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Combating Proliferation: Addressing the Russian Nuclear Threat

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Fifteen years after the initiation of U.S. threat reduction programs in the former Soviet Union and some four years after the terrorist attacks of September 11, 2001, more than half of Russia's vast stockpile of weapons-usable fissile materials remains to be secured, and is thus vulnerable to diversion by terrorists for use in a nuclear device. This paper assesses the state of fissile material security in Russia today, taking as a case study the security of nuclear materials involved in the operations of the Russian Navy's Northern Fleet. Recommendations are made drawing on the successes and shortcomings of the U.S. Department of Energy's Material Protection Control and Accounting Program at the Fleet's naval facilities. This analysis leads into a broader examination of the effectiveness and adequacy of U.S. nonproliferation efforts in keeping weapons of mass destruction out of the hands of terrorists.[1]

Introduction

The collapse of the Soviet Union in 1991 marked an unprecedented change in the global security structure and environment. From 1945 until 1991, the Soviet Union and the United States were embroiled in a superpower rivalry that polarized Europe and much of the Third World. In this contest for global superiority, an arms race transpired in which each side acquired vast conventional and nuclear arsenals. With the dismantlement of the Soviet Union into fifteen successor states, the threat of Soviet power which had characterized U.S.–Soviet relations for the duration of the cold war

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was suddenly replaced by a very different sort of threat—that stemming from Russian weakness. Amidst political, economic, and social upheaval, a vast legacy of nuclear weapons and material was left spread across the former Soviet territories.

This paper will focus on the state of fissile material control and security in Russia today, taking as a case study the Russian Navy's Northern Fleet. The nuclear dilemma in Russia is multifaceted. An effective assessment of the situation requires a broad understanding of the many existing economic, political, and social inter-linkages that contribute to the concern of fissile material diversion. This paper will assess the successes and failures of U.S. nonproliferation programs in averting fissile material diversion, in the context of both the Northern Fleet and the entire Russian arsenal of nuclear materials. Drawing on the analysis of the Northern Fleet, the factors that impede greater progress in securing Russia's nuclear materials will be considered and a set of policy recommendations will be offered, based both on the successes and the shortcomings of the naval programs. The conclusion discusses the greater framework of current U.S. initiatives to combat the proliferation of weapons of mass destruction.

The Nuclear Legacy of the Former Soviet Union

Fissile Stockpiles: Quantities and Location

At the time of the Soviet Union's collapse, some 27,000 nuclear weapons were spread across the territories of the fifteen successor states "Woolf 2003", One analyst indicated that in this "post-Cold War hangover," there also existed enough enriched uranium and plutonium in the Former Soviet Union (FSU) to make 60,000 more nuclear weapons (Holgate 2003). Former U.S. Senator Richard Lugar described a situation in which, as "a consequence of the collapse of the Soviet totalitarian command and control society, a vast supermarket of weapons and materials of mass destruction became potentially accessible to rogue nations and terrorists" (U.S. Congress 2004).

Considering the secrecy that surrounds a state's nuclear programs, a good deal is known about the size and state of the Russian weapons complex. In addition to some 40,000 nuclear weapons built by the Soviets, quantities of highly enriched uranium (HEU) were produced to make 40,000 new nuclear weapons (U.S. Department Of Energy (U.S. DOE) 2001). Yet there is still much to be learned, including the actual amount of weapons-usable material produced in the Soviet Union, as well as how much is being produced in Russia at present.

What is certain is that while the FSU and Russia have produced the world's largest stockpile of weapons-usable plutonium and HEU, a 1997 U.S. intelligence report indicated, "the Russians may not know where all their material is located" (National Research Council (NRC) 2001). In fact, no site-specific or national program exists for fissile material tracking in Russia (Allison et al. 1996). A greater concern, however, is not the size of the stockpile, but the accompanying deterioration of infrastructure and security that has allowed these materials to go largely unaccounted for and weakly protected.

Fissile material is located in three segments of the Russian nuclear complex.[2] The material in nuclear weapons under the Ministry of Defense's (MOD) custody constitutes the first category, over which security remains tight. The second category is the material within weapons design and production facilities and in nuclear power reactors overseen by the Ministry of Atomic Energy (Minatom). The final category is comprised of nuclear materials that are used for non-weapons purposes under the shared custody of the MOD, Minatom, and other government agencies and private organizations. Materials used for naval reactors and civilian merchant ship reactors are in this last category.

Security of Fissile Materials

More than half of the weapons-usable nuclear material in Russia today is housed outside of the weapons complex, and subject to "only the most rudimentary" security standards (U.S. DOE 2001). A U.S. National Intelligence Council (NIC) report found that "Russian facilities housing nuclear weapons-usable material…typically receive low funding, lack of trained security personnel, and do not have sufficient equipment for securely storing such material" (Wolfsthal and Collina 2002). A 1998 report by the U.S. DOE highlighted numerous security inadequacies at Russian nuclear facilities: a lack of unified physical protection standards and inadequate defenses of buildings and facilities with site-perimeter fences; a lack of portal monitors to detect fissile materials leaving or entering a site; few central alarm stations and poor alarm assessment and display capabilities; insufficient protection of guards from small-arms fire and sub-par guard force communications; a lack of material accounting procedures that can detect and localize nuclear material losses; inconsistent measurements of waste and scrap; hold-up of nuclear materials during processing; lax accounting of transfers of nuclear materials between facilities; and antiquated tamper-indicating devices on material containers (NRC 2001). A 2003 report of the Russian nuclear regulatory agency stated that the analysis of inspections carried out over the previous year demonstrates that "there are serious flaws in the physical protection" of hazardous nuclear facilities and that "[t]he system of accounting, control, storage and transportation of radioactive materials is not fully operational yet … the unauthorized use of radioactive materials and their theft cannot be ruled out" (Nuclear Threat Initiative (NTI) 2004f).

