPROLIFERATION REV. 355, 358 (2006).

while allowing most others to go unpunished.⁸² Moreover, any enforcement action would require the consent of all five permanent members. Although obtaining Security Council consensus on any matter is difficult, this requirement is particularly problematic in the realm of nuclear security because it allows the country that may pose the greatest threat, Russia, to veto any punitive measures for its failure to meet obligations. Because of these factors, meaningful enforcement of UNSC 1540 obligations seems unlikely. In the absence of enforcement measures, “few international disincentives exist for failing or refusing to implement the resolution.”⁸³ As a result, the fulfillment of UNSC 1540 obligations with respect to the security of nuclear materials and weapons remains dangerously low.⁸⁴

The failings of the multilateral instruments outlined above yield the conclusion that they may be nothing more than “paper tigers.”⁸⁵ Consequently, states will continue to “make minimal efforts in order to give the appearance of compliance while achieving little actual improvement in global control over the world’s most dangerous arms.”⁸⁶ Accordingly, the current U.S. policy of relying on such instruments to catalyze real improvements in the level of importance that states attach to nuclear security seems at best overly optimistic and at worst sorely misguided.

C. *The Central Problem: Insufficient Incentives for Compliance*

The central problem with the current U.S. approach to nuclear terrorism is that it limits punishment to cases of intentional collaboration, leaving a wide gap in which states can recklessly neglect nuclear security without fear of reprisal. Although financial assistance programs such as Nunn-Lugar may have improved the ability of other states to secure their nuclear arsenals, they have done far less to address their motivation to do so.⁸⁷ Both these programs and the multilateral agreements that currently comprise the U.S. policy for combating negligent nuclear security impose no real costs on states for failing to meet nuclear security obligations or resisting cooperation with the United States. As a result, states lack the incentives necessary to forgo other priorities in favor of allowing the United States access to sensitive facilities and investing in upgrades to poorly equipped facilities, better

⁸² See *id.* at 358–59.

⁸³ Crail, *supra* note 81, at 359.

⁸⁴ According to one report, the average level of fulfillment for UNSC 1540 accounting and security obligations for nuclear weapons is a mere 35.9%. *Id.* at 377 tbl.5.

⁸⁵ See *id.* at 356.

⁸⁶ *Id.*

⁸⁷ Matthew Bunn, *Incentives for Nuclear Security 1* (Belfer Ctr. Conference Paper 2005), available at <http://belfercenter.ksg.harvard.edu/files/inmmincentives2005.pdf>.

training for security personnel, electronic locks on weapons, or other measures necessary to protect their nuclear stockpiles. Although the desire to avoid bolstering nuclear terrorism might furnish some incentive to act, available evidence suggests that other states may not take this threat as seriously as American leaders; indeed, the prevailing attitude in other capitals seems to be captured by Pakistani President Pervez Musharraf's recent comment that Washington is "overly concerned" with nuclear terrorism.⁸⁸ Given the inclination of other governments to downplay the nuclear terrorism threat, the failure of U.S. policy to impose any penalties or provide tangible disincentives for non-compliance is even more problematic because it is unlikely that states will develop any real sense of urgency for taking nuclear security measures on their own.

In fact, drawing a sharp distinction between intentional collaboration and negligent security may create perverse incentives encouraging states not to secure their arsenals adequately. By improving security at nuclear facilities, states reduce the likelihood that terrorists could acquire weapons or fissile material without government authorization. In the event that the United States experiences a nuclear terrorist attack and attributes it to material from a state with strong security practices, Washington is more likely to conclude that some intentional collaboration was involved and retaliate. As a result, a state might calculate that maintaining some level of nuclear insecurity actually offers the strategic advantage of plausible deniability in the event that terrorists use one of its weapons in an attack on the United States. Knowing that retaliation would be certain if the United States determines that a state willfully assisted terrorists, states might believe they can insulate themselves from suspicions of intentional collaboration by leaving open the possibility that terrorists stole the weapon from an insecure facility.

The incentive gap outlined above poses a serious challenge to U.S. efforts to secure nuclear stockpiles worldwide. Individual states are the least cost avoiders of the risk associated with inadequate fissile material security. This is so because they have the most information regarding the location, contents, and existing security arrangements at each nuclear facility and control the access required to install additional protection. Until these states face real costs for permitting negligent security practices at their nuclear facilities, they will likely continue to take unreasonable risks, and progress in securing global stockpiles of nuclear weapons and materials will remain inadequate.

⁸⁸ BUNN & WIER, *supra* note 13, at 43 (internal quotation mark omitted).

