PROTECTING AGAINST THE SPREAD OF NUCLEAR, BIOLOGICAL, AND CHEMICAL WEAPONS

PROTECTING AGAINST THE SPREAD OF NUCLEAR, BIOLOGICAL, AND CHEMICAL WEAPONS

AN ACTION AGENDA FOR THE GLOBAL PARTNERSHIP

Volume 2: The Challenges

Project Directors
Robert J. Einhorn
Michèle A. Flournoy

Principal Project Sponsor
Nuclear Threat Initiative,
Washington, D.C.

January 2003

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This publication has been principally supported with funds from the Nuclear Threat Initiative. Its contents represent the views, findings, and opinions of the authors and are not necessarily those of the Nuclear Threat Initiative.

Library of Congress Cataloging-in-Publication Data

Protecting against the spread of nuclear, biological, and chemical weapons : an action agenda for the global partnership / project directors, Robert J. Einhorn, Michèle A. Flournoy.
p. cm.—(CSIS report)
Includes bibliographical references.
Contents: v. 1. Agenda for action—v. 2. The challenges—v. 3. International responses—v. 4. Russian perspectives and priorities.
ISBN 0-89206-418-8 (set : alk. paper)—ISBN 0-89206-419-6 (v. 1 : alk. paper)—
ISBN 0-89206-420-X (v. 2 : alk. paper)—ISBN 0-89206-421-8 (v. 3 : alk. paper)—
ISBN 0-89206-422-6 (v. 4 : alk. paper)
1. Arms control. 2. Weapons of mass destruction.
I. Einhorn, Robert J. II. Flournoy, Michèle A. III. Center for Strategic and International Studies (Washington, D.C.) IV. Series.
JZ5665.P76 2003
327.1'745—dc21 2002155212

The CSIS Press
Center for Strategic and International Studies
1800 K Street, N.W., Washington, D.C. 20006
Telephone: (202) 887-0200
Fax: (202) 775-3199
E-mail: books@csis.org
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About the Project

Since the end of the Cold War, the United States, Europe, and others have worked with the successor states of the Soviet Union to account for, secure, and dismantle nuclear, biological, and chemical weapons, agents, materials, and infrastructure, as well as to help former weapons scientists and specialists reintegrate into civilian work. In large part, these programs have been successful, but there is much unfinished business.

In June 2002, leaders of the Group of Eight (G-8) nations announced a global partnership against the spread of weapons and materials of mass destruction. In the words of former U.S. senator Sam Nunn, "This global partnership represents a major step in the right direction in terms of how the United States and its partners and allies must work together to prevent dangerous groups from gaining control of the most dangerous materials—materials that could be used to carry out catastrophic terrorism."

The project—Strengthening the Global Partnership: Protecting against the Spread of Nuclear, Biological, and Chemical Weapons—seeks to reinforce and expand upon the objectives of the G-8's Global Partnership against the Spread of Weapons and Materials of Mass Destruction, by advancing support in Europe, Asia, and North America for assistance programs aimed at reducing the threats posed by nuclear, biological, and chemical weapons and materials.

Over the last year, CSIS has led a consortium of 15 influential policy research organizations in Europe, North America, and Asia as part of a three-year project, sponsored by the Nuclear Threat Initiative (NTI), aimed at strengthening future threat reduction efforts. The consortium has concluded a major assessment, published here, that identifies shortfalls and lessons learned from existing threat reduction programs; recommends future programmatic objectives; and proposes how best to accomplish the remaining tasks.

Based on the findings and recommendations of this study, during the second phase of the project, consortium partners will actively reach out to key constituencies—government officials, parliamentarians, journalists, scholars, and other opinion leaders—to promote governmental and public support for the goals outlined by the G-8 in June 2002 and, in particular, to ensure that the Global Partnership's ambitious funding target ($20 billion over 10 years) is met.

This four volume set, entitled *Protecting against the Spread of Nuclear, Biological, and Chemical Weapons: An Action Agenda for the Global Partnership,* is designed to assist the reader in assessing threat reduction programs to date and identifying priorities for the future. The assessment consists of four volumes:

Volume 1: Agenda for Action
Volume 2: The Challenges
Volume 3: International Responses
Volume 4: Russian Perspectives and Priorities

For more information on the project, please visit our Web site at <http://www.csis.org/isp/sgp/index.htm>

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CHAPTER 1

The Brain Drain Problem

Victor Alessi
United States Industry Coalition

The Setting

The American delegation entering St. Catherine's Hall in the Kremlin in late July 1991 had every reason to be happy, relieved, and proud. They had come to Moscow for the signing of the START I treaty. The treaty, which took nine years to negotiate, was the crown jewel of arms control and the symbol of a new era in U.S.-Soviet relations—a sign that the two superpowers could finally come to terms with the nagging issue of strategic nuclear weapons and begin actual reductions.

The United States saw President Mikhail Gorbachev as the long-awaited Soviet leader with whom the United States could do business. He was to be the person who would transform the Soviet Union into a nation that would no longer seek confrontation with the West, but peaceful interaction. And despite compelling evidence that *perestroika* was not working and that *glasnost* had opened a hornet's nest of dissatisfaction and criticism of the government, the situation seemed manageable. U.S. leaders still believed that the Gorbachev approach would eventually lead to a more benign, friendly, peaceful, and prosperous Soviet Union. In fact, President George H. W. Bush was to go immediately from Moscow to Kiev on a mission to persuade the Ukrainian Rada, its parliament, not to seek separation from the Soviet Union. Quite simply, not one American in that room, from the president on down, suspected that the Soviet Union would shortly implode.

The confidence and hope that filled St. Catherine's Hall were shattered only three weeks later by the arrest of President Gorbachev in a coup led by members of the Supreme Soviet. The perpetrators included many of those who sat with their U.S. counterparts, applauding the signing of START I. Suddenly, the U.S. attitudes toward the Soviet Union were hopelessly out of date. Although the coup failed within days, the Soviet Union began to spiral into oblivion. Gorbachev's frenzied efforts to hold the union together proved futile, as the Baltic States declared independence, followed by Ukraine, and then the other republics. Four months later, the Soviet Union was no more.

No one was prepared for the Cold War's quiet end. The effects of slow Soviet economic decay, which had been underestimated, if not missed altogether, during the years of confrontation, now became alarmingly evident as 15 former Soviet republics began new political lives. The ruble and its derivative currencies in non-Russian republics plummeted. Workers, as well as officials, went unpaid for months at a time, only to receive back wages in disastrously devalued currency. This included the military and those scientists who had once been responsible for the Soviet nuclear arsenal. The United States worried about revolution and terrorism, especially in Russia where many thousands of nuclear warheads were held.

The seriousness of the situation prevented any celebration of the Soviet demise, or self-congratulation by the United States and its allies. Instead of a powerful Soviet Union, the West was confronted by a weak and struggling Russia. Hopes for lasting peace and stability gave way to widespread fear that former Soviet nuclear weapons, materials, and expertise could fall into the hand of terrorists, revolutionaries, or proliferant nations because the individuals entrusted with their stewardship could no longer support themselves.

Getting Started after the Soviet Collapse

Almost immediately after the August 1991 coup, the U.S. nuclear weapons laboratories (Lawrence Livermore, Los Alamos, and Sandia) started receiving reports of Soviet (and soon to be former Soviet) nuclear weapons scientists becoming more desperate as month after month passed by without pay. The U.S. scientists had established a close working relationship with their Soviet counterparts during the Joint Verification Experiment[1] and the subsequent negotiations on the Threshold Test Ban Treaty and Peaceful Nuclear Explosion Treaty. These exchanges had led to periodic communications between the laboratories of both sides as they worked together to prepare for the intrusive inspection regimes they had negotiated to verify compliance with the terms of those treaties.

In late 1991, scientists at the U.S. weapons laboratories asked for authorization from the U.S. Department of Energy (DOE) to establish a laboratory-to-laboratory channel of regular interactions in order to learn more about the internal economic situation at the Russian nuclear weapons institutes, assess whether there were any signs of selling secrets or expertise in order to pay bills, and seek ways to help their Russian counterparts manage their difficult circumstances. The Department of Energy passed the request to the National Security Council (NSC) staff, which gave its approval in early 1992. Within days, the laboratory-to-laboratory program began.[2]

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1. The Joint Verification Experiment (JVE) involved underground nuclear tests at the Nevada test site and at a Soviet test site near Semipalitinsk in Kazakhstan. During these tests, each part demonstrated its preferred method of monitoring the yield of underground nuclear explosions to improve the verifiability of the Threshold Test Ban Treaty (TTBT) and Peaceful Nuclear Explosion Treaty (PNET). These two tests were also noteworthy in that they permitted the presence of large numbers of each side's nuclear weapons scientists at the test site of the other side, a dramatic departure from Cold War practices of extreme measure of secrecy accompanying nuclear tests.

2. The ground rules for the laboratory-to-laboratory discussions were laid out in an internal State and Energy Department agreement.

One objective of this deliberately low-key effort was to encourage former Soviet nuclear weapons scientists to stay in Russia where they could contribute to their country's economic future. The United States feared that hopelessness would lead the Russian nuclear weapons scientists to emigrate from Russia to countries seeking to acquire weapons of mass destruction (WMD). The NSC staff approval of these laboratory-to-laboratory interactions also permitted the U.S. laboratories to provide limited assistance to head off any serious problems in the Russian nuclear weapons program that could lead to an inability to safeguard the weapons, materials, and nuclear secrets. However, with no budget for this program, the U.S. laboratories were expected to fund this self-initiated effort out of their existing programs.

The initial laboratory-to-laboratory program was essentially an effort by U.S. scientists to help their Russian counterparts on a small scale, case-by-case—and often individual—basis. But the size and scope of the problem quickly became apparent and greatly exceeded previous estimates. Experts feared a potential mass exodus of scientists, engineers, and technicians from the entire former Soviet WMD complex (biological, chemical, in addition to nuclear weapons). Although the extensive U.S.-Russian laboratory interactions had helped the United States identify immediate needs through which the United States could assist Russia in downsizing, consolidating, and protecting its nuclear weapons arsenal, it was clear that the temporary, stop-gap, laboratory-to-laboratory program was not equipped to deal with a problem of this magnitude. In what looked like a growing period of political and economic instability, a more ambitious program involving the broader resources and talent of the U.S. government would be needed to provide incentives for former Soviet weapons scientists to work at home and not seek employment from or in countries of concern. The situation was made more difficult by the mingling of weapons and peaceful nuclear programs in the newly formed Russian Ministry of Atomic Affairs (MINATOM).[3]

In the United States, the huge and growing budget deficits of the early 1990s made it politically difficult for the Bush administration to propose a costly program to ease the serious economic crisis in the former Soviet Union (FSU). Fortunately, influential members of the U.S. Senate were following the situation closely. Senators Sam Nunn (D-Ga.) and Richard Lugar (R-Ind.) proposed a bill to provide assistance aimed at reducing the proliferation and terrorist threat posed by the Soviet collapse and to expedite the START I nuclear arms reductions by absorbing the costs of reducing the former Soviet strategic stockpile.

The Nunn-Lugar bill was passed by the U.S. Congress in early 1992, yet the U.S. executive branch was caught off guard. Since no such funds had been included in the administration's proposed budget, there was no formal program or plan for spending the congressionally appropriated money. The Department of Energy

3. Viktor Mikhaelev, the first director of MINATOM, the Russian agency responsible for nuclear power and weapons, spoke of his responsibility for approximately 1 million employees. Of course, not all had skills applicable to nuclear weapons, but the size of the Russian nuclear complex was beyond what the United States had expected upon the collapse of the Soviet Union. There were thousands of others in Kazakhstan, Ukraine, and Belarus where Soviet nuclear weapons were deployed, as well as in other republics of the former Soviet Union.

seized the opportunity afforded by the Nunn-Lugar legislation and turned to its nuclear weapons laboratories for ideas. The already existing laboratory-to-laboratory interactions had allowed U.S. scientists to make first-hand assessments of the problems facing Russia. Within days, U.S. scientists proposed a number of initiatives to help address congressional concern that Russia would become a massive source of nuclear weapons proliferation.[4]

Working groups were promptly formed around the laboratory ideas, and the Bush administration was able to respond quickly to the Nunn-Lugar initiative. The principal players for the United States were the Departments of Energy, Defense, and State, and the then-independent Arms Control and Disarmament Agency. The overall diplomatic effort, named Safe Secure Dismantlement (SSD), was headed by the State Department, with deputies from the Defense and Energy Departments.[5] This evolved *inter alia* into the Department of Defense's Cooperative Threat Reduction (CTR), which has since played a major role in helping Russia downsize its nuclear weapons forces in accordance with the provisions of the START I treaty. Other important offshoots of this initial effort were the Department of Energy's material control and accounting program—later to become the material control, protection, and accounting (MPC&A) program—and the science and technology center programs sponsored by the Department of State.