The Human Factor: Economic and Social Instability

Because the Soviet state maintained strict control over individuals in a closed political, social, and economic system, minimal physical security over nuclear materials was required. Yet,

> [t]he foundations of the Soviet approach to nuclear security were swept away in the transition from a closed totalitarian state to a more turbulent democratizing state…. The system that worked to protect weapons and fissile materials in the Soviet period cannot work in the new political environment in Russia (Allison et al 1996, 37).

Despite improvements in recent years, Russia's troubled transition from communism has increased the incentive for individuals working with nuclear materials to resort to theft for financial gain. "[T]he greatest problem is the person who works with the nuclear [materials]. He knows the secrets, he has the access, he knows the security system" (Wolfsthal 2002).

Implications for Proliferation

Since 1991, there have been eighteen reported attempts to steal HEU or plutonium in Russia (Birch 2004). One U.S. intelligence report found that "weapons-grade and weapons-usable materials have been stolen from some Russian institutes. We assess that undetected smuggling has occurred, although we do not yet know the extent or magnitude of such thefts" (Wolfsthal and Collina 2002). A 2005 NIC report concluded that theft of nuclear materials in Russia "has occurred" and the Council "continues to be concerned about vulnerabilities to an insider who attempts unauthorized actions as well as potential terrorist attacks" (Agence France-Press 2005). It is known that buyers from Iraq, Iran, and other countries, as well as terrorist groups, have actively sought nuclear weapons material from Russian sites.

The international nonproliferation regime is based on the difficulty of obtaining weapons quantities of fissile material, essentially creating a 'choke point' that makes it untenable for aspiring proliferants to produce nuclear weapons. If this material can be purchased or stolen, it "dramatically reduces—but does not eliminate—the challenges associated with producing a nuclear weapon" (Carnegie Endowment for International Peace (CEIP) 2002, 35). Given an adequate supply of fissile material, there is consensus among U.S. weapons designers that most states and many terrorist groups can construct a simple nuclear weapon (Allison et al 1996, 12).

The terrorist attacks on the World Trade Center and the Pentagon of September 11, 2001, as well as those in Europe and Russia in recent years, have raised global awareness of the threats posed by nuclear terrorism. The diversion of nuclear materials is a threat regardless of whether a terrorist group has the capacity to construct a nuclear device; it is "a likely scenario that somebody would get hold of either a warhead or some material and just break it apart over a geographic area, and that would cause a great deal of contamination—not immediate deaths from blast effects, but perhaps longer-term contamination and deaths from nuclear materials" (PBS 2001). Seen in this light, it is not an understatement that

> [t]he most urgent unmet national security threat to the United States today is the danger that weapons of mass destruction or weapons-usable material in Russia could be stolen and sold to terrorists or hostile nation states and used against American troops abroad and citizens at home. The threat is a clear and present danger to the international community as well as to American lives and liberties (U.S. DOE 2001, iii).

U.S. Programs to Address the Nuclear Dilemma in the FSU

In November 1991, the U.S. Congress allocated $400 million of the defense budget to assist Russia in securing its nuclear weapons and materials. This program, known as the Cooperative Threat Reduction (CTR) program, or the Nunn-Lugar program named after the sponsoring senators, was created with three basic goals: to aid in the transportation, storage, safeguarding, and destruction of nuclear, chemical, and biological weapons; to prevent the proliferation of weapons of mass destruction; and, to prevent the dispersion of weapons-related scientific expertise (Woolf 2003, 6).

Since initiation of the CTR program under the direction of the U.S. Department of Defense (U.S. DOD), the effort to secure Russia's nuclear arsenal has expanded significantly. U.S. DOD continues its work primarily within the weapons complex, while U.S. DOE and the U.S. Department of State (U.S. DOS) have implemented programs mainly outside of the weapons complex. In 1995, U.S. DOE assumed full responsibility for overseeing the security of all weapons-usable nuclear materials and in 1996 assumed an independent budget for its programs.

Because this paper is primarily concerned with programs aimed at securing Russia's stockpiles of nuclear materials outside of the weapons complex, certain U.S. DOE programs are of particular relevance to this analysis. Specifically, pertinent projects include those that have focused on material accounting and physical protection systems, training for nuclear personnel in proper safeguard techniques, assistance in developing a comprehensive and enduring regulatory basis for nuclear material security in Russia, and assistance in improving the physical condition of nuclear weapons-usable material in transit (U.S. DOE 2001, 11). The Material Protection, Control, and Accounting (MPC&A) program is the largest U.S. DOE project, initiated in 1994 to improve safety and security issues at Russian facilities where fissile materials are stored. A Second Line of Defense program enhances the original MPC&A program with the mandate to reduce the threat of nuclear proliferation and terrorism through cooperative efforts with the Russian government to strengthen and deter illicit trafficking at the border. A Site Operations and Sustainability program was added in 1999 to ensure that upgrades are sustainable in the long-term, while in the same year a Material Conversion and Consolidation program was implemented to reduce the quantity of fissile materials, as well as the number of sites where weapons material is located (Wolfsthal, Chuen, and Daughtry 2001, 58).[3]

MPC&A security upgrades are either rapid or comprehensive. Rapid upgrades, which are intended to deter external threats, typically consist of bricking up windows in storage facilities; installing strengthened doors, locks, and seals; establishing controlled access areas around nuclear material; and implementing procedures that require the presence of two people where nuclear material is handled (U.S. Government Accountability Office (GAO) 2003, 24). Comprehensive upgrades are designed to deter both internal and external threats through the use of motion detectors and electronic sensors, central alarm stations and guards, and computerized material accounting systems.