IV. CREATING STRONGER INCENTIVES FOR FISSILE MATERIAL SECURITY

Filling the incentive gap left by current U.S. policy will require the creation of stronger inducements for compliance and the application of real punitive measures for states that fail to meet obligations. Although policymakers could try to strengthen the existing legal regime, a better approach would be to create a new global alliance committed to nuclear security. In order for this alliance to succeed, however, the United States must implement a broad array of commercial, political, and deterrence-based incentives to ensure that states actually join the alliance and fulfill the nuclear security obligations created by it.

A. Strengthening the Existing Legal Regime

One option policymakers should consider involves strengthening the existing international legal regime by giving UNSC 1540 real teeth. As suggested by the above discussion of UNSC 1540's shortcomings, this option first requires creating a clear definition of what qualifies as "appropriate effective" physical protection of nuclear materials. Once a clear set of criteria has been established and states submit reports detailing their adherence to these standards, the monitoring committee must have the ability to order onsite inspections when necessary to verify state compliance. In cases in which the monitoring committee and subsequent inspections reveal that a state is not fulfilling its obligations, the committee would refer the matter to the Security Council. Accordingly, the Security Council would work with the state in question to develop a concrete plan for meeting obligations within a specified time period. If the state fails to meet these benchmarks and continues to abdicate its nuclear security obligations, the Security Council could act under its Chapter VII authority to impose sanctions and take whatever other enforcement actions it deems necessary to address the threat.

Strengthening the existing legal framework in this manner would create numerous incentives for states to improve fissile material security. Motivated by the desire to avoid the economic cost, international embarrassment, and unwanted scrutiny that accompany inspections or sanctions ordered by the Security Council, states would likely place greater emphasis on meeting nuclear security obligations. Moreover, the development of an authoritative global standard would furnish an opportunity for states to gain international prestige and demonstrate technical prowess by joining an exclusive group of nations capable of meeting stringent security standards.

However, despite these benefits, efforts to strengthen UNSC 1540 in the manner described above would remain vulnerable to two critical problems with the current regime. First, the political will of the Security Council to authorize enforcement action might be paralyzed by the

fact that a majority of U.N. members will likely fall short of meeting their nuclear security obligations.⁸⁹ Given that UNSC 1540 does not create any hierarchy of obligations or impose a greater burden on the nine nuclear-weapons states, it will be difficult for the Security Council to single out one of these states when dozens of others have also abdicated their duties. Even if a clear candidate for sanctions emerged, economic interests or other considerations might compel one or more permanent members to block or at least temper the impact of any sanctions resolution. Second, the efficacy of any attempt to locate enforcement power in the Security Council would still be severely limited by the fact that Russia has the power to veto any proposed action against itself. As a result, in order for the threat of enforcement action to influence Moscow's nuclear security practices, it will likely have to originate outside the Security Council framework.

B. *Building a Global Alliance*

The potential problems with locating enforcement power in the Security Council suggest that policymakers might want to consider creating an independent framework for dealing with nuclear security. Indeed, Professor Allison has called for a "Global Alliance Against Nuclear Terrorism" that would unite the nuclear-weapons states in an effort to take "every action physically, technically, and diplomatically possible to prevent nuclear weapons or materials from being acquired by terrorists."⁹⁰ Members of this alliance would be obligated to adopt a "gold standard"⁹¹ of safeguards to secure all nuclear weapons and materials on their own territory. Once the content of the "gold standard" has been determined, all members of the alliance will commit to a reasonable timetable for achieving it in their own countries. They would also provide complete transparency by allowing IAEA inspections to verify that the security standards had been met. Although each member state would ultimately be personally accountable for meeting the deadlines, alliance members would make security a cooperative effort by sharing best practices and lessons learned in order to facilitate progress. Alliance members would also receive financial assistance from the United States and other G-8 nations for investments in security technology, equipment, and personnel. In the event that members of the alliance or states outside of it continued to fall short of the "gold standard" despite this cooperation, the alliance would collec-

⁸⁹ See Crail, *supra* note 81, at 358–59.

⁹⁰ ALLISON, *supra* note 1, at 187.

⁹¹ Professor Allison calls it a "gold standard" because he argues that nuclear weapons and material should be as secure from theft as the gold held at Fort Knox or the Kremlin Armory. *See id.* at 149–51. This standard would presumably be developed by the alliance in concert with the IAEA and other nuclear experts.

tively use all sources of economic, political, and diplomatic influence to compel them to comply.