Coping with the Problem

The initial Nunn-Lugar programs were focused on securing existing nuclear weapons and materials rather than on the potential threat of scientists leaving Russia for dangerous countries in order to support themselves and their families. Yet as a consequence of the growing number of government-to-government interactions to implement the SSD program, and through continuing laboratory-to-laboratory interactions, reports poured in on the sad state of the Russian nuclear weapons institutes and the desperate circumstances of their scientists—especially those living in the 10 closed nuclear cities where alternative employment was not even feasible.

This bad news was coupled with disturbing developments elsewhere in the world. The conflict with Iraq in the year before the Soviet collapse had awakened the world to the sobering prospect of weapons of mass destruction falling into the hands of rogue states. The United Nations inspections following Desert Storm

4. The laboratories proposed seven initiatives: (1) discussion on responding to nuclear weapons accidents; (2) provision of containers for transportation and storage of plutonium and uranium; (3) provision of container and Kevlar blankets for the transportation of nuclear weapons; (4) provision of safe and secure railcars for transporting nuclear weapons from deployment areas to storage areas where they would be consolidated; (5) construction of a storage facility for nuclear components and fissile materials; (6) establishing a system of accounting and control for Russian nuclear material; and (7) discussion on the disposition of highly enriched uranium and plutonium from dismantled nuclear weapons.

5. The first head of these talks was William Courtney from the State Department, later to become ambassador to Kazakhstan and Georgia. He was followed by Maj. Gen. William Burns (ret.) and finally by Ambassador James Goodby, also from the Department of State.

uncovered large-scale attempts by Iraq to develop the entire suite of weapons of mass destruction—nuclear, chemical, biological, and the missile programs to launch them—that were much more advanced than anticipated. Iran appeared to be seeking the same capabilities. North Korea's dangerous nuclear program was just emerging into the international political eye. The prospect of thousands of weapons designers, testers, technicians, and fabricators from the former Soviet Union flooding the world markets out of personal financial hopelessness raised the new threat of potential proliferants and terrorists able to quickly and easily purchase the necessary talent.

The United States set about a structured approach to solve this potential "brain drain" problem under the leadership of the Department of State. Ten years later, the United States and its allies can be proud that brain drain programs have made some genuine progress and, at a minimum, prevented a massive exodus of talented weapons scientists to dangerous countries.

At the same time, it is clear that, although some programs have been more successful than others, all have had to deal with serious obstacles—especially an entrenched officialdom that has continued to hold important intermediary positions in the new republics, particularly Russia. All the brain drain efforts were begun in the hope that they would succeed within several years. Most experts assumed that the former Soviet bureaucracy would diminish over time as the programs became successful. In fact, the opposite has occurred. The cultural, bureaucratic, and economic problems that were present when the Soviet Union collapsed have lingered as Russia, for example, tries to make a transition to democracy and capitalism in a continuing environment of bureaucracy, cronyism, and corruption.

This chapter highlights three programs that have to a large extent succeeded or are expected to succeed soon.

- The Science Centers: The International Science and Technology Center (ISTC) in Moscow, Russia, and the Science and Technology Center in Kiev, Ukraine (STCU), administered for the United States by the State Department;
- The Initiatives for Proliferation Prevention (IPP), administered by the Energy Department; and
- The Nuclear Cities Initiative (NCI), also administered by the Energy Department.

All three overlap to some degree, but each plays a distinctive role.

The oldest of these—the Science Centers program—has funded and continues to fund scientific research and development (R&D) projects for many thousands of weapons scientists. This chapter focuses on the ISTC in Moscow, although much of it applies to the SCTU as well.[6] The IPP, which also supports thousands of scientists, begins largely where the Science Centers end, by working to commercialize already

6. The STCU in Kiev, although such smaller than the ISTC, has been very effective and less bureaucratic. The STCU provides former weapons scientists and engineers in Ukraine, Uzbekistan, and Georgia opportunities to redirect their talents to peaceful purposes in the same way the ISTC does for its participating former Soviet republics.

completed R&D. The newest program, NCI, focuses on the closed MINATOM cities, especially the three largest—Sarov, Snezhinsk, and Zheleznogorsk.

Other successful programs worth noting, although not as strictly focused on the brain drain problem among weapons scientists, include the U.S. Civilian Research and Development Foundation (CRDF), the NATO Science Program, and the INTAS (International Association for the Promotion of Cooperation with Scientists from the Newly Independent States of the Former Soviet Union) program of the European Union (EU).

Like the ISTC, the CRDF supports research projects that offer scientists and engineers the opportunity for work in the former Soviet Union. To a lesser degree, it is assisting those doing applied research in bringing their work to the marketplace. The NATO Science Program supports collaboration among scientists from countries of the Euro-Atlantic Partnership Council. This includes former–Warsaw Pact countries and former Soviet republics, whose scientists collaborate with scientists in NATO countries. INTAS supports partnerships between scientists of the European Community and the former Soviet Union. Each of these three has been important in supporting unpaid scientists from the former Soviet Union and in encouraging excellence in science from the Newly Independent States (NIS).

The ISTC

To deal with the unexpected problem of unpaid or underpaid scientists, engineers, and technicians in the NIS, the United States turned to several of its closest allies to explore the formation of a science center in Moscow to support peaceful research projects by weapons scientists. Germany enlisted the support of the EU. Japan was quick to come on board. By spring 1992, the United States, Russia, the EU, and Japan were negotiating the terms of agreement for establishing an international science and technology center (ISTC) in Moscow.[7] The center's primary objectives were to

- give weapons experts in the former Soviet Union the opportunity to redirect their talents to peaceful scientific activities;
- support basic and applied research and technology development;
- familiarize former Soviet weapons scientists with the standards and procedures of the international science community; and
- help solve national and international science and technology problems such as environmental restoration and arms control verification.

These four-party negotiations of the ISTC agreement were completed by fall 1992, and preparations were soon under way to begin operations. Unfortunately, President Boris Yeltsin was, by that time, caught in an escalating conflict with the Russian Duma, the lower house of parliament. The Duma, still dominated by Com-

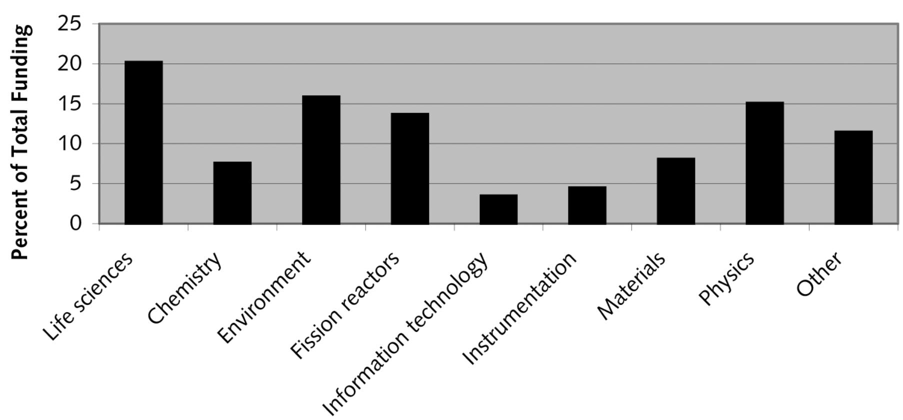
7. As noted earlier, this chapter focuses on the ISTC in detail. The author notes that the STCU has followed a similar route, although on a smaller scale.

munists, resisted any agreements with the West, especially involving the United States, and thus refused to ratify the ISTC agreement.

Despite this parliamentary roadblock in Russia, the ISTC signing partners moved forward to organize the center and to assign staff. The parties agreed that the United States would furnish the first executive director and the other signatories would provide deputy directors. The EU would assume the chairmanship of the ISTC's board of directors. The funding partners—the United States, the European Union, and Japan—worked with MINATOM, the implementing ministry for Russia, to find suitable space. Administrative preparations were begun and implementation procedures were drafted. The new executive director and his staff set about collecting and reviewing project proposals that could be funded once the ISTC agreement was ratified. This period of preparation lasted until the Yeltsin-Duma feud came to a violent head in late 1993 and the Duma was disbanded. Soon after, the Russian government approved the opening of the ISTC,[8] and the center officially began operations in March 1994.

The center got off to a quick start at its first board of governors meeting by approving a large number of research projects that had already been screened and reviewed. The ISTC was immediately able to put thousands of scientists to work. Today, it supports more than 21,000 scientists and engineers[9] working on hundreds of projects in Russia, Georgia, Armenia, Kazakhstan, Belarus, and the Kyrgyz Republic. Figure 1.1 indicates the various areas of research supported by the center.

Figure 1.1. ISTC Funding by Technology Area



Source: ISTC, *Annual Report 2000*.

The center's success since 1994 is the result of an extraordinary degree of international collaboration and cooperation. The founding partners have been joined by

8. However, the ISTC agreement has not yet been ratified by the Russian Duma, although the center recently was granted international diplomatic status in Russia.

9. This is in addition to those supported at the STCU in Kiev.

new members, including Norway, South Korea, Armenia, Belarus, Georgia, Kazakhstan, and the Kyrgyz Republic.

The Moscow-based staff, although largely Russian, is composed of experts from all member countries. The ISTC has been multilateral from top to bottom—in its governing board, its secretariat, and its scientific advisory board. The United States, for its part, has contributed scientists and financial experts over the years to ensure that the center had the professional competence to effectively meet its goals.

All projects must be approved by consensus at meetings of the ISTC Board of Governors (usually three a year). Each project must meet high scientific standards, involve mostly WMD scientists or engineers, and meet the goal of preventing proliferation. The ISTC approval process validates the technical worth of a proposed project, certifies how many of the personnel involved are weapons scientists, and ensures that the project does not pose dangerous dual-use problems.

The founding partners vote to approve or disapprove each proposed project, even though an individual project is ordinarily funded by only one or two parties. Any project funded by the ISTC must also be acceptable to the country where the research will be performed.

Each country has its own method for evaluating the worth of ISTC proposals. U.S. involvement in the ISTC is managed by the State Department, which scans every project to ensure proper preparation by the ISTC staff. Projects are then circulated for review and evaluation by other U.S. agencies and rated as to suitability for U.S. funding. The U.S. review parallels the ISTC process: proposals are evaluated for scientific merit, consistency with U.S. nonproliferation policy, involvement of weapons scientists, and potential for practical application of the project (with an eye toward eventual commercialization or application to "real-world" challenges such as the environment and arms-control monitoring).

Technical reviews are managed by a team of science advisers, primarily from DOE's national laboratories, who in turn, circulate the proposals to experts in relevant fields. Reviews are collected and collated by the laboratory advisers who rate them from a technical perspective. Even on cofunded projects, the United States requires a significant percentage of the participants to be weapons scientists. The United States, however, does not require that all the scientists on a project have expertise in WMD. Non-weapons scientists are often welcome for providing expertise in areas that will help weapons scientists make a transition to peaceful research.

The nonproliferation policy review is conducted by those agencies usually involved in related issues such as export-control and dual-use regulation. The Russian or NIS institute proposing the research is also reviewed to ensure that it is conducting its overall activities in a manner consistent with U.S. nonproliferation goals. When all reviews are completed, the State Department establishes priorities for funding and instructions are issued to the U.S. ISTC delegation.

Once a project has been approved by the ISTC governing board, procedures for implementing the project are negotiated between the ISTC and the appropriate institutes. After the project begins, the ISTC pays the scientists directly by depositing their salaries into individual bank accounts. A typical project lasts about 30 months. The ISTC and the funding parties conduct periodic inspections to ascertain that the work is being performed as agreed and that money is being spent properly.

Sample ISTC Project: Decommissioning Nuclear Submarines

Decommissioned nuclear-powered submarines pose a dangerous threat to the environment until their nuclear materials are properly removed and stored. Russia alone had approximately 180 decommissioned nuclear submarines, but it lacked the resources to properly manage their decommissioning.

ISTC Project #0968 supported 135 team members, including 106 former weapons scientists, as they investigated new technologies for cutting apart submarine hulls and their internal equipment and for handling and transporting the submarine radioactive materials to safe disposal areas.

Following specialist training in Great Britain and France, a new private company in Russia is leading this study. The company is also creating a regional center for ecologically safe nuclear submarine recycling and is developing contracts with a Norwegian firm for the storage of liquid and solid radioactive wastes.

Source: ISTC, *Annual Report 2000.*

The ISTC has been particularly successful in funding projects for nuclear weapons scientists. This should be no surprise, given the nuclear laboratory-to-laboratory interaction in early 1992. But as time passed and the United States became more aware of an equally troubling situation with regard to biological weapons scientists, the ISTC increased its support for such scientists. Much of this increased support has come through U.S. funding for the Partners Program, as well as through appropriated ISTC funds. For example, biotechnology accounted for almost 40 percent of new project funding in 2001. Chemical scientists have not been as well supported by the ISTC. However, their skills are much more readily transferable to peaceful applications and that sector of the former Soviet scientific world got off to a much quicker start in commercialization than the nuclear and biological weapons scientists.