MPC&A projects have been undertaken at Russian naval facilities in cooperation with the Russian Navy. The intent of these projects is threefold: the consolidation of fissile material, particularly fresh naval fuel; physical protection of consolidated sites; and the physical protection of spent fuel. Work on naval sites has concentrated on upgrading security both on land-based storage sites and on ships that serve as storage and refueling bases (Wolfsthal, Chuen, and Daughtry 2001, 59).

Case Study: The Northern Fleet

The Soviet Cold War Naval Legacy

The former Soviet—now, Russian—Navy has traditionally been dominated by submarine forces. Following World War II, Josef Stalin embarked on a massive expansion of the Russian Navy to protect Soviet interests throughout the world and project an image of unparalleled military power. Soviet military doctrine is inseparable from the broader context of communist ideology and economics, which has important implications for the state of fissile material in Russian naval operations today.

The Soviet Navy was not spared the overarching bureaucracy and intertwining and often conflicting political, economic, and ideological complexities of the Soviet system. Submarines were often built under conditions dictated not by the Navy itself, but by state-driven economic, political, and ideological interests. For instance, while the United States installed one reactor aboard each nuclear submarine it produced, the Soviets chose to use two for added power, despite increased safety risk (Weir and Boyne 2003, 294). Although over twenty classes of nuclear submarines were constructed from 1967 to 1985 (Weir and Boyne 2003, 292),

> [t]he Cold War arms race developed far too fast for the Soviet authorities to plan how to dispose of the nuclear waste that would be generated from the operating vessels, and later, from the decommissioning of the submarines.... The development of infrastructure for handling and storing spent nuclear fuel and radioactive waste lagged far behind the rate at which the submarines themselves were being built (Bellona 2004a).

Until 1986, no plan existed for decommissioning nuclear submarines. Nor was a central storage facility ever constructed to handle the nuclear materials associated with nuclear submarine operations. Rather, spent fuel was held either in storage at the shipyards and bases, or dumped in the Barents and Kara Seas.

The Northern Fleet Today

Once the smallest of the four Soviet naval fleets, the Northern Fleet surpassed the Baltic, Black, and Pacific Fleets in both size and importance between 1950 and 1970, a position it maintains to this day (NTI 2004a). Admiral Viktor Kravchenko recently stated that Russia must possess a powerful naval capability in the 21st century in order to provide defense and security (Moss 2004). The Northern Fleet would be at the heart of such a strategy. The conditions in Russia today, while improving, have nonetheless significantly affected the Northern Fleet's capacity to fulfill this role. Despite a drastically reduced budget, the Fleet must deal with an array of difficulties: an aging and deteriorating fleet; the decommissioning and dismantlement of retired vessels; the naval nuclear fuel cycle; radioactive waste and environmental decontamination; and compensation of naval officers. All of these factors play into the potential for diversion of fissile materials from the shipyards and naval bases maintained by the Northern Fleet.

The Russian Navy has undergone profound change since the dissolution of the Soviet Union. During the height of the Cold War, Soviet military spending approximated 25 percent of GNP; the Russian military budget now accounts for 3.8 percent of GDP, of which some 12 percent is allocated to the Navy (Moss 2004; NTI 2004f). Cuts in the defense budget, coupled with safety concerns arising from deteriorating infrastructure, have driven an across-the-board downsizing of naval operations. Not only has the number of operational vessels been drastically reduced in recent years, but it is estimated that most of Russia's submarines will reach the end of their service lives by 2007 (Wolfsthal and Collina 2002).

Financial constraints that prevent the operation of a Soviet-size naval force, international disarmament treaties, and the sheer age and condition of many vessels have spurred the process of submarine decommissioning and dismantlement. Already a total of 183 nuclear-powered submarines have been withdrawn from service in the Russian Navy; 113 of these from the Northern Fleet. Of these 113 retired vessels, 42 have not been defueled and only 32 have been dismantled (Bellona 2004b). The Navy lacks the funding and supporting infrastructure to carry out the decommissioning and dismantlement process, and is plagued by inadequate spent fuel storage and transport capabilities. The slow pace of decommissioning has been further exacerbated by conflicts over responsibility between government agencies and the military, as well as taxes and liabilities that impede international assistance.

Financial constraints are the primary obstacle to decommissioning and dismantlement. The Russian Finance Ministry provided the Northern Fleet with only 47 percent of the necessary funding in 2003. In the same year, the Russian government acknowledged that $1.2 billion would be needed to solve the problems of nuclear and radioactive safety in the Murmansk region; yet only $66 million was allocated from the state budget for this purpose (Bellona 2003a). Inadequate financial support has also played a role in the misuse of funds that are actually received; in one case, more than one billion rubles ($37 million) which had been earmarked for the decommissioning of submarines in the Navy's budget was spent elsewhere

(Chuen and Jasinski 2001). The result has been detrimental to both the safety of the decommissioning process and the maintenance of operating vessels.