Such a framework would have numerous benefits from an incentive standpoint. States that enter the alliance and fulfill security obligations would acquire newfound international prestige, demonstrating the technological prowess required to meet the “gold standard” and joining other major powers in an exclusive club. Meanwhile, a failure to join or unwillingness to achieve “gold standard” security levels would expose states to costly economic, political, and diplomatic countermeasures from a united front of world powers.

Despite these incentives, however, convincing states to join and submit to intrusive inspections that might compromise closely guarded national secrets will be a very difficult obstacle for the alliance to overcome. In addition to problems that the United States has already experienced in trying to get access to Russian facilities to install security upgrades, it is reasonable to expect that countries like India and Pakistan may be even more reluctant to cooperate because their arsenals are much smaller (and therefore more vulnerable) than that of the Russians. For example, Professor Allison believes that due to Pakistan’s fear that India could locate and preemptively destroy its nuclear arsenal, it is unlikely that Islamabad would reveal the locations of its nuclear facilities to the United States.⁹²

C. *Creating Incentives for Joining the Alliance*

Accordingly, in order for the alliance to succeed, policymakers must develop a wide array of incentives to convince states to join despite the significant costs involved with giving other countries access to sensitive nuclear facilities. The first tool the United States should rely upon is the creation of strong commercial inducements for states to join the alliance. The United States could condition future nuclear cooperation agreements, like the recent deal with India, on membership in the alliance. In effect, this would make adequate security over nuclear weapons and materials the “price of admission” to the lucrative global nuclear market.⁹³ Moreover, the United States could create regulations that require, or informally encourage, banks to consider adequacy of nuclear security and membership in the alliance as criteria in making decisions about whether to issue loans or other forms of financing to nuclear-weapons states.⁹⁴ The “Equator Principles” originally developed by the World Bank provide an example in which this model has

⁹² *Id.* at 152.

⁹³ Bunn, *supra* note 87, at 7.

⁹⁴ See GEORGE PERKOVICH ET AL., UNIVERSAL COMPLIANCE: A STRATEGY FOR NUCLEAR SECURITY 58–59 (2005), available at http://www.carnegieendowment.org/files/UC2_FINAL3.pdf.

succeeded — a large number of banks follow these principles, which call on lenders to require that borrowers meet certain environmental and social standards as a precondition for receiving loans for projects in countries that have historically struggled to meet those standards.⁹⁵ In addition to these commercial incentives, the United States can also offer political and diplomatic inducements. For example, for countries like India, which yearn to be recognized as global powers, the United States should portray alliance membership as an exclusive invitation to join the world's great powers in addressing a matter of grave international importance.

Should these attempts to convince states to cooperate fail, a more extreme option would be to threaten to hold states responsible if their failure to meet alliance security standards results in a terrorist attack on the United States. For example, Robert Gallucci, the lead negotiator of the 1994 Agreed Framework with North Korea, has proposed expanding the application of deterrence by punishment to include not only states that willfully transfer nuclear weapons to terrorists, but also countries whose negligent failure to secure nuclear weapons and materials allows unauthorized terrorist access.⁹⁶ This “expanded deterrence” model involves warning states that if their failure to cooperate fully in controlling fissile materials results in terrorists using a nuclear weapon, then the United States will hold them responsible for the attack and retaliate accordingly.⁹⁷ The underlying logic here is that the desire to avoid retaliation will compel a heightened level of urgency and force states to take reasonable and prudent measures to secure their nuclear stockpiles.

In theory, the United States could combine expanded deterrence with a negligence doctrine to create a powerful incentive to join the alliance as well as a strong disincentive for refusing to do so. On the positive incentive side, in exchange for joining the alliance and being certified by the IAEA as having met the “gold standard,” states would receive a presumption of “non-negligence” in the event of any terrorist attack on the United States that employs one of their nuclear weapons. Unless further investigation of the incident reveals extensive evidence of negligence to rebut this presumption, these states would be able to avoid potentially devastating retaliation. On the other hand, states that refuse to join the alliance, or that accept membership but fail to

⁹⁵ *Id.* at 58.

⁹⁶ Robert L. Gallucci, *Averting Nuclear Catastrophe: Contemplating Extreme Responses to U.S. Vulnerability*, 607 ANNALS AM. ACAD. POL. & SOC. SCIENTISTS 51, 51, 56–58 (2006).

⁹⁷ *Id.* at 58. A number of other analysts have advocated a similar strategy. See, e.g., Anders Corr, *Deterrence of Nuclear Terror: A Negligence Doctrine*, 12 NONPROLIFERATION REV. 127 (2005); Michael A. Levi, *Deterring Nuclear Terrorism*, ISSUES IN SCI. & TECH., Spring 2004, available at <http://www.issues.org/20.3/levi.html>.

make adequate progress toward the “gold standard,” would automatically be considered negligent in the event of any terrorist nuclear attack that utilizes their weapons or fissile material. As a result, they would stand to bear the brunt of whatever retaliatory response the United States and its allies deem appropriate.