The ISTC seems immune from many of the day-to-day irritations that plague other Russian programs. Difficulties are usually resolved quickly and amicably. Of course, the ISTC has a major advantage over other programs used by the United States for dealing with Russia. As an international organization, it is able to rise above the ups and downs of the U.S.-Russian relationship, even though the United States plays a major role in its operation. Thus, the ISTC escapes the Russian domestic political accusation that it is yet another U.S. initiative motivated by a desire to take advantage of a weakened and unstable Russia.

Generally, the policies and operations of the ISTC are characterized by collegiality.[10] Under the ISTC charter, all members provide some level of support to its activities. Russia provides office space (Armenia, Kazakhstan, and Georgia do the same for their branch offices) and most of the staff. Most direct support for the center and its projects comes from the United States, the EU, and Japan. Project funding is not subject to taxation or to high overhead support costs by the institutes. The scientists who perform R&D are paid directly by the ISTC, while the former Soviet republics absorb most of the support costs born by the participating institutes, such as health care and housing for the scientists. In short, the costs of running ISTC are shared in some fashion by all ISTC members, not just the three funding partners.

Each ISTC funding partner has its own priorities for supporting projects. As the largest funder, the United States has emphasized applied science over basic science in the hope that at least some of the projects will eventually be suitable for commercialization and thereby help create long-term employment for scientists, technicians, and engineers in the commercial high-tech world. The funding of projects by source is illustrated in table 1.1. Although the Partners Program is not identified by source, most of its funds came from U.S. companies or agencies.

Table 1.1. Funding for New ISTC Projects in 2001

Funding Source	Allocated Funds
European Union	$13,188,652
Japan	9,496,809
Korea	269,335
Norway	100,000
United States	21,423,172
Partners	30,767,201
Other	538,000
Total	$75,783,169

Source: ISTC, *Annual Report 2001*; <http://www.istc.ru/istc/website.nsf/html/01/en/data.htm>.

10. There are, however, occasional problems with the ISTC. These are tied more to internal Russian disputes than to the operations of the center itself. The ISTC, which started mostly to help the nuclear weapons scientists, has gradually increased its support to chemical and biological institutes. MINATOM, which provided office space and has generally overseen the Russian staffing of the center, has seen this broadening as a threat to the focus on nuclear scientists from MINATOM. Clearly, the internal clearance process within Russia needs to be broadened to other ministries. This problem has little to do with the United States.

Since the economic situation in the former Soviet Union did not recover as expected when the ISTC was first founded and, in fact, devolved further with the 1998 ruble crash, outside funding for WMD scientists will be needed for the foreseeable future. With strong U.S. backing, the ISTC has taken steps toward eventual creation of permanent and sustainable work for former weapons scientists—establishing the Partners Program in 1997 to join the competence and results of former Soviet institutes with the research and development strategies of commercial companies and public organizations of the ISTC parties other than their principal support agencies.

The Partners Program authorizes funding of ISTC projects by corporations, foundations, academic, or scientific organizations. By broadening the funding base and encouraging research with practical and marketable applications, ISTC is aiming to create sustainable jobs tied to the commercial world with less reliance on governmental funding and subsidies. The Partners Program now represents a significant portion of the overall ISTC program.

In 1994, the ISTC's principal goal was to keep weapons scientists at home doing peaceful research and away from weapons programs in countries of proliferation concern. The many thousands of scientists supported by the ISTC since its founding are testimony to the achievement of that goal. In 2000, more than 21,000 scientists on many hundreds of scientific projects were supported by more than $85 million from the ISTC. Another 313 projects were started in 2001. Although there is no absolute way to ensure that no scientists have been lured away by would-be proliferators, the ISTC program has provided immeasurable relief to what would have been overwhelming pressure on thousands of former Soviet scientists to seek their livelihoods in dangerous places—and has thus reduced what could have been a disastrous threat to the security of the United States and the rest of the world.

Initiatives for Proliferation Prevention

Despite the ISTC's immediate success, some members of the U.S. Congress felt the United States was moving too slowly in dealing with the post-Soviet proliferation threat and taking advantage of the historic opportunity to forge relationships with the emerging new republics. Senator Pete Domenici (R-N. Mex.), who exemplified members of this group, began a dialogue with U.S. business leaders and nuclear experts from the national laboratories to try to create business partnerships between U.S. companies and scientists in the four nuclear states of the former Soviet Union: Russia, Ukraine, Kazakhstan, and Belarus. A key part of the Domenici plan was to tap U.S. laboratory scientists to help identify and validate research and development in the former Soviet Union that would be suitable for joint commercial ventures. To this end, he sponsored legislation to create the Industrial Partnering Program and placed the program under the Department of Energy. IPP's title was later changed to Initiatives for Proliferation Prevention. The new title was more explicit about the important proliferation mission of the program, which was to create long-term, sustainable high-tech jobs for WMD personnel.

The IPP was launched in 1994 soon after the ISTC began operations. IPP defined commercialization as a three-tiered program. “Thrust 1” would consist of research and development aimed at creating commercially viable products. “Thrust 2” would focus on engineering the science and technology already proven in the R&D stage into commercial products. “Thrust 3” would emphasize the capitalization, manufacturing, and marketing of those commercial products.

To get the IPP off the ground quickly, the Department of Energy focused mostly on Thrust 1 projects. By starting there, DOE was able to draw on the established and close working relationships of the U.S. national laboratories with their former Soviet counterparts. Furthermore, focusing on Thrust 1 projects enabled DOE to support as many scientists as possible as quickly as possible, similar to the ISTC. It was difficult to distinguish IPP from ISTC projects at first, except for the more applied and practical bent in the IPP-selected projects.

In today’s global economy, however, the R&D of an IPP Thrust 1 or ISTC project is only the first step toward commercialization of a new high-technology product. Few R&D projects ever turn into marketable products unless they are sponsored from the beginning by a company that sees commercial potential in the endeavor. Most R&D in the scientific world is “pushed” by scientific curiosity—an essential element for the advancement of science but not the usual way in which technology is commercialized. Instead, successful technology commercialization is most often “pulled” from the scientific community by corporate interests, which see potential profits in specific applications of new technologies.

Since an eventual measure of success for IPP was not solely the amount of R&D supported, but rather the commercialization of science and creation of long-term employment in Russia, Ukraine, and Kazakhstan,[11] the program was expected to rapidly transition to Thrust 2 projects. To achieve this, IPP officials turned to private U.S. industry as partners.

The nonprofit United States Industry Coalition (USIC) was created in July 1994 to support the IPP program. USIC members are American businesses, large and small, with interests in commercializing science and technology in the former Soviet Union. USIC aimed to help support the IPP mission by

- matching technological developments with potential commercial development sources such as a company and/or investment bank;
- promoting industrial and commercial employment by facilitating corporate and financial investment in the territory of the former Soviet Union;
- redirecting the talent of former weapons scientists, engineers, and technicians to peaceful production and industry;
- creating a high-tech industry base in Russia and the other states that would help create prosperity and nurture democracy.

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11. Belarus is no longer emphasized because of the undemocratic and repressive political situation there.

The original cohort of USIC members included companies with well-established relationships with national laboratories and/or technology projects already under way in the former Soviet Union.

The early phase of IPP, when Thrust 1 projects were stressed, led to a broad engagement with institutes and scientists, helping to create the relationships and confidence necessary on both sides to take the next steps toward commercialization. It resulted in speedy employment of thousands of former Soviet scientists and engineers (in addition to those already supported by the ISTC) and helped deal with the immediate problem of employing those scientists until other measures could be brought into being. Unfortunately, this phase of stressing scientific R&D lasted too long, and the introduction of Thrust 2 projects lagged.

Growing congressional impatience, combined with a failure to understand how long it takes to bring a new high-tech commercial venture from R&D to market, led to an investigation by the Government Accounting Organization (GAO) in 1997. The ensuing GAO report criticized the Department of Energy *inter alia* for not creating self-sustaining jobs for WMD scientists and engineers. In response to the report, DOE placed an emphasis on accelerated commercialization and Thrust 2 projects.

By late 1997, IPP shifted from engagement in R&D to technology commercialization. Instead of seeking new R&D projects, IPP sought already completed projects that private U.S. companies believed could lead to commercial success if engineered to a reproducible, durable, and affordable product. The role of the U.S. laboratories shifted to validating the worth of already completed R&D and helping steer the engineering process along commercially viable lines. Today, all new IPP projects stress Thrust 2. These projects may be launched in any one of three possible ways:

- A U.S. company approaches DOE, USIC, or a U.S. national laboratory;
- A U.S. laboratory identifies a former Soviet technology and approaches a U.S. company to commercialize it, USIC to identify an appropriate and interested company, or DOE to ascertain U.S. government interest;
- Russians (or other former Soviet scientists) seek U.S. industry partners through DOE, USIC, or laboratories.

As noted earlier, technology "pull" is the most likely route to commercial profitability. Unless a company sees the technology as likely for profitable commercialization, it will not be selected for Thrust 2.

During Thrust 2, the U.S. national laboratories work with their Russian counterparts to eliminate technical risks and provide engineering for production and profitability. The laboratories certify the quality of the original former Soviet R&D and where necessary assist in the engineering so that the eventual product meets commercial and other standards demanded in the marketplace. The Department of Energy pays the salaries of the NIS and DOE scientists as they engineer their R&D to a salable product—a product that the U.S. industrial partner has confidence can be profitably marketed. Once this phase is completed, the product is ready for capitalization and production (Thrust 3). At this stage, the national laboratories drop out, IPP funding ceases, and the new commercial venture by U.S. companies and their Russian partners is on its own.

The process through which IPP projects are brought into being—and eventually to success—in Thrust 3 is often long, but it combines technical validation with commercial know-how. Before the formal process of approval begins, one of the national laboratories certifies that the technology under consideration is what it claims to be, so that, from a preliminary and solely technical perspective, there is minimal technical risk at the outset of a project.

The IPP process officially begins with submission of a formal project proposal by a U.S. company and a national laboratory partner. USIC processes a new proposal by reviewing or, if it does not yet exist, developing a summary business plan, which includes a market analysis for the proposed product of the venture. It also includes a cost-benefit analysis, a preliminary finance plan, and a risk analysis. USIC also looks for evidence that the project will create sustainable jobs for weapons scientists, engineers, and technicians within the former Soviet Union.

After the USIC review, the proposal is reviewed by the Inter-Laboratory Board (ILAB)[12] to ensure that the original technical assessment by the participating laboratory is correct. In addition, the ILAB takes a quick look for dual-use issues where an ostensibly peaceful technology may have a weapons application. After the ILAB has completed its work, and assuming that the evaluation is positive, the proposal is sent to DOE for review. As an integral part of its review, DOE submits the proposal to an interagency group to ascertain no dual-use or export-control problems. The interagency review also ensures that the former Soviet institute involved is not selling proliferation equipment or expertise to countries of concern. A positive outcome to this review leads to DOE approval of the project, and authorization for funding is granted (provided that funds are available).

A statement of work is then developed, as well as a cooperative research and development agreement (CRADA) between the laboratory and the company. The laboratory and the former Soviet institute then negotiate milestones, deliverables, and payment schedules. Finally, a contract is placed with the institute.

The new Thrust 2 project then commences. The engineering process to take the completed R&D into a durable, affordable product that lends itself to manufacturing is usually conducted for a period of one to two years. This process is technically tracked by the U.S. laboratory in cooperation with the involved U.S. company. After Thrust 2 is completed, the project is ready for Thrust 3 and commercialization by the company. The IPP role in the process is completed.

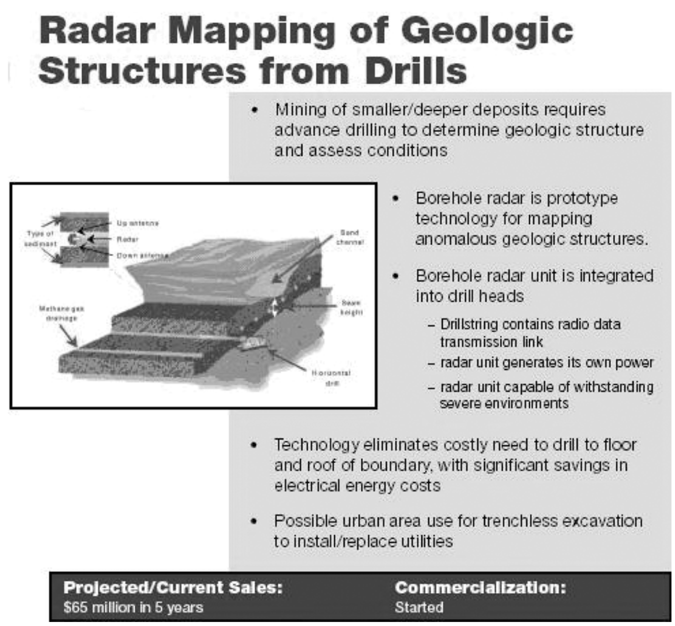
IPP Thrust 2 projects offer specific benefits to the U.S. industry partner: technical risks are virtually eliminated by the U.S. laboratory contribution; the proliferation risks are dealt with effectively by the Department of Energy (working with the interagency group); and the company does not have to pay the full costs of the Thrust 2 period of engineering a new technology. Once the project is ready for commercialization and Thrust 3 begins, the company bears the full responsibility for capitalization and production in partnership with its FSU colleagues. The

12. ILAB is composed of representatives from 10 DOE national laboratories and the DOE Kansas City plant.

amount of money involved in transitioning to this final commercial phase is many times what the government has invested (it will often require investment 10 to 20 times that of the government's investment).