Numerous examples illustrate the safety inadequacies that characterize the operations of the Northern Fleet today. Some of these are well known, such as the sinking of the Kursk in the Barents Sea in 2000; others are less publicized, such as a 2003 incident in which,

> [d]espite gale conditions in the Barents Sea above the Arctic Circle, a tugboat left Russia's Northern Fleet shipyard in Gremikha … pulling a rusty, Soviet-era nuclear attack submarine atop four pontoons, and headed to a plant on the Kola Peninsula, where the decommissioned sub was to be scrapped … when the tug was about halfway to its destination, Polyarny, the fierce storm snapped the lines that tied the 40-year-old K-159 submarine to the pontoons. The November-class vessel with ten crewmembers on board sank in 560 feet of frigid, murky water… (Badkhen 2003).

The Naval Fuel Cycle: Fresh and Spent Nuclear Fuel

The Northern Fleet possesses large stocks of naval reactor fuel. The primary concern these stocks pose is the security of fresh fuel rods; a subordinate, though nonetheless critical concern, is the spent fuel from reactors. Most naval fuel is enriched to between 20 and 45 percent U-235, but some submarine reactors and icebreakers use fuel enriched to 90 percent (PBS 1998). A typical reactor core contains 315 kg. uranium (NTI 2004c).

Reactors containing both spent and low-irradiated fuel (which retains a large quantity of HEU) remain in operation in the reactors of submarines decommissioned before the end of their service lives. Furthermore, because naval reactors are lighter and easier to work with than power reactor assemblies, they pose a greater proliferation risk. Removing spent fuel from submarines is a difficult process; ironically, spent fuel is generally more secure while in the reactor cores than once it has been removed and placed in a more vulnerable security environment (NTI 2004b). Approximately 60 percent of Russia's decommissioned submarines still have spent fuel on board (U.S. GAO 2004, 2).

Little dry storage is available for the spent fuel removed from the reactor cores of decommissioned submarines; hence, the decommissioned submarines and service ships have become "de facto long-term spent fuel storage facilities" (NTI 2004c). A report released by Minatom in March 2000 indicated that at least thirty submarines with nuclear fuel in their reactors have been laid up for some fifteen years and are in danger of sinking, as "[y]ears of corrosion have led to a situation in which the hulls are no longer hermetic, downgrading the submarines' capability to remain afloat" (Nilsen 2000).

After removal from vessels, spent fuel assemblies are put in temporary storage and after three years are sent to the Mayak reprocessing facility in the Urals (NTI 2004c). At the end of 2000, fuel from 118 reactor cores was being stored at onshore bases and nuclear service ships in the Northern Fleet, while an additional 130 reactor cores remained in retired submarines (Bellona 2004c). The Fleet is presently storing approximately 60,000 spent fuel assemblies (26,000 in dry storage and 30,000 in laid-up submarines). Some 9,000 assemblies are being stored by the Murmansk Shipping Company, which operates the civilian icebreaker fleet. An additional 5,040 spent nuclear fuel assemblies are being stored in service ships and, by 2007, there will be another 20,000 assemblies, mostly from laid-up submarines (Bohmer 2000).

Less than half of the spent nuclear fuel that has accumulated in storage sites over the years in the region has been transported to the Mayak reprocessing facility in the Urals, which was built to house the fissile materials from dismantled nuclear weapons. The facility is capable of housing up to sixty-six metric tons of weapons-grade materials, but it will take about fifty years to transfer all the spent fuel to the newly completed facility (Wolfsthal and Collina 2002). In the meantime, there is "no other place in the world where such large amounts of spent nuclear fuel are so improperly stored as at the Kola naval bases" (Bohmer 2000).

Theft of Nuclear Materials

In recent years, several accounts of theft involving nuclear materials utilized in the operations of the Northern Fleet have been reported. Not all important diversion cases, however, are necessarily recognized by the Russian government or publicized in the media. This is certainly the case for at least five other actual or attempted thefts of HEU at naval facilities between 1994 and 1996 (Lee 1998, 106).

Several cases of theft of weapons-usable materials have taken place in the Murmansk region. One such case occurred in July 1993 at a secret storage facility where two naval servicemen broke into a storeroom and removed two fuel rods, from which they extracted 1.8 kg. HEU enriched to 36 percent HEU. In another case, a man sawed through a door into a storage unit and broke off parts of three reactor core assemblies from a nuclear submarine, acquiring almost 4.5 kg. HEU enriched to approximately 20 percent U-235. In August 2003, the deputy director of the civilian icebreaker fleet Atomflot was arrested on suspicion of smuggling nuclear weapons; he kept six pounds of uranium in his car, garage, and summerhouse. Another theft took place at Atomflot in 1999 involving the radioactive element californium-252 and 17 kg. of mercury. A group of specialists who had worked with the materials—a technician from a nuclear support ship, a reactor decontaminator and his son, a programmer in a St. Petersburg military installation—loaded the materials into the trunk of a car and covered them with paraffin, then embarked on an 800 kilometer journey, intending to sell it on the black market (Digges 2003).