Upon closer analysis, however, an expanded deterrence doctrine based solely on military retaliation raises serious concerns. As an initial matter, the entire approach depends on the assumption that the United States has the ability to quickly and reliably identify the state of origin of a nuclear weapon after it detonates.⁹⁸ Without this ability, the United States would have to delay its retaliatory response and risk undermining the credibility of its threat. Worse yet, pressure to maintain a credible deterrent might force the United States into a “commitment trap”⁹⁹ whereby it proceeds with retaliation against a state that has not been proven guilty by forensic analysis. Moreover, even if progress on nuclear forensics eliminated such problems, questions would still remain regarding what evidentiary standard the United States must meet before holding a state responsible, how it could structure the attribution process to avoid accusations of bias by other states, and how political leaders could be trained to make decisions that require highly technical, scientific knowledge.

A second major problem is that fulfilling the commitment to retaliate would likely require the United States to incur major costs or endanger important interests. The most obvious scenario here involves the case in which Russia is the negligent state responsible for an attack on the United States. Fulfilling the retaliatory commitment here requires attacking a potential ally and risks provoking substantial counterattacks, possibly leading to full-scale war between two nuclear powers. Given these circumstances, it is difficult to believe that the United States would ever attack Russia. More generally, the problem is that in many cases following through on the threat of retaliation might actually decrease American security or otherwise impose costs that out-

⁹⁸ Developing this type of attribution capability requires combining traditional intelligence and investigative techniques with nuclear forensics, in which scientists analyze the physical, chemical, elemental, and isotopic signatures left behind after an explosion. They then compare it against a database of known reactor types or HEU samples to pinpoint the origin of the material. Talmadge, *supra* note 8, at 25–26. Although the recent establishment of the National Technical Nuclear Forensics Center and creation of a forensics analysis team at the Pentagon signal progress toward this goal, *id.* at 27, the fact that the United States was unable to identify directly (as opposed to using a process of elimination method) the source of the uranium hexafluoride found in Libya suggests that “gaps in our knowledge” still exist, Graham Allison, *Nuclear Accountability: Forensics Technology May Deter States from Giving Terrorists Nukes*, *TECH. REV.*, July–Aug. 2005, at 43, <http://www.technologyreview.com/Energy/14597>.

⁹⁹ See, e.g., Scott D. Sagan, *The Commitment Trap: Why the United States Should Not Use Nuclear Threats To Deter Biological and Chemical Weapons Attacks*, 24 *INT’L SECURITY* 85, 87 (2000).

weigh the deterrence benefits. Thus, because retaliation may be strategically unwise for the United States, other states will question the credibility of the American threat.

Given these flaws, a negligence model based on military retaliation should be considered only as a last resort, and even then regarded warily. A more promising approach involves expanding the concept of retaliation to include strong countermeasures just short of the use of force. By maintaining strategic ambiguity regarding the scope and nature of retaliation, the United States would retain significant flexibility to design a case-specific response that would punish wrongdoing while still comporting with long-term strategic considerations. For example, in the case of Russia or another major U.S. ally such as India, the United States might forgo military retaliation and instead focus on economic and political retaliation. It could force the country at fault to shoulder the massive financial costs of an attack by freezing the country's assets, imposing severe restrictions on trade, and implementing other sanctions, or waiving sovereign immunity to allow victims of a nuclear attack to sue the state for damages in U.S. courts. Only after policymakers exhaust such options and conclude that the punishment still remains incommensurate to the state's conduct should the United States consider military retaliation.

Though policymakers will need to explore each of the specific incentive policies outlined above in far greater detail before implementing them, they should recognize the more general point that any multilateral alliance on nuclear security will require a comprehensive package of incentives to ensure wide state participation.

V. CONCLUSION

This Note argues that the current U.S. policy of relying on financial assistance programs and largely unenforceable international legal instruments has not yielded sufficient progress in securing nuclear weapons and materials throughout the world. The primary driver of this failure is that the current policy does not furnish sufficient incentives for states to prioritize nuclear security. Accordingly, the critical task for policymakers going forward will be to create more robust incentives for meeting nuclear security obligations and punitive measures for failing to do so. Although a number of options are available, the most promising involves combining the creation of a global alliance of states committed to a "gold standard" of nuclear security with the implementation of a series of commercial, political, and, if necessary, deterrence-based incentives to compel all nuclear powers to participate in the effort.