As of June 2002, USIC members have begun commercialization of more than 10 projects with another 20 or so scheduled to begin within the next year. These successful IPP "graduates" have created more than 700 sustainable industrial jobs in the former Soviet Union. This number is projected to grow to about 2,000 within 18 to 24 months. These jobs would be in addition to roughly 2,000 more currently subsidized by DOE for Thrust 2 projects (see figure 1.2). Most of these initial commercially successful projects involve small U.S companies, and the projects themselves usually generate less than $10 million per year in sales. The next wave of commercialized projects is expected to contain several large endeavors, each with projected annual sales between $50 million and $2 billion.

Figure 1.2. Sample Thrust 2 Project Moving to Commercial Success



Note: The U.S. company involved in this project is Stolar Horizon, Inc.; the DOE technical facility is the Kansas City plant; and the Russian partner is the Institute for Measuring Systems Research (NIIS). This illustration is from a poster of the U.S. Industry Coalition, Inc. (USIC, October 2001). Used with permission of the USIC.

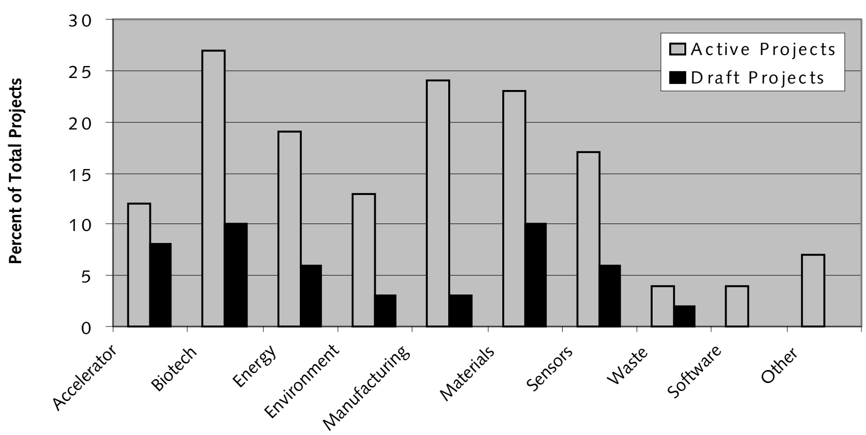
Today, there are 100 U.S. companies involved in about 130 Thrust 2 projects. These USIC members range from some of the largest companies in the world to small entrepreneurial efforts designed largely to create new businesses in the NIS. IPP requires U.S. partners to match the U.S. government investment in a project. Since a significant portion of the government funds (about 35 percent) goes to the

U.S. national laboratory for its role in IPP, this means that the company investment in Russia is much more than that of the U.S. government.

IPP projects, especially those sponsored by smaller companies, are beginning to attract outside investment capital for the Thrust 3 commercialization phase. In 2001, four small USIC companies raised almost $60 million for their projects—roughly four times the amount that the DOE actually invested in its IPP projects in the former Soviet Union during the same period. The scale of outside investment is expected to climb as more projects complete the Thrust 2 process and their sponsoring companies seek investment capital. This amount will be in addition to what the larger companies can invest by themselves once they are ready to commercialize.

The IPP projects cover a range of technology areas as noted in figure 1.3. Of these, approximately 50 (including planned projects) are in the three closed nuclear cities of Sarov, Snezhinsk, and Zheleznogorsk. The vast majority of the projects are with MINATOM institutes in support of nuclear weapons scientists, engineers, and technicians. This focus reflects the primary expertise of DOE and its national laboratories. There is, however, a growing emphasis on biological scientists similar to that of the ISTC. This new emphasis parallels the growth in biological and environmental expertise in the DOE national laboratories and in DOE's R&D portfolio. Chemical remains the smallest emphasis, in large part because of growing direct access to Western companies for work.

Figure 1.3. IPP Projects by Technology Area



Source: Produced by USIC from its IPP data base.

A fairly recent obstacle to IPP progress was the congressionally mandated requirement that U.S. government money spent on IPP projects be exempt from Russian taxation. Unlike the ISTC and NCI, IPP does not enjoy a government-to-government agreement that would guarantee tax-free payments. For reasons that are not entirely clear, the United States did not push for such an agreement. To achieve the congressional mandate, IPP has begun to use the ISTC and CRDF as the vehicles to pay for its projects.

The Nuclear Cities Initiative

Russia cannot afford to maintain the vast, inefficient, and decaying nuclear weapons infrastructure that it inherited from the Soviet Union. Indeed, reductions in nuclear weapons through a series of arms-control treaties and arrangements have significantly reduced the number of nuclear warheads to be maintained and deployed.[13] This new regime of deep reduction has also virtually eliminated the need to develop and test new weapons.

To succeed in reducing its crumbling weapons infrastructure, Russia needs to manage an economic transition for the many thousands of nuclear scientists, engineers, and technicians in the 10 "closed cities" overseen by MINATOM. The Nuclear Cities Initiative, established in September 1998 and sponsored by DOE, seeks to assist Russia in this task. NCI's immensely challenging goal is to create the conditions for sustainable civilian-sector jobs for the 30,000 to 50,000 Russians with nuclear weapons expertise who work in the closed cities. The principal programs for chemical and biological scientists are the ISTC and IPP.

NCI is based on a government-to-government agreement through which DOE works with MINATOM to expand the economy of the closed nuclear cities beyond the nuclear weapons role and thereby create the conditions for new economic opportunities for those whose jobs and livelihood will not survive. The first focus for NCI has been on the key cities of Sarov, Snezhinsk, and Zheleznogorsk. The NCI agreement with MINATOM provides tax exemption for projects and works "outside the fences" in the closed cities (i.e., in areas cordoned off from the classified nuclear weapons research of those cities). The NCI goal is to sponsor business development through direct commercialization in high-tech areas or to help establish the infrastructure conducive to attracting new industries.

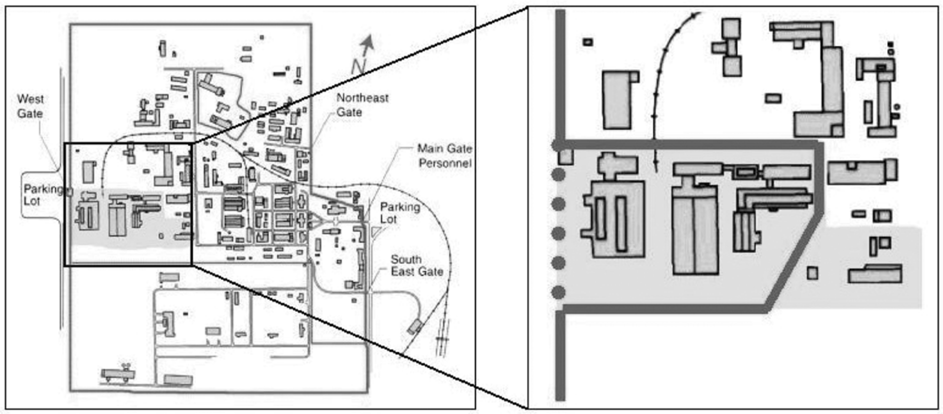
NCI has worked to create enterprise zones outside the fence in the three targeted closed cities. For example, Avangard, a weapons assembly facility in Sarov, is slated for decommissioning over the next five years. An essential NCI objective is to create alternative peaceful employment for those displaced by the Avangard decommissioning. To this end, the fence around Avangard has been moved to permit part of the facility to become dedicated to peaceful, commercial activities (see figure 1.4).

Despite NCI's enormous mandate, critics complain there have been few signs of measurable progress and that the program has spent its meager resources in a scattershot fashion—focusing on social rather than commercial or infrastructure programs (although it has sponsored open computing centers in two cities). These criticisms and unfavorable comparisons to the ISTC and IPP programs have unfortunately led to a watchdog mentality within the government, including congressionally mandated restrictions and conditions that have made it impossible to use appropriated NCI funds without first fulfilling conditions over which DOE has little or no control. A "chicken-and-egg" state of affairs has been created in which, for example, DOE may not allocate resources to NCI projects before reach-

13. These include INF; START I; the unilateral reductions announced by the Soviet Union on October 5, 1991; START II (never entered into force); and the anticipated bilateral arrangement with the United States.

ing an agreement with the Russians who, in turn, refuse to sign agreements unless DOE shows its good faith by spending money on NCI projects.

Figure 1.4. Sample NCI Project at Avangard



Old Fence Configuration New Fence Configuration

Source: U.S. Department of Energy, *Nuclear Cities Initiatives,* October 2000. Used with permission of the National Nuclear Security Administration.

Criticisms of NCI are not entirely unfounded. Few would dispute that NCI has had a stormy time getting off the ground. Some of its problems are due to internal DOE management. Nevertheless, it has been unfairly criticized for not being as mature as ISTC and IPP. Those two programs had a significant head start on NCI, and critics should recall that it was several years before IPP had any successful commercialization progress. IPP's early failure to accomplish its primary mission was masked by the fact that it was sponsoring thousands of scientists to do research and development. The GAO report was instrumental in moving the IPP into concentration on the Thrust 2 projects.

In last year's congressional legislation, NCI was combined with the IPP program into a common Russian Transition Initiative Office under a single director. Congress imposed this action to force the two programs to work with one another and to encourage the Nuclear Cities Initiative to take advantage of the commercialization practices of IPP. DOE has tried to create more synergy between the two programs, and all signs point to more cooperation. By using IPP as the principal vehicle for commercialization in the closed cities, NCI will be able to focus more attention on providing the needed infrastructure so that companies will be more likely to work in the cities and commercialization will be facilitated.

Potential Exit Strategies

When the United States began its efforts to stem a potential brain drain of weapons scientists from the former Soviet Union, the programs were not envisioned as a permanent subsidy for those displaced by the economic collapse of the new republics. If anything, they were viewed as temporary measures to relieve the pressure toward emigration until the economies and tax bases of the new republics were able to sustain employment for these scientists, engineers, and technicians. This view envisioned that many of the underemployed and unemployed would find work at home, outside of their current institutes and laboratories in a commercial high-tech company. The United States, therefore, launched these programs with the intention of withdrawing in the future, although no specific deadline was set at the beginning. Up until now, however, a timetable for exiting has been unthinkable. The Russian economy declined continuously and precipitously throughout the 1990s, and only now is it showing strong signs of recovery.

It is time for the United States to determine a schedule for disengagement or, more appropriately, a definition of success that, once achieved, would lead to an exit strategy.

The new focus on the Partners Program at the science centers in Moscow and Kiev, the emphasis on Thrust 2 and 3 projects in the IPP program, and NCI's creation of commercial infrastructures and encouragement of sustainable non-weapons job creation are all aimed toward an exit strategy. A recent effort by IPP could benefit all three programs. Working through USIC, DOE is supporting the establishment of a Russian National Industry Coalition or NIC. Based on the model of USIC as a nonprofit facilitator, the Moscow-based NIC will assist U.S. companies in attracting Russian industrial partners with strong potential for success. NIC will include Russian banks and investors that could be sources of investment in projects, not just in IPP, but NCI and ISTC.

This process could also be accelerated by a higher level of U.S. financial commitment to the three existing programs—a commitment that will pay dividends to the United States in taxes from successful joint ventures between U.S. companies and Russian counterparts.

Another approach could be the establishment of endowed funds that would require payback and equities in successful commercialization. One method is through debt conversion in which the Russians would provide a special fund with a substantial amount of rubles equivalent, for example, to its debt to the U.S. Department of Agriculture (about $1.2 billion). The fund would use the rubles to lend to high-tech commercial ventures that targeted Russian weapons scientists. The interest on the loans would be used to pay down the loan to the United States. This could be done in a way that would obviate congressional appropriations. It would put into the system the kind of funding that would make a huge difference. Finally, the fund, if managed properly, would provide an ongoing vehicle for helping weapons scientists, even for other countries such as North Korea or Iraq, once the former Soviet problem is under control.

Obstacles to Progress

There is no shortage of critics of brain drain programs. The IPP is criticized by the companies attempting to partner with Russian institutes or companies: In a world where technology levels turn over every 18 months or so, spending a year or more to begin a program is too slow and contrary to commercial interests. The significance of IPP's growing list of current commercial successes has drowned out this chorus. Nevertheless, such criticism is well founded and must be taken into account and solved if the program is to have the needed dramatic success over the long term. Some of the problem is due to the need to comply with cumbersome government regulations and procedures and a system that is complicated and duplicative.