Although involving the Pacific Fleet and not the Northern Fleet, another case is illustrative of the dynamics that characterize these thefts. In January 2000, Federal Security Bureau agents arrested four sailors at the nuclear submarine base on the Kamchatka peninsula with a stash of precious metals and radioactive material they had stolen from an armored safe on their nuclear submarine; additional stashes of radioactive material and submarine components were discovered at their homes (U.S. DOE 2001, v). In yet another instance, 1.8 kg. of 36 percent HEU was stolen by two naval servicemen from nuclear submarine fuel assemblies (PBS 1998).

These cases all reflect a similar dynamic: individuals under financial duress attempting to take advantage of insecure materials for financial gain. These cases cannot be categorized as isolated instances, but "must be regarded as a pattern of poor nuclear security in the Russian submarine fleet" (Lee 1998, 118). Considering the low salaries of officers and financial constraints the Navy faces, it is not surprising that "individual submariners moonlight and sometimes resort to pilfering" (Chuen and Jasinski 2001). In 2003, the military prosecutor for the Northern Fleet stated, "ongoing theft of electronic equipment and parts from the Fleets' bases was so rampant that it had done 'enormous damage' to the military capability of the Fleet's ships" (NTI 2004f). The Russian Audit Chamber reports, "submarines arrive for decommissioning with half of their electronic equipment and precious metals already stripped off" (NTI 2004f).

In most cases, attempted thefts of nuclear materials have been interdicted because the individuals did not know what to do with the materials once they had acquired them. Yet a single case of weapons-grade HEU successfully smuggled would be enough to teach a lesson of devastating consequence. The theft of weapons-usable material—which is typical of naval reactor fuel, HEU enriched to at least 20 percent—could be used to create a lower-yield, but still highly destructive nuclear device.[4]

Assessment of MPC&A and Related Initiatives

U.S. DOE's MPC&A efforts have led to security upgrades that now protect 38 percent of the total weapons-usable nuclear material in Russia, or 228 of some 600 metric tons (U.S. GAO 2003). An earlier U.S. GAO report specified that of the 32 percent of Russian sites that had been secured as of May 2001, 18 percent had received rapid upgrades and 14 percent had received comprehensive ones (U.S. GAO 2001). However, U.S. DOE's success has varied significantly depending on the type of facility targeted; while substantial progress has been made in upgrading security in the civilian and naval sectors, progress has been painstakingly slow at facilities within the nuclear weapons complex.

The work of U.S. DOE and the Russian Navy in securing the fresh naval fuel rods and enhancing the security at Northern Fleet facilities where nuclear materials are stored has progressed rapidly: thirty-three of thirty-six naval sites have been secured, and the MPC&A program for fresh naval fuel is expected to be complete by 2006 (U.S. GAO 2003, 5). By 2003, rapid upgrades had been completed on all of approximately sixty tons of naval fuel, with comprehensive upgrades remaining to be implemented on only 2 percent of the fuel (NTI 2004e). The positive work of U.S. DOE led to a request by the Russian government that the agency assist in securing stored nuclear weapons; as of 2001, installation of security systems was underway at forty-one of forty-two naval weapons storage sites (Wehling 2001).

Despite these accomplishments, concern remains over the effectiveness and long-term sustainability of MPC&A systems at both naval and civilian sites, as well as those within the weapons complex. The sustainability of the upgraded systems over the long-term is key to fissile material security. An effective safeguards system is comprised of physical protection measures, a material control and accounting system to deter and detect shrinkage, and a human reliability component to reinforce the responsibility of individuals involved in the nuclear sector. Thus far, MPC&A has primarily concentrated on the physical component of safeguards systems.

Many sites in Russia currently lack the human and financial resources to maintain high-tech equipment. In some cases, "key personnel neglect essential procedures … and (security) equipment is not operated at all times … [a]t some sites, portal monitoring is only operated during working hours" (Wehling 2001). Referring to the installation of security systems in several states of the FSU, one U.S. official noted in 2002 that "audits and detection equipment in some countries had never been used and remained in storage; expensive high-technology equipment was only being used in the presence of visiting U.S. delegations; and equipment was going unused because it needed battery replacement, very minor repairs, or major repairs that required out of country servicing" (U.S. GAO 2002b, 21).

Additional testing is necessary to ensure that the installed security systems are effective. From January 1999 through September 2000, U.S. DOE sent a technical survey team to numerous sites where upgrades had been implemented to assess whether the systems were effectively reducing the risk of nuclear theft from these facilities. Of the thirty sites visited, it was determined that twenty-two were "reducing the risk of theft by increasing the ability of Russian sites to detect, delay, and respond to an attempted theft or otherwise strengthen control over nuclear material." At six of the reviewed sites, "little or no risk reduction occurred because systems were not installed in accordance with guidelines, the teams did not have sufficient access to the buildings to install systems, or the systems were installed around material presenting a low risk of proliferation." At the two remaining sites, it was "too early" to determine whether the systems were working (U.S. GAO 2001b, 6).

Impediments to Progress

U.S. DOE has estimated that MPC&A upgrades at all Russian facilities housing nuclear materials will be completed by 2020 at an estimated cost of $2.2 billion (U.S. GAO 2001b, 4). The cost and timeline for completion are dependent upon overcoming several obstacles that have plagued the program since its initiation, and which are broadly characteristic of the difficulties that plague U.S.-Russian nonproliferation initiatives in general. Russia has been most often cited for difficult and erratic behavior in granting access to sites and hassles over transparency issues. Persistent internal security and bureaucratic issues that impede nonproliferation programs are a sign of both weak political will and a lingering Soviet-era mentality that dictates strict control over the nuclear complex and a feeling that granting foreigners access to these sites compromises national security. Financial issues are a major impediment. When the MPC&A program was implemented in 1995, it was assumed that Russia would assume responsibility for the maintenance of U.S-installed security systems. Russia's ability to pay for the operations of such systems has proven limited, however, and the financial burden has fallen on U.S. DOE (U.S. GAO 2003, 6).

The most effective means of addressing the Russian nuclear dilemma has been hampered by less than full cooperation and political will on both sides, despite stated support at the highest levels of government (U.S. DOS 2001). On the American side, "insufficient political support and attention has resulted in funding limitations and restrictions, bureaucratic battles, and delayed program implementation" (Luongo and Hoehn 2003). One analyst attributed impeded cooperation to "pockets of resistance within Congress and the administration" (Lugar 2004).

Funding for CTR programs is dependent upon an annual presidential waiver to ascertain that Russia is committed to a number of standards, including compliance with arms control agreements and human rights provisions. In 2002, the Bush administration expressed "serious concerns about Russian chemical and biological weapons activities" (Bleek 2002) and new programs in Russia were halted for more than six months because Russia had not provided what the United States considered "full and accurate" disclosure of the size of its chemical weapons stockpile (Lugar 2004).

Similarly, a new set of interagency guidelines has forced U.S. DOE to push back its 2006 planned date for completion of naval site upgrades and halt further assistance to many sites where an initial round of upgrades has already been installed. The new guidelines came out of fear that U.S. assistance could enhance Russia's military capability; this applies to several Northern Fleet MPC&A sites because many of these facilities are operational (U.S. GAO 2003).

The absence of a joint strategy and a set of agreed-upon goals to guide Russian and American cooperation in addressing the threat of fissile material diversion further impedes accelerated cooperation. Whereas the original CTR program was carried out by the U.S. DOD and the Russian MOD with agreed-upon goals embodied in arms control agreements (Wehling 2001), the scope of current programs and the number of governmental and civilian bodies involved have greatly expanded. In this more complex framework, the bureaucratic hurdles are greater and there is more room for confusion regarding the division of responsibilities.

Assessment of the U.S. Nonproliferation Agenda

Despite the successes of CTR and other nonproliferation initiatives, there still remains a great deal to be done in curbing the threat of accessible weapons-usable nuclear materials in Russia. As former Senator Sam Nunn pointed out, there is "very little protection for about 60 percent of the weapons material in Russia. That doesn't mean there's no protection; it means there's poor protection, and not the kinds of security standards that we would even think about tolerating here" (PBS 2001). Referring to Nunn-Lugar, President Bush declared in February 2004, "[w]e're helping former Soviet states find productive employment for former weapons scientists. We're dismantling, destroying, and securing weapons and materials left over from the Soviet WMD arsenal.... We have more work to do" (Bush 2004).

The question is thus whether the pace of U.S. nonproliferation efforts has been adequate to secure Russia's nuclear materials before they get into the hands of terrorists and rogue states. In the 2004 presidential debates, both presidential candidates identified weapons of mass destruction in the hands of terrorists as the country's most pressing security concern. Yet heightened concern since the terrorist attacks of September 11, 2001 has not been adequately translated into increased action. After the attacks, the Bush administration expressed intent to accelerate the MPC&A effort. However, since then, rapid upgrades have been completed for only an additional 9 percent of Russia's potentially vulnerable nuclear material, while comprehensive upgrades have been completed in only an additional 2 percent of vulnerable sites (NTI 2004e).

In the 2004 budget proposal, the Bush administration requested $1.3 billion for U.S. DOE's nuclear security and proliferation programs—the largest single request for nonproliferation funding in U.S. history. This figure was increased to $1.5 billion in the fiscal year 2005 budget proposal. Neither request comes close, however, to the tripling in spending recommended by many nonproliferation experts. A 2001 U.S. DOE report card on U.S. nonproliferation programs in Russia called for $3 billion annually to address the Russian nuclear threat (U.S. DOE 2001). Moreover, not all of the funding allocated to U.S. DOE goes to nonproliferation programs in the FSU; some goes to domestic programs such as fissile material disposition and various Homeland Security initiatives (CDI 2004).

President Bush described in February 2004 a key initiative to include the expansion of Nunn-Lugar programs. Yet on February 16, 2004, the administration cut funding for U.S. DOE's MPC&A programs from $259 million in 2004 to $238 million in the fiscal year 2005 budget request (Cirincione 2004). Funding for several programs aimed at curbing the nuclear threat from the former Soviet Union were reduced or cut entirely. *New York Times* columnist Nicholas Kristof pointed to the questionable logic behind such cuts at a time when the bipartisan program to secure weapons of mass destruction is already underfunded. Kristof called it a "puzzle" why "an administration that has spent hundreds of billions of dollars in Iraq doesn't try harder to secure uranium and plutonium in Russia and elsewhere" (Kristof 2004).

The 2006 U.S fiscal budget request similarly marginalizes threat reduction programs in Russia. While the 2006 budget request represents an increase of some $130 million over the 2005 budget for global threat reduction programs and a net increase in funding for enhancing nuclear security in Russia, there are "ill-advised cuts proposed for key nuclear material security…" (Hoehn 2005). For instance, $343.3 million was requested for the MPC&A programs, a 17 percent increase from the 2005 request. However, within the MPC&A budget, increases in funding would be provided primarily for projects outside the FSU, while some Russian activities would be cut (Hoehn 2005). Programs to ensure the sustainability of MPC&A programs were cut by $11 million.