The most telling criticisms of NCI are that the program has not delivered the goods to Russia, which had expected the program to be a quick fix. This is partially due to the fact that NCI did not initially draw from its sister program, IPP, to create successful business ventures in the closed cities and spent too much of its resources on efforts unrelated to either direct commercialization or infrastructure. Its recent restructuring into a common division with IPP is promising, but results will probably not be evident for another year or two.

Despite their faults and weaknesses, however, these programs have in large part been successful. Furthermore, much of the fault for nonperformance is not attributable to the United States, but to its partners in the former Soviet republics. It is true that the Russians, for example, were extremely accommodating in the first days of U.S.-initiated Russian programs in the early 1990s. This cooperative and accommodating attitude, however, has been eroding over the past decade.

Part of this is the result of slow progress toward prosperity in Russia. The disappointment at continued neediness at Russian institutes led to a tension with the United States and its programs. The poor performance of the Yeltsin administration led to quasi-anarchy, in which every institute and ministry looked out for itself. Old Communist-style habits, which at first seemed destined for the ash pile, gradually reinstated themselves. The Russian security organization reestablished its prominence, especially in the national security parts of the Russian government. As a result, it is difficult for those who wish to create jobs or otherwise help deal with the brain drain in MINATOM facilities to gain timely access. Some of this uncooperativeness may be attributed to comparable problems with the U.S. facilities.

In addition to access issues, getting country approval for projects that would provide jobs for scientists is often slow and delays the beginning of commercial projects. It is difficult to determine why such problems arise. Some result from reciprocity and some from frustration with what appears to the Russians as slow and inadequate financial assistance—without the realization that they themselves are often the cause.

Certainly some of the problems arise as the result of the cultural circumstances in the countries affected by ISTC, IPP, and NCI. For example, in Russia there is a need to convince the government and scientific organizations that there are significant benefits tied to supporting a sound business climate. Research institutes can no longer rely solely on the Russian government to sustain them or to maintain scientific excellence. Such institutes must face practical business realities of meeting schedules, producing deliverables to customers, and properly invoicing their efforts for payment. Government ministries that oversee science in the former Soviet Union must understand the business disincentives of unclear government procedures, unpredictable regulatory changes, and overly restrictive security regimes. These obstacles discourage those who seek to help these institutes do research or convert them to peaceful use. (One of the goals of the proposed NIC is to help create a better business environment within Russia and thereby overcome some of the long-standing obstacles to timeliness and efficiency in the brain drain programs.)

The funding provided by the brain drain programs is aimed at helping the scientists, engineers, and technicians in the field gain employment. U.S. subsidies for such scientists under the brain drain programs are often much higher than the salaries of those in the government who have to grant approval for the projects. This also contributes to the lack of enthusiasm on the part of those who control the pace of approvals. The Russians often hide behind the accusation that the U.S. government and laboratory visits to their facilities are nothing but nuclear tourism, even when such visits are aimed at expediting assistance.

In short, the Russians themselves are in many ways the major problem standing in the way of speedy progress toward success in ISTC, IPP, and NCI. This is an issue of utmost importance to the United States, and setting it straight will require a very high level of intervention—secretarial or even presidential. Perhaps some form of subsidy for those responsible for approving such projects within the Russian government would provide the sort of incentive that would move decisions along quickly. In any case, solving these problems should be of the highest priority to increase their already significant achievements to a level commensurate with U.S. investments.

Final Thoughts

The U.S.-Russian relationship continues to be unpredictable and unsettled, even 10 years after the Soviet collapse. The euphoric bilateral rapport of 1992 that led to the speedy negotiation of a START II treaty evolved into a cautious and wary relationship in which Russia's disappointment over not being able to quickly make a transition to democracy and prosperity led to heavy internal criticism of the United States and a growing anti-Western sentiment. Expressions of cooperation and agreement at the highest levels, such as summits and ministerial meetings, were undermined at lower levels of the Russian government where old habits of Communist bureaucracy resurrected themselves.

The ISTC, IPP, and NCI programs originally took aim at preventing an avalanche of technical talent with expertise in WMD from leaving the former Soviet Union and employing WMD skills in dangerous markets. Taken as a whole, the programs have largely succeeded. For example, the thousands of jobs created by the programs have significantly relieved the pressure in Russia for WMD scientists to support themselves. Even so, there is no program that could guarantee that no one from these scientific ranks would refrain from selling scientific knowledge to proliferants any more than the United States itself could provide such a assurance with regard to its own scientists. There will always be someone willing to sell out to the highest bidder.

With a push and emphasis from both governments, Russia could create a significant high-tech business base in partnership with the United States. Such a base would not only provide high-paying jobs as an alternative to WMD, and thereby prevent a brain drain, but would create an engine for Russian economic prosperity.

The mission and success of these nonproliferation programs leads to a next-generation question: Is some variation of this brain drain approach appropriate for other countries—for example, those currently characterized as part of the "axis of evil"? Of course, the time is not yet ripe for such initiatives, but one could envision an eventual program as a vehicle to assist weapons scientists in those countries once their political culture has changed. Pakistan and India are other countries where such programs could be used to nudge them away from reliance on nuclear weapons. All such potential applications of analogous programs could alleviate the growing threat of proliferation from countries of concern. Such programs could create a new basis for high-tech economic development in those countries.

For now, however, the focus should remain on the most important program—that of a brain drain from the former Soviet Union, especially Russia. An acceleration of commercially sponsored work for WMD scientists will alter the nature of what was once a weapons-driven economy and move it toward a modern balance that exploits one of the significant strengths of the former republics of the Soviet Union.

CHAPTER 2

From Co-option to Cooperation
Reducing the Threat of Biological Agents and Weapons

Derek Averre
European Research Institute
University of Birmingham

Security Stakes for Europe, Russia, and the United States

Although there is a long history of attempts to stem the proliferation of biological weapons (BW)—bacteria, viruses, rickettsia, fungi, or toxins produced by these organisms, which are lethal or incapacitating to humans or which attack valuable livestock and crops, together with the technology for dispersing them—the collapse of the Soviet system and the disintegration of the USSR, the world's main producer of BW, at the end of 1991 made the task more urgent. Political and economic instability in the newly independent successor states (NIS) underlined the need for a comprehensive response to proliferation challenges.

Even more than nuclear, chemical, and missile goods and technologies (G&T), the BW challenge is complicated by continuing uncertainty stemming from, first, the fact that many products of microbiology and biotechnology are widely used for medical and pharmaceutical purposes permitted by the 1972 Biological and Toxin Weapons Convention (BWC); second, difficulties in verifying to what extent Soviet offensive military programs have been dismantled or reoriented to civilian purposes in compliance with international arrangements under the BWC; and third, the sheer size of the Soviet BW effort.

Russian president Boris Yeltsin's admission in January 1992 that there had been "a lag in implementing" the BWC was followed by revelations that the Soviet Union had created a large-scale offensive BW program, generally reckoned to be much larger than those formerly possessed by the United States and the United Kingdom, on the basis of extensive indigenous capabilities. Part of the program was carried out in ostensibly civilian microbiological facilities, emphasizing the difficulties faced by the international community in reliably tracking developments for military purposes in this branch of science.

The term "proliferation" covers several interrelated aspects of the problem of the spread of weapons of mass destruction (WMD). "Vertical" proliferation denotes the development of an offensive program, including agents and means of delivery, within a possessor state—still a concern in Russia. "Horizontal" proliferation describes the leakage of materials from production or research facilities for illegal transfer to groups wishing to use them for offensive purposes; the transfer of know-how via a brain drain or through personal or electronic contact between scientists; or the illicit export from one country to another of dual-use G&T. Simply put, the possibility exists that some state or substate group has obtained a sample of pathogen, either by theft or purchase from one of the many facilities in Russia, and has recruited some of the hundreds of scientists with the knowledge of how to turn it into a biological weapon.

Concern about the security of pathogenic collections and over the movements of senior scientists who formerly worked on Soviet BW programs—particularly as it appears likely that Iran and possibly other states have tried to recruit Russian specialists—has prompted a response from the international community. The Cooperative Threat Reduction (CTR) program established by the United States and initiatives put in place by other developed countries have attempted to a greater or lesser extent to confront all of these challenges.

International concern about the horizontal proliferation of BW has grown in recent years. In the 1990s, the international community discovered the extent of Iraq's BW program—Iraq had already demonstrated its readiness to use chemical weapons (CW) in regional conflicts and against its own population—which was partly built using cultures and technologies supplied by the United States and other Western countries in the 1980s. Moreover, the attack by the Aum Shinrikyo cult on the Tokyo metro using a chemical nerve agent and the discovery of BW agents in its arsenal—some obtained from commercial suppliers in Japan—awakened attention to the potential of BW in terrorist attacks. One leading authority has argued that

> although capacity for waging [chemical and biological warfare] is spreading to more and more countries, and although a part of the spread is indeed due to the conscious desire of renegade states such as Iraq actually to wield CBW weapons, the greater part is simply an unfortunate side effect of a process that is otherwise beneficial and anyway impossible to stop: the diffusion of competence in applied chemistry and biology from the rich to the poor parts of the world. The concern about CBW proliferation lies, basically, in the fact that the diffusion is taking place within what seems to be an environment of diminishing restraint.[1]

Pathogens are widely available either naturally or as part of culture collections or even in some consumer products. Nutrient media are widely traded and a lot of equipment usable in producing BW is wholly dual use—from simple fermenters to freeze-drying and milling machines for producing dry powder agents. Technological advances have greatly reduced the size of facility capable of producing

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1. J. Perry Robinson, "Chemical and Biological Weapons Proliferation and Control," in *Proliferation and Export Controls: An Analysis of Sensitive Technologies and Countries of Concern* (Chertsey, England: Deltac/Saferworld, 1995), p. 32.

substantial quantities of agent, making detection much more difficult. As one analyst concludes: "The expanding global commerce in dual-use technologies will continue to make it easier for state and sub-state actors to acquire chemical and biological weapons."[2] Moreover the threat posed by a possible loosening of inhibitions against using this type of weapon within an environment of easier access is compounded by the gap between the extent of the threat and public knowledge about it. All of this naturally impacts on threat reduction strategies involving Russia and the NIS.

September 11: New Challenges and Opportunities

Some commentators have suggested that the events of September 11, 2001, and the deliberate use of anthrax to cause casualties in the United States together represent a qualitatively new challenge—a "new age of insecurity." The loosening of technical and political constraints, in particular the possible use of BW, not to attain specific political ends but as a form of punishment or revenge by substate groups less concerned with alienating opinion, raises new risks and policy priorities. Michael Moodie, president of the Chemical and Biological Arms Control Institute, has argued that before September 11, CBW proliferation and CBW terrorism were conceptualized and addressed separately but that now war and terrorism are linked through mutual state/substate dependence and that traditional arms control agreements aimed at averting biological warfare might not be enough.[3]

Ambassador Tibor Toth, president of the 5th BWC Review Conference, has stated that the anthrax attacks force us to live with the notion that use of BW is becoming part of everyday life: "Such a notion is slowly eroding all the prohibition layers, both politically and legally binding, as contained in the consensus final declarations of all the previous Review Conferences and in the [BWC] itself. The Convention is facing perhaps the greatest challenge in its 26-year history."[4] The Web site of the journal *Nature* prefaces its focus on anthrax by saying, "Recent events have confirmed that bioterrorism is no longer a threat but a reality."[5]

These bleak assessments tend to overshadow the opportunities a fuller appreciation of the challenge provides. Complacency among the international community has been severely shaken; governments are awake to the threat to political, social, and economic stability inherent in even limited use of BW, and a comprehensive program of measures to increase awareness and public confidence can be expected.

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2. J. Tucker, "The Proliferation of Chemical and Biological Weapons Materials and Technologies to State and Sub-State Actors," Testimony before the Subcommittee on International Security, Proliferation and Federal Services of the U.S. Senate Committee on Governmental Affairs, November 7, 2001, at <http://www.senate.gov/~gov_affairs/110701tucker.htm>.

3. M. Moodie, Testimony before the Subcommittee on International Security, Proliferation and Federal Services of the U.S. Senate Committee on Governmental Affairs, November 7, 2001, at <http://www.senate.gov/~gov_affairs/110701moodie.htm>.

4. *CBW Conventions Bulletin* [Harvard Sussex Program on CBW Armament and Arms Limitation] 54 (December 2001): 15.

5. At <http://www.nature.com/nature/anthrax/>.

Whether or not one supports the Bush administration's refusal to endorse the BWC verification protocol, it is obvious that these new threats and the politics, science, and trade issues involved in establishing international norms to counter the proliferation and use of BW are such that new ways of thinking are needed.

Specifically with reference to the CTR program, the knowledge gained from contact and cooperation with the former Soviet BW community and the partial transparency established thus far provides a basis for major responsible international players to address jointly both "old" and "new" threats and redirect resources accordingly. As the U.S. country report in CSIS's companion CTR volume makes clear,[6] U.S. government officials have declared that stopping bioterrorism is a new top priority for the cooperative threat reduction program.