The 2006 budget provides for the largest increase in military spending since the Reagan administration, up some 40 percent since 2001 (U.S. Office of Management and Budget (OMB) 2005). Nevertheless, nonproliferation initiatives remain "the stunted pillar in the administration's three-part strategy to combat weapons of mass destruction" (CEIP 2004). The approximately $1 billion spent on threat reduction programs represents a mere one-third of 1 percent of the total U.S. defense budget (Bellona 2004f). Nunn-Lugar and related threat reduction programs are not only inexpensive in comparison to other defense programs, but "spending in this kind of far-sighted defense measure may end up saving Americans billions of dollars and much future grief" (*Boston Globe* 2004).

There has been significant progress in securing Russia's nuclear materials, much of which can be attributed to CTR and other nonproliferation initiatives, but there remains a long road ahead. It would be appropriate at this point in time for both the current administration and the departments involved in carrying out the programs to pause and consider the long-term objectives of the threat reduction and nonproliferation programs, as well as the most effective means for achieving those ends. The experience of U.S. DOE with the Northern Fleet offers insight into the strategies that have made the naval programs a relative success, while bringing into focus with renewed urgency the remaining work to be done in securing Russia's arsenal of nuclear materials. The path that should now be taken must reflect lessons learned from past successes and failures, and most of all, embody a greater understanding of the root causes of the factors that impede greater cooperation.

Policy Recommendations

Emphasize Russia's stake in the game: Greater focus must be placed on making it clear to the Russians that nonproliferation is a global goal in which their stake is high. A terrorist could use fissile materials from the Russian complex to set off an explosion in Moscow as easily as in

New York or San Francisco. As one analyst put it, the "missing ingredient in these programs is a concerted, high-level effort to change the Russian preference structure, and to create a greater commitment to enhancing nuclear security" (Allison et al 1996, 9).

Resolve issues of cooperation, transparency, and access: Strong support has been expressed for the CTR goals at the highest levels of government, yet reports still indicate that Russian officials have been uncooperative and American officials have been denied access to key sites. The United States must insist on verifying that measurable progress has been made in the programs it funds, but should be more willing to compromise on issues of access and transparency, and instead focus on nurturing relationships that will lead to greater cooperation on these issues. The experience of U.S. DOE with the Russian Navy should set a precedent for establishing the relationships that lead to greater cooperation.

Pursue engagement on an individual level: To the extent possible, the CTR program must engage the Russians on an individual level. The CTR and nonproliferation projects that have been most successful are those that have directly involved the individuals working with nuclear materials, and provided them with future opportunities. The success of the MPC&A programs in the naval realm is a testimony to the fact that strong ties among individuals are a key to effective nonproliferation programs. Whereas most MPC&A program personnel are rotated annually, those working on naval projects are on long-term assignments (Wehling 2001), allowing personal relationships to develop that imbue a greater sense of trust and openness between the two parties. Personal engagement increases the involvement of Russians in the CTR programs, making them much more sustainable in the long-term, and also sets the stage for the eventual Russian takeover of the CTR initiatives.

Focus on accounting and long-term sustainability of security upgrades: The physical aspect of a national safeguards system is highly valuable, but the MPC&A programs should now do more to strengthen material accounting and human responsibility. As of yet, there is no plan to provide the "incentives, resources, and organizational arrangements for Russia to sustain high-levels of security" (NRC 2001). Measures must be taken to ensure that the MPC&A programs are sustainable in the long-term. Furthermore, programs should prioritize the creation of a national or site-specific fissile material inventory.

Address the human factor: CTR programs have been successful in improving the lives of many former weapons scientists and experts in the closed nuclear cities to reduce their incentives to market their expertise abroad. Likewise, the economic situation and opportunities of all individuals working with nuclear materials must be enhanced to reduce the likelihood that they will resort to material diversion.

The case of the Northern Fleet demonstrates that economic difficulties are at the heart of the fissile material diversion threat. When the Navy must choose between using its funds to pay for the maintenance of vessels in service, pay the salaries of its employees, decommission and dismantle retired vessels, and ascertain tight security over nuclear materials, it is likely to do so in that order. The economic position of the service people and officers in the Northern Fleet must be improved to ensure that the MPC&A programs initiated at naval facilities will be effective. If the Navy is unable to sufficiently compensate its employees, the threat of material diversion will consistently threaten to undermine even upgraded security.

U.S. policy thus far has not done much to improve the living standards of the individuals working with nuclear materials and it is increasingly hard to spend U.S. tax dollars on any efforts to do so (NRC 2001). The political will must be found to address the threat in its entirety. Congress should view the CTR and other nonproliferation initiatives not as a tax burden, but as a security investment.

Reassess the scope of the problem and the means to address it: The scope of the work to be done in securing fissile materials in Russia is now understood to be substantially greater than was originally thought; in addition, the "projected completion of the initial security upgrades and material consolidations have been delayed by many years and planned schedules are now unacceptably stretched out" (Bukharin, Bunn, and Luongo 2000). U.S. strategy should be reassessed in order to ensure that current policies and levels of funding are sufficient. There are numerous bureaucratic and political inefficiencies that must be addressed before greater funding will be most useful. Funding should be allocated in greater sums to those programs that are able to absorb and effectively utilize such increases. Additional funding would be appropriate for the MPC&A programs, as U.S. DOE's original mandate has expanded to include new projects. A long-term U.S. strategy should be developed that provides several future options based on varying levels of progress in overcoming current obstacles.

The Russians must likewise devise a detailed timeline, including planning for a larger financial burden commensurate with their capability to pay. The United States and Russia should develop a joint strategy that focuses on the attainment of common threat reduction and nonproliferation goals. Clear, common goals would serve to increase the efficiency of program implementation.

Enlist greater international participation: The involvement of the international community is essential at this point, both for financial assistance and in resolving issues that have stemmed from a primary U.S. role. The Global Partnership Against Weapons of Mass Destruction, initiated at the 2002 G-8 Summit in Kananaskis, Canada, is a step in the right direction. The centerpiece of this agreement is the 10+10 Over 10 Program, in which the United States will provide $10 billion over ten years to sustain the existing threat reduction programs in Russia, while the other G-8 countries will commit a combined total of $10 billion over ten years. Russia has pledged $2 billion for nonproliferation programs. Issues of taxes and liabilities must be overcome, and actual funding should back these pledges.

Conclusion

The collapse of the Soviet Union altered not only the world political structure, leaving the United States as the sole global superpower, but removed the threat that had shaped the foreign policy agenda for over seventy years. For the duration of the Cold War, the United States was engaged in a superpower rivalry characterized by a strategy of mutually assured destruction with a clearly defined, rational enemy. The events of September 11, 2001 tragically illustrated that the very nature of power and character of threats have been redefined. The threats that challenge us today are indeed less clearly defined and more difficult to address than those of the past.

As George W. Bush stated, "[t]here is a consensus among nations that proliferation cannot be tolerated. Yet this consensus means little unless it is translated into action. Every civilized nation has a stake in preventing the spread of weapons of mass destruction" (U.S. DOS 2004). The United States must consistently question the degree to which its policies are achieving these goals. The experience of U.S. DOE with the Russian Navy in implementing security systems illustrates that a great deal can be done to secure Russian fissile materials. The initiatives undertaken at these naval facilities are far from assuring complete security over Russia's arsenal of nuclear materials, yet serve as a model for securing the remaining stockpiles.

The political will must be found to address the Russian nuclear threat in its entirety. Averting the threat of fissile material diversion requires more than installing physical safeguards; an effective safeguards program must take into account the long-term sustainability of a security system. Such sustainability is fundamentally based on a stable political, social, and economic foundation in which the incentive for individuals to resort to nuclear theft is minimized.

As the United States and the Soviet Union were partners in the build-up of vast nuclear arsenals, the United States and Russia must now partner in deconstructing these arsenals. Together, they must work to assure that the nuclear legacy of the Cold War does not become the nuclear weapon that threatens their security today. As the evidence presented in this paper illustrates, it is clearly in the U.S. national interest to address the threat of nuclear proliferation at the source. The Nunn-Lugar program has accomplished a great deal in curbing the proliferation threats born of the Soviet collapse, yet its mandate is far from complete. An enlightened U.S. policy would treat the danger of fissile material diversion as the pressing national security concern that it is. That means active and committed engagement with Russia and the former Soviet states in addressing the source of fissile material diversion—which is overwhelmingly the economic and social conditions that lead the individuals working with these materials to resort to nuclear theft. Stated commitment to nonproliferation goals must be translated into robust action. As Joseph Cirincione of CEIP aptly stated, "[W]e're at this crucial point … and how we handle these situations in the next couple of years will tell us whether the nuclear threat shrinks or explodes—literally" (Kristof 2004).

Notes

[1] The author would like to acknowledge the invaluable support and mentorship of Dr. Daniel Chirot, Amb. Thomas Graham, Dr. Christopher Jones, Dr. Vladimir Kaczynski, and Dr. Victor Sosnin in drafting this paper.

[2] In a vast reorganization of the Russian government in May 2004, the Ministry of Atomic Energy (Minatom) was replaced with the Russian Federal Agency for Atomic Energy (FAAE). It is still unclear what the exact effects of these changes will be on Nunn-Lugar and other related U.S. nonproliferation programs in Russia, to be discussed later in the paper. The FAAE now controls most of the nuclear materials outside the weapons complex, is responsible for material control and accounting, and oversees the naval fuel cycle (NTI 2004e).

[3] U.S. DOE also implements the Initiative for Proliferation Program (IPP), intended to persuade Russian nuclear scientists and engineers from seeking employment in other countries. The Nuclear Cities Initiative (NCI) further seeks to curb the temptation of Russian scientists and engineers to sell knowledge to states or groups seeking nuclear weapons by bringing commercial enterprises to closed nuclear cities. The HEU Purchase Agreement is a commercial undertaking that provides financial incentives to dismantle thousands of Russian nuclear

warheads and render the material in those warheads impotent for future weapons use. The Plutonium Disposition program is intended to dispose of thirty-four metric tons of excess weapons plutonium. Additional programs aim to address Russia's arsenals of chemical and biological weapons.

[4] The International Atomic Energy Agency (IAEA) sets the amount of weapons-grade material required to construct a nuclear bomb at 8 kg. of plutonium or 25 kg. of highly-enriched uranium, yet other analysts maintain that one kiloton yield-pure fission nuclear weapons can be made with amounts that are approximately eight times smaller than the IAEA threshold (NRDC 2004).

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