International Efforts to Deal with Biological Agents and Weapons Threats

The United States has taken the lead in international programs, with several agencies and institutions involved in coordinating or funding collaborative research projects. The U.S. Departments of State (DOS) and Defense (DOD), the National Academy of Sciences, the Defense Advanced Projects Research Agency (DARPA), the Defense Threat Reduction Agency (DTRA) and the U.S. Departments of Agriculture (DOA, which has established initiatives in agriculture-related biotechnology, though not on dangerous pathogens) and of Health and Human Services (HHS) have signed partnership agreements with the International Science and Technology Center (ISTC) in Moscow and the Science and Technology Center (STCU) in Kiev allowing them to fund their own biotechnology projects. The U.S. Department of Commerce has provided funding to facilitate business training and exchanges, and the Environmental Protection Agency has funded projects under the BW Expertise Redirection Program. The Proliferation Strategy Policy Coordinating Committee, chaired by a National Security Council senior director, provides interagency oversight.[7]

Within the CTR program three main initiatives have been instituted under the title Biological Weapons Proliferation Prevention:

- Biosecurity and Biosafety Enhancements. This is aimed at improving the security of pathogenic collections held at former Soviet BW facilities and ensuring safe storage and handling of pathogens at microbiological research centers. Projects at a number of facilities have been initiated by the ISTC; it also hosted 20 scientists at the Atlanta Centers for Disease Control biosafety conference in February 2000. And CTR biosecurity workshops have been in held in Albuquerque, New Mexico.

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6. See volume 3, *International Responses,* in the four-volume set, Robert Einhorn and Michèle Flournoy, project directors, *Protecting against the Spread of Nuclear, Biological, and Chemical Weapons: An Action Agenda for the Global Partnership* (Washington, D.C.: CSIS, 2003).

7. Michelle Stem Cook and Amy F. Woolf, *Preventing Proliferation of Biological Weapons: U.S. Assistance to the Former Soviet States*, CRS Report for Congress, April 10, 2002, p. 15.

- Collaborative Research. This is designed to prevent proliferation of BW-related biotechnology, improve transparency, and enhance U.S. force protection capabilities through research projects with former BW scientists at biological research centers. Numerous project agreements have been established or are being solicited through the ISTC and other initiatives (see below). The first annual CTR Biotechnology Symposium was held in Moscow in April 2000.
- Facilities dismantlement. This is aimed at eliminating infrastructure and equipment at biological research centers that did or could provide a BW production capability. This has included relocation of the Vektor pharmaceutical plant in Russia (see below) from BW-capable buildings; dismantlement of infrastructure and equipment at the Vektor facility and the Scientific Center of Applied Microbiology in Obolensk, with plans for three other facilities; and two programs in Kazakhstan (BW production facility dismantlement at the Biomedpreparat production facility at Stepnogorsk, where several buildings have been dismantled, and discussions are continuing on dismantling remaining structures) and provision of basic biosecurity protection for national BW collections at two further locations, the State Research Agricultural Institute in Otar/Gvardeisky and the Kazakhstan Institute for Research on Plague Control (KIRPC) Almaty. A 15-month contract was awarded to KIRPC in March 2000 to secure strains, remove excess infrastructure, and erect a perimeter around the site; a new repository is planned for erection Q4 2002 and some KIRPC strains have been stored at Ft. Collins Center for Disease Control in the United States.

In addition to the above, European countries have initiated BW demilitarization work. The European Council Joint Action of December 17, 1999, established the legal and operational basis for an EU-Russia cooperative program for nonproliferation and disarmament in Russia, including a task force in Moscow. A number of projects have been funded by the EU through the ISTC and the STCU.

International efforts to deal with pathogens proliferation via the funding of projects involving former BW scientists have been pursued through a number of channels:

- The ISTC has emerged as the main multilateral source of funding for projects in Russia, Armenia, Belarus, Georgia, Kazakhstan and Kyrgyzstan. Table 2.1 shows the number of projects established in the biotechnology and life sciences field by category; 531 projects have been funded in this field out of a total of 1,569 projects to date. It has also funded symposia, such as the Increasing Threat of Infectious Diseases held in Bergendal, Sweden, and the UK-Russia Seminar on Biotechnology: International Partnerships and Commercial Opportunities held in Edinburgh, both in 2001, and a Special Symposium on Problems of Biosecurity and Bioterrorism in St. Petersburg in June 2002.
- The STCU, which oversees projects in Ukraine, Georgia, and Uzbekistan, has a far lesser orientation on biotechnology and life sciences. Its Medicine, Health Care, and Biological Technologies project field has accounted for only 28 projects (24 in Ukraine) out of 415 regular projects hitherto; only a few of these appear linked to possible BW-related research.[8]

Table 2.1. ISTC Projects in Biotechnology and Life Sciences by Country (to June 2002)

Project Field	Russia	Armenia	Belarus	Georgia	Kazakhstan	Kyrgyzstan	Total
Biochemistry	27	8	4	13	6	2	60
Cytology, genetics, & molecular biology	39	5	2	4	8	3	61
Ecology	10	2	2	9	9	2	34
Immunology	41	1	–	3	3	2	50
Microbiology	33	5	1	6	9	3	57
Nutrition	2	1	–	–	1	–	4
Other	17	–	–	1	4	–	22
Pathology	6	1	2	3	2	–	14
Pharmacology	44	5	2	7	7	1	66
Physiology	5	2	–	5	–	–	12
Public health	73	3	7	12	10	3	108
Radiobiology	31	3	–	1	7	1	43
Total biotechnology & life sciences	328	36	20	64	66	17	531

Source: Data culled from the ISTC's Web site, <http://www.tech-db.ru/istc/db/projects.nsf/htm/index.htm>.

- DOE's initiative for Proliferation Prevention (IPP) creates a phased process to move beyond cooperative research and development to form commercial partnerships between U.S. industry and former Soviet WMD facilities. IPP is mainly targeted on the nuclear field, but since the program's inception, around 15 percent of projects accounting for just over 16 percent of funding have been in the biotechnology field (see table 2.2).
- The U.S. Civilian Research and Development Foundation (CRDF) receives support from the DOS, the U.S. National Science Foundation, and the National Institutes of Health for its Cooperative Grants Program, which supports joint U.S./NIS research teams in basic and applied research and gives special consideration to proposals that include the participation of former defense scientists. Up to the end of 2001, 167 awards had been granted for work in areas roughly equivalent to the ISTC biotechnology and life sciences field (107 in Russia, 5 in Armenia, 1 in Belarus, 8 in Georgia, 13 in Kazakhstan, 1 in Kyrgyzstan, 1 in Turkmenistan, 26 in Ukraine, and 5 in Uzbekistan) with a further two grants under the Armenia-U.S. bilateral grants program and several under its U.S.-Russia Young Investigator Program. The CRDF also supports related activities such as travel grants, equipment transfer to regional centers, and the Next Steps

8. Disaggregated data with funding for projects in this field are not available.

to Market Program. It has also recently announced funding for 11 joint U.S./NIS workshops aimed at identifying R&D that can provide solutions to protect civilians from terrorist acts, of which three relate to pathogens and toxins (one in Kazakhstan and two in Russia).

Table 2.2. Summary of IPP Project Funding

Project ID	Number of Projects	Allocated	Cost
Accelerator	21	$5,082,214	$3,443,144
Biotechnology	89	27,134,980	17,383,899
Energy	79	19,094,258	13,346,473
Environment	43	10,473,376	7,652,032
Manufacturing	64	21,369,232	12,702,621
Materials	150	36,915,106	28,495,803
Other	15	4,936,700	2,136,388
Program management	1	470,000	28,938
Sensors & instrumentation	87	22,368,597	14,851,395
Software development	1	681,000	0
Waste management	34	9,245,528	6,590,553
Not categorized	9	1,780,000	867,883
Total	**593**	**$159,550,991**	**$107,499,129**

Source: See <http://ipp.lanl.gov>.

- The Department of Commerce has provided funding to facilitate business training and exchanges.
- The U.S. Centers for Disease Control and Prevention and the National Institutes of Health have collaborated with and provided training for Russian scientists.
- The National Research Council has been attempting to establish collaborative research projects with American nongovernment scientists working at Russian facilities.
- The Nuclear Threat Initiative provided funding for four projects in 2001: integrating NIS scientists into the international research community, a hepatitis vaccine manufacturing feasibility study, a three-year brain-drain prevention program, and two-year brucellosis vaccine research project (cofunded with the DTRA via the ISTC and managed through the CRDF).
- NASA has had some small-scale collaboration on space-related research.

Funding for Projects and Results Achieved

A steadily increasing share of CTR funding in recent years has been directed to BW nonproliferation projects.

- Department of Defense. Funding for BW nonproliferation increased from $2 million in 1999 to $12 million each year for 2000 and 2001 and $17 million in 2002. A General Accounting Office (GAO) April 2000 report stated that the United States plans to boost funding to a total of about $220 million in 2000–2004 to expand efforts to engage former Soviet BW institutes; around half of this is slated for redirecting scientists toward peaceful research, while $36 million will be spent on BW research in Russia to improve U.S. BW defense, $40 million on upgrading security/safety at select facilities including physical protection, personnel training and material protection, control, and accounting verification procedures (each project is estimated to cost between $5 million and $15 million depending on the facility concerned), and $39 million on dismantling Russian facilities, if agreement with Russia can be reached.[9] The DOD is transferring $30 million to DOS in 2002 to fund expansion of the latter's BW Expertise Redirection Program under the Science Centers.
- Department of State. Funding in 2002 for the BW Expertise Redirection program is $37.7 million, and this is set to increase to $52 million in 2003 (presumably as a result of the transfer of funds from the DOD referred to above).
- Department of Agriculture. Through the Agriculture Research Service/FSU Scientific Cooperation Program for BW scientists with expertise in animal and plant diseases, nine projects in Russia and four in Kazakhstan were under way by the end of 2001, with new projects being developed in these countries and in Uzbekistan. Funding was $0.55 million for 1998, $2 million for 1999, $6.98 million for 2000, and $6 million for 2001, with $5 million expected for 2002.
- Health and Human Services. The Biotechnology Engagement Program started in March 1999, involving U.S. scientists from the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), academic institutes, and HHS agencies (Centers for Disease Control and Prevention, National Institutes of Health, and Food and Drug Administration); as of November 2001, it had two completed and nine ongoing projects, with 16 in the final stages of authorization and 29 under review. Funding was $4.8 million in 1999, $11 million in 2000, $10 million in 2001, and $9 million in 2002, with $10 million requested for 2003.
- Nuclear Threat Initiative. NTI has provided a total of around $2.4 million for the projects described above.

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9. U.S. General Accounting Office, *Biological Weapons: Effort to Reduce Former Soviet Threat Offers Benefits, Poses New Risks*, Report to Congressional Requesters GAO/NSIAD-00-138, April 2000, p. 6.

- Environmental Protection Agency. The EPA received $1 million to fund involvement in the BW Expertise Redirection Program for 2001.

Table 2.3. Summary of ISTC Project Funding (through December 2001)

	2001				1994–2001	
	Funded		Completed		Funded	
Technology Area/ Technology Field	Project number	$ Value	Project number	$ Value	Project number	$ Value
Biotechnology and life sciences Biochemistry, cytology, genetics and molecular biology, ecology, immunology, microbiology, nutrition, pathology, pharmacology, physiology, public health, radiobiology	79	29,621,417	19	$2,964,364	289	84,003,328
Chemistry Analytical chemistry, basic and synthetic chemistry, industrial chemistry and chemical process engineering, photo and radiation chemistry, physical and theoretical chemistry, polymer chemistry	14	3,014,173	4	582,500	69	15,801,959
Environment Air pollution and control, environmental health and safety, modeling and risk assessment, monitoring and instrumentation, radioactive waste treatment, remediation and decontamination, seismic monitoring, solid waste pollution and control, waste disposal, water pollution and control	32	6,463,836	29	7,435,540	228	67,652,971
Fission reactors Decommissioning, experiments, fuel cycle, isotopes, materials, modeling, nuclear and other technical data, nuclear instrumentation, nuclear safety and safeguarding, reactor concept, reactor engineering and NPP, reactor fuels and fuel engineering	20	4,428,536	14	5,485,277	155	48,758,284
Fusion Hybrid systems and fuel cycle, inertial confinement systems, magnetic confinement systems, plasma physics	6	1,699,000	1	1,000,000	37	11,080,013
Information and communications Data Storage and peripherals, high-definition imaging and displays, high-performance computing and networking, microelectronics and optoelectronics, sensors and signal processing, software	17	4,725,423	7	505,310	66	16,218,407

Table 2.3. Summary of ISTC Project Funding (through December 2001) *(continued)*

	2001				1994–2001	
	Funded		Completed		Funded	
Technology Area/ Technology Field	Project number	$ Value	Project number	$ Value	Project number	$ Value
Instrumentation Detection devices, measuring instruments	12	2,583,240	10	3,679,000	86	23,032,997
Manufacturing technology CAD and CAM, engineering materials, machinery and tools, manufacturing, planning, processing and control, plant design and maintenance, robotics, tribology	12	2,825,540	1	40,000	38	6,811,650
Materials Ceramics, composites, electronic and photonic materials, explosives, high-performance metals and alloys, materials synthesis and processing	16	3,341,272	11	2,216,900	124	39,888,480
Non-Nuclear Energy Batteries and components, electric power production, fuel conversion, fuels, geothermal energy, heating and cooling systems, miscellaneous energy conversion, solar energy	6	2,534,000	3	958,000	30	8,870,936
Other	5	1,326,213	4	193,540	12	1,919,753
Other Basic Sciences Agriculture, building industry technology, electrotechnology, geology, natural resources and earth sciences	5	1,264,288	3	72,354	19	3,855,368
Physics Atomic and nuclear physics, fluid mechanics and gas dynamics, optics and lasers, particles, fields and accelerator physics, plasma physics, radio-frequency waves, solid state physics, structural mechanics	45	9,014,624	21	4,189,000	228	50,568,407
Space, Aircraft and Surface Transportation Aeronautics, astronomy, extraterrestrial exploration, manned spacecraft, space launch vehicles and support equipment, space safety, spacecraft trajectories and flight mechanics, surface transportation, unmanned spacecraft	11	2,941,606	9	3040,238	70	19,675,418
Totals	280	75,783,168	136	32,362,023	1,448	398,137,971

Source: See <http://www.istc.ru/istc/website.nsf/html/01/en/projects.htm>.

As a result of this trend of increased provision, biotechnology and life sciences has emerged as the best-funded ISTC field of activity over the 1994–2002 period; it received the greatest share of funding in 2001 (see table 2.3).[10] An increasing share of partner funding has been committed, so that in 2001 it reached an impressive level of more than 70 percent of the total for biotechnology and life sciences. This trend reflects a response both to the extent of former Soviet BW capabilities and "to intensified attempts by Iran and other countries of proliferation concern to acquire BW expertise and materials from former Soviet institutes."[11] As of June 2002, ISTC funding by donor country/countries was as follows: United States, 33.56 percent; EU, 15.37 percent; Japan, 3.47 percent; Korea, 0.42 percent; partners/other funding, 47.12 percent.

A summary of IPP funding is shown in table 2.2. A typical IPP project is in the $1 million to $1.5 million range over two years, of which 70 percent goes to the NIS partner institute.

Lessons Learned

Within the overall goal of the CTR program—furthering the nonproliferation of weapons technologies and thereby contributing to global security—the specific objectives of the ISTC provide a useful template against which the questions dealt with in this section need to be evaluated. The ISTC aims to

- provide weapons scientists in the NIS with the opportunity to redirect their talents to peaceful activities;
- support basic and applied research and technology development;
- contribute to the transition to market-based economies;
- foster integration of scientists and engineers from the NIS into the global scientific community;
- contribute to solving national and international technical problems by coordinating talents of governments, national and international laboratories, and public and private-sector organizations.

What Has Worked and Why

BW threat reduction programs in Russia and the other NIS funded through the ISTC appear to have proved highly cost-effective. By 2000, more than 2,200 former Soviet BW personnel were funded, including more than 745 senior scientists, and access had been gained to 30 of about 50 nonmilitary BW-related institutes. To put these figures in context, estimates have suggested that there are 5,000 former Soviet

10. The 27th ISTC Governing Board at its meeting in Bishkek in April 2002 approved 61 new projects with funding of $10.4 million and €7.2 million; 54 partner projects with funding totaling $13.5 million have been approved since the previous meeting. Several new projects in the biotechnology and life sciences field were approved, taking the total spending to around $93 million.

11. U.S. General Accounting Office, *Biological Weapons,* p. 27.

BW scientists and 10,000 with weapons-relevant skills. ISTC projects were funded at 29 institutes, including 19 where BW research was developed and managed, and 10 other supporting facilities. The IPP program had also funded contracts with 15 former Soviet BW-related institutes, 10 of which have also been funded by the ISTC. Together these programs have provided access to 15 out of 20 key former BW institutes.[12]

Anecdotal evidence partly provided by Russian partners suggests that would-be proliferators have sought but been denied access to sensitive technologies at more than 15 former BW institutes. There do not appear to be any confirmed cases of pathogens being diverted from NIS facilities. As described earlier in this report, safety/security enhancement and facility dismantlement projects have also been carried out at a number of key centers, with further work planned.

A substantial portion of funding has gone to key former BW institutes in Russia that formed part of the Biopreparat organization, created in 1973 and of major importance in financing and managing Soviet BW R&D. These institutes worked on many organisms included in categories A (highest-priority agents posing a risk to national security, easily disseminated/transmitted, and causing high mortality) and B (other high-priority) in recently published U.S. government lists.[13] These are the Scientific Center of Applied Microbiology in Obolensk (work included vaccines against highly pathogenic viruses including recombinant preparations against plague and anthrax, molecular preparations against anthrax, and legionnaire's disease); the Scientific Research Institute of Molecular Biology in Koltsovo, incorporating the State Scientific Center of Virology and Biotechnology Vektor (vaccines against highly pathogenic viruses including Marburg, Ebola, Lassa, Crimean-Congo hemorrhagic fever, Eastern equine encephalitis, and others) and the Institute of Immunological Design in Lyubuchany, Moscow district (which was involved in the full cycle of basic and applied R&D, fermentation and production, including detection of and developing vaccine against tularemia); as well as a number of other important facilities in Moscow, St. Petersburg, Serpukhov, Sarov, Snezhinsk, and elsewhere.

The director of Vektor, Lev Sandakhchiev, has stated that "it is difficult to overestimate the importance of the ISTC." Whereas in 1990, 78 percent of the facility's funding came from the state, in 2000 it received more than twice as much funding from ISTC projects as from the federal budget—a figure that is likely to have increased substantially in 2001 allowing Vektor to pursue several lines of important research (see below).

As table 2.1 shows, outreach in this field beyond Russia has also been impressive. As well as the dismantlement of the Stepnogorsk base in Kazakhstan (a Soviet mobilization reserve facility designed to produce modified anthrax, plague, glanders, and tularemia, research anthrax and glanders, and test anthrax, glanders, and

12. Ibid., pp. 16–17, 23–4.

13. Tommy G. Thompson, secretary, U.S. Department of Health and Human Services, "Civilian Preparedness for Biological Warfare and Terrorism: HHS Readiness and Role in Vaccine Research and Development," Testimony before the Committee on Government Reform, Subcommittee on National Security, Veterans Affairs, and International Relations, U.S. House of Representatives, October 23, 2001, at <http://www.hhs.gov/asl/testify/t011023.html>.

Marburg), for example, the ISTC has funded projects at important institutes in Stepnogorsk itself (the Institute of Pharmaceutical Biotechnology), in Otar/Gvardeisky (the Scientific Research Agricultural Institute), and in Almaty (the Institute for Research on Plague Control, the Aitkhozhin Institute of Molecular Biology, and the Institute of Physiology, Genetics, and Bioengineering of Plants).

Official pronouncements by U.S. government agencies have been unequivocal about the achievements of these programs. Transparency has generated "high confidence" that no offensive BW research is now going on at former Soviet partner institutes, and this is likely to lead to more extensive engagement. DOD has stated it is sure that at least 95 percent of assistance is being used as intended and is adequately accounted for—based on day-to-day program management, periodic audit/examination team visits, and analysis of intelligence information. Proposals are screened for potential proliferation concerns, but weapons scientists have submitted few proposals contrary to U.S. policy.[14]

The State Department is confident that the monitoring efforts of NIS specialists who carry out evaluations under the guidance of Western senior project managers comply with Western standards and that contact with Western companies and agencies is gradually eroding the sense of institutional isolation characteristic of the Soviet defense complex: "The majority of these individuals are former weapons scientists who are now committed to the mission and nonproliferation objectives of the science centers."[15] Furthermore, ISTC and IPP projects have begun supporting long-term transition to peaceful research by helping NIS facilities to identify and develop the commercial potential of research, providing business training and funding patent applications.

What Has Not Worked and Why

Financial constraints have meant that funding has not reached all facilities of possible concern. For example, of the 148 proposals submitted at the March 2001 meeting of the governing board, 92 met U.S. funding criteria, but only 31 were funded by the DOS—those with highest number of senior scientists and providing evidence of greatest scientific merit and/or involvement of institutes of particular proliferation concern.[16] Current levels of funding are insufficient to finance security upgrades and peaceful research at all former Soviet BW-related facilities. Although a number of core facilities have been generously provided for, others that still possess high scientific potential, pathogenic culture collections, and dual-use equipment have remained relatively untouched. Indeed, these may now present more of a brain-drain proliferation risk than the likes of Vektor and the Obolensk facility.

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14. U.S. General Accounting Office, *Cooperative Threat Reduction: DOD Has Adequate Oversight of Assistance, but Procedural Limitations Remain,* Report to Congressional Committees, GAO-01-694, June 2001.

15. U.S. General Accounting Office, *Weapons of Mass Destruction: State Department Oversight of Science Centers Program,* Report to the Chairman and to the Ranking Member, Subcommittee on Foreign Relations, Committee on Appropriations, U.S. Senate, GAO-01-582, May 2001, p. 20.

16. Ibid., p. 13.

A primary concern is that CTR programs have not reached certain military microbiological facilities subordinated to the Russian Ministry of Defense, which evidence suggests have extensive expertise in several dangerous pathogens in categories A and B referred to above. Concern over the closed nature of Russia's ostensibly defensive BW program and over Moscow's commitment to BW nonproliferation commitments was one of the reasons for the Bush administration withholding certification to Congress for CTR assistance funding for 2002. There are at least four or five key applied R&D or manufacturing facilities that form the centerpiece of a vast supporting network of fundamental research institutes, equipment manufacture, security, counterintelligence, espionage, and testing facilities, and whose current activities are unclear:

- The Scientific-Research Institute of Microbiology in Kirov. This facility developed typhus, Q fever, tularemia, brucellosis, glanders, anthrax, and melioidosis, as well as toxins and genetically altered bacterial strains, produced/stockpiled plague, and maintained a proving ground and field-testing laboratories. Its main known activities appear to concentrate on development of vaccines against plague, diagnostic systems to detect infectious disease agents and toxins, emergency prophylaxis, gammaglobulins and antibiotics.
- The Center for Military-Technical Problems of Anti-Bacteriological Defense in Ekaterinburg (formerly Sverdlovsk). This center developed anthrax, tularemia, glanders, and melioidosis, researched toxic weapons including botulinum toxin, antibiotic-resistant anthrax, and multi-drug resistant glanders, produced anthrax and glanders, and stockpiled anthrax. Current known activities center on BW defense research and proliferation monitoring, technical work on vaccines manufacture (including against anthrax), and developing new antibiotics and eubiotics.[17] This center was the source of the notorious anthrax outbreak of 1979, after which some of its activities were curtailed.
- The Center of Virology in Sergiev Posad (formerly Zagorsk). This facility researched and developed smallpox, monkey pox, Bolivian hemorrhagic fever, Argentinean hemorrhagic fever, Marburg, Ebola, Lassa fever, Rift Valley fever, Venezuelan equine encephalitis, researched Japanese encephalitis, tick-borne encephalitis, Eastern equine encephalitis, Western equine encephalitis, Murray Valley encephalitis, Saint Louis encephalitis, and others, and stockpiled smallpox. Its known current activities focus on developing antiviral vaccines and prophylaxis and treatment methods for dangerous diseases, as well as biological protection and decontamination. It was formerly responsible for field-testing laboratories in Aralsk (Kazakhstan) and on Vozrozhdenie Island in the Aral Sea.[18]
- The Scientific-Research Institute of Military Medicine in St. Petersburg. This is now one of the leading centers for defense against nuclear and CBW engaged in

17. Eubiotics are live cultures of bacteria that normally inhabit a healthy human gastrointestinal tract. Drugs based on them are used to treat gastrointestinal disorders.

testing vaccines, developing mass immunization and prophylactic methods, and means of detecting pathogenic agents.

- A facility at Strizhi, Kirov district. Little is known about this facility except that it developed and manufactured viral and bacterial BW.

Some sources have emphasized the difficulty of being certain about the number of military facilities central to the Soviet BW program, indicating that there may in fact be several more besides those mentioned above. Also, the nature of their work remains obscure; for example, unconfirmed sources have stated that smallpox samples probably exist at Kirov, Sverdlovsk, and St. Petersburg as well as at Sergiev Posad. The trilateral U.S./UK/Russia agreement established in the early 1990s, which aimed at implementing a set of confidence-building measures to address concerns about Russia's compliance with the BWC and included reciprocal inspection visits to BW facilities, failed to gain more than limited access to a few Russian military centers and hence did not allay concern. In fact, Michael Moodie has argued that the CTR program has emerged as a more acceptable alternative than the trilateral agreement on inspections, as it has given access to numerous facilities of concern.[19] Other Soviet agencies in addition to the Ministry of Defense—notably the Ministries of Health and Agriculture—had BW-related facilities subordinated to them, some of whose activities remain unclear.

Information provided by Ken Alibek, a former senior figure in the Soviet BW program, highlights the extent of concern over military-related activities. Alibek recounts how he took over the program for a new smallpox weapon in December 1987 and how subsequently smallpox production was put "on an industrial scale" by 1990, with up to 100 tonnes annual capacity, and work started on genetically altered strains of smallpox (work on genetically altered toxins was also carried out). He also describes plans put in place in late 1988 to arm SS-18 strategic missiles with BW.

Gorbachev's Five-Year Plan provided a massive boost to the BW complex, with close to $1 billion spent on BW programs as late as 1990. A proposal aimed at obtaining the leadership's agreement to switch the offensive BW program to defensive work was sabotaged in May 1990 when it was changed to allow Biopreparat to maintain facilities in readiness for the manufacture and development of BW agents.[20] In view of this it cannot be ruled out that a mobilization capacity was maintained at military facilities as well. Alibek also described the networks of influence and funding and secretive bureaucratic practices, which even excluded then

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18. Some of this information came from an interview with Valentin Evstigneev, a senior Russian BW official; *Yadernyi kontrol Digest* [PIR Center], no. 11 (1999), at <http://www.nyu.edu/globalbeat/nuclear/PIR071299.html>. Evstigneev stated that the Ekaterinburg and Sergiev Posad facilities are within the Kirov facility structure and that only these three centers are engaged in all defense ministry biological programs. He confirmed that its collection includes a wide range of substances but only up to one gram of agent, and he claimed that there was no serial production of agent after 1992 and that offensive development was discontinued.

19. M. Moodie, "The Soviet Union, Russia, and the Biological and Toxin Weapons Convention," *Nonproliferation Review* 8, no. 1 (Spring 2001): 68.

20. K. Alibek (with S. Handelman), *Biohazard* (New York: Random House, 1999).

foreign minister Eduard Shevardnadze from knowledge about the program, with only Gorbachev and the heads of the KGB, defense ministry, and defense complex among the top leadership being kept informed. My own previous research concluded that a similar situation existed in the CW sphere.[21] Several sources have suggested that these practices have endured, with Soviet-era generals still in charge of military facilities. Although the scope of military programs has most likely diminished, concern over a residual offensive BW effort will persist as long as access is not given to all facilities.

Thus, the question arises whether the CTR program risks sustaining vertical proliferation in the former Soviet BW complex by misusing funds to sponsor Russian scientists' skills to develop offensive BW R&D. U.S. authorities weigh the risks that financing certain projects could help sustain a weapons program that might otherwise cease due to a lack of government funding, but the division between offensive and defensive research is often difficult to determine.

There is also concern to what extent the CTR program has co-opted all Russian specialists capable of building BW in order to stem horizontal proliferation. Alibek has stated that some BW scientists have emigrated to the West, but others who have dropped out of sight may offer their technical skills on the open market; some Russian microbiologists are reportedly teaching students from rogue states.[22] Sandakhchiev has claimed that, although approximately 50 of his former employees at Vektor are now working in various research centers abroad, he knows the intellectual expertise that each carries and all are working "in civilized countries"[23]—but he has also voiced concern over the potential for brain drain to rogue states.[24]

A May 2001 GAO report acknowledges that the State Department does not have complete information on the total number and location of senior weapons scientists, as well as having no access to senior scientists at Russian defense ministry BW sites; it knows little about scientists' activities outside of ISTC projects or when their project ends.[25] It has concentrated resources on funding senior scientists identified by national governments as having sufficient expertise to pose a significant proliferation risk, but as suggested above, funding constraints have meant that not all can be reached. The implication is that the movements of other scientists with relevant expertise are less visible but still of concern.

An additional problem is that the quality of personnel at many former weapons facilities is declining, with new employees proving less skilled and experienced in safety and security procedures, within an overall atmosphere of demoralization.

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21. "The Mirzayanov Affair: Russia's Military-Chemical Complex," *European Security* 4, no. 2 (Summer 1995): 273–305; "Chemical Weapons in Russia: After the CWC," *European Security* 8, no. 4 (Winter 1999): 130–164.

22. Testimony to House Armed Services Committee, October 20, 1999, at <http://www.house.gov/hasc/testimony/106thcongress/99-10-20alibek.htm>.

23. Interview with Iraida Fedorova, *Argumenty I fakty* (Internet version), October 10, 2001.

24. "Terrorists may persuade Russian scientists to create bacteriological weapons," Interview in Russian with NTVRU.com, November 8, 2001, at <http://www.ntvru.com/russia/08Nov2001/sandahciev.html>.

25. U.S. General Accounting Office, *Weapons of Mass Destruction,* p. 2, 18–19.

This could compromise nonproliferation aims, particularly as measures to tackle the problem are falling short of what is required.

One key issue is that co-option is essentially a short-term goal. According to State Department and ISTC officials, the commercialization of projects has not been a primary objective; some proposals that are weak in terms of scientific merit might receive funding if the facility in question poses a proliferation concern. Although there has been some success in developing joint projects to commercialize research, far from all BW-related facilities offer readily marketable infrastructure and expertise. Private commercial organizations have been much less visible in joint projects than government and other public institutions. The political and economic environment in the NIS currently does not favor investment in biotechnology. The decline in high-technology sectors and the underfunding of science from domestic sources, allied to the lack of acceptable alternative employment and transferable skills—particularly among older scientists, stemming from the close link between world class science and weapons development due to Soviet funding priorities—mean that the problem is likely to persist for some time.

These problems should be kept in perspective. It was never the mission of CTR programs to engage directly every single scientist in Russia and the NIS; hence, the emphasis on cooperative threat *reduction,* not *elimination*. The mandate pursued through the ISTC and STCU is to engage key WMD scientists in peaceful research activities and aid their integration into the international scientific community, while seeking commercial market opportunities where possible. Resources are insufficient, and much more far-reaching agreements would have to be negotiated with NIS governments, to achieve a complete outreach program. Despite a lack of information about the activities of institutes and their scientists outside of ISTC projects, most institutes maintain contact with the ISTC and a transparent working relationship is being developed.[26] Also, although the Russian Defense Ministry has not yet granted access to some BW facilities, the U.S. DOD has taken the lead in attempting to engage it in a series of exchange and site visits, which, if access is granted, could be capitalized on by the ISTC. The foundation has, therefore, been laid for the development of a BW nonproliferation strategy in the NIS.

Best Practices for the Future

Best practices for the future should aim to cement nonproliferation arrangements that satisfy both the short-term and longer-term national security considerations of the United States and other countries providing funding, while reinforcing standards of international ethics, social responsibility, and compliance with international norms among Russian actors. Several measures are worthy of consideration:

- Plans have been outlined to put U.S. scientists to work side by side with their NIS counterparts in order to advance confidence about research and ensure that the United States receives the same results. On-site collaboration is particularly important for sensitive biotechnology projects. This is a delicate political issue

26. Ibid., pp. 26–27.

that should nevertheless be pursued with NIS governments. It would also be costly but, if harnessed to genuine collaboration, would be a significant advance.

- Given that there are no instant solutions to proliferation problems, programs should be part of a long-term strategy involving financial and political commitment on both sides to trust confidence-building and scientific and commercial collaboration. The whole legal/commercial aspect of joint ventures, particularly the issue of intellectual property rights, presents difficulties but also may prove to be an opportunity for groundbreaking collaboration. Again, governments must find common ground and provide a policy framework for this, but flexible joint R&D/production agreements that are responsive to the needs of the market are key to success.
- Minimum requirements regarding funding former BW-related facilities should not be compromised, and this should be made clear to governments and facility managements alike. They should have an open, civil- or defense-related agenda with free discussion about their activities; allow access for overseas scientists; permit their personnel to travel freely, engage in joint R&D activities with colleagues elsewhere, present at conferences, and publish their research (taking into account relevant proprietary rights); have transparent financing and not be funded by military-related agencies; and ensure that their top personnel are civilian-trained or free from military links.
- The U.S. and Russian governments should, as Sandakhchiev has suggested, start by seeking an agreement on the future of each facility of concern and put in place a strategy for first, safety and security enhancement and, second, sustainable development in order to cement the culture of transparency and dispel fears that funding is being used for prohibited purposes. Resources should be focused on core former BW facilities and facilities of scientific excellence that could potentially engage in BW-related R&D. Others could be subcontracted to carry out research for these core facilities, subject to the above-mentioned transparency standards, but otherwise would be left to their own devices.

The above measures would entail substantial additional resources—certainly greater than the extra monies already being allocated over the next year or two—but funding priorities need to be reassessed in the light of the increased threat of bioproliferation. As one U.S. analyst has pointed out, echoing the conclusions of the Baker-Cutler commission report,[27] "We are now spending two dimes on [CTR] programs for every dollar that we spend on missile defenses. Our budget allocations are wildly out of alignment."[28] Elisa Harris, former director for nonproliferation and export controls on the National Security Council staff, has estimated a cost of $750 million over five years—in other words a several-fold increase over current

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27. *A Report Card on the Department of Energy's Nonproliferation Programs with Russia*, January 10, 2001, at <http://www.seab.energy.gov/publications/rusrpt.pdf>.

28. "Roundtable on the Implications of the September 11, 2001, Terrorist Attacks for Nonproliferation and Arms Control," *Nonproliferation Review* 8, no. 3 (Fall–Winter 2001), at <http://cns.miis.edu/pubs/npr/vol08/83/round83.pdf>, p. 4.

levels—to support further peaceful research, dismantle or reorient the work of other former BW production facilities, expand collaborative research on global diseases such as HIV and TB, broaden work with U.S. scientists on vaccines and other BW defense measures, facilitate commercialization activities at former BW facilities, and further strengthen safety and security at sites that maintain culture collections and dangerous pathogens.[29]

Sums of this magnitude represent a fraction of the billions of dollars slated for spending by the United States on homeland defense against bioterrorism over the next few years. The drive to engage European and other wealthy nations to devote greater resources should also be stepped up. A relatively small percentage of this amount could be directed into CTR programs to allow NIS facilities to do specific research for BW defense purposes. This could include an aggressive R&D program into vaccines, medicines and diagnostic tests, research training, production of vaccines and antibiotics, and research aimed at solutions to operational problems of responding to bioterrorism (such as how potential bioterrorism pathogens may be weaponized, transported, and disseminated).

There is much expertise, in Russia in particular, upon which international networks could draw—expertise that some analysts believe to be lacking in the United States and that could bring benefits to biomedical research in general. An alternative approach suggested is for the United States to recruit the best Russian microbiologists *en masse*, but drawing Russia into the international knowledge economy could be more effective in terms of nonproliferation aims.

The Task Ahead

Quantitative and Qualitative Challenges

The sheer scale of the former Soviet BW effort and residual expertise and capabilities in certain areas of biotechnology and microbiology mean that there will be continuing concern over the potential for proliferation. Independent expert analysis has put the number of facilities with basic dual-use equipment, much of which was produced indigenously, at several hundred in Russia alone and several dozen each in many of the other NIS. As mentioned above, although many facilities have been opened to outside scrutiny, there remain several known military institutes and centers whose activities have not been investigated. There may be several more formerly involved in some aspect of the Soviet BW program that are as yet unknown.

Vertical proliferation remains a concern. Many senior scientists with a background in offensive military programs are still apparently *in situ*. Scientists engaged in ISTC projects could conceivably share the results of their work with closed military facilities. Even if ISTC funds are not being misused in this way, it could be that state funding meant for co-opted ISTC partner facilities is being transferred to closed ones, as details of the Russian defense budget are not released and only a select group of government and parliamentary officials have access to them.

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29. Statement before the House International Relations Committee, December 5, 2001, at <http://www.puaf.umd.edu/CISSM/Scholars/HIRCTestimonyFinal.htm>.

However, the CTR program has provided much information about the scope and nature of a large part of potentially offensive research in the NIS. Transparent collaboration is providing a measure of trust and control and may indeed be helping to instill a different culture. Although military scientists from the Soviet period remain, there are many more talented microbiologists who simply want funding for interesting, leading-edge research. ISTC projects help to ensure that talented younger researchers are not lured to military facilities but have sustainable work into which they are free to move. CTR also provides a potential basis for efforts to engage military facilities.

Since the end of the Cold War, the challenge of horizontal proliferation has moved to the fore. Based on known personnel levels at facilities such as Vektor, estimates of up to 15,000 former BW scientists in the USSR successor states might well be accurate. There have been positive developments in this respect. Some scientists have left for other employment; Sandakhchiev recently claimed that the number of Vektor personnel had been more than halved by 2001, to 715 engaged in scientific work and 700 in production, many of whom are engaged in CTR projects.[30]

Furthermore, although it is true that it only takes a few of the right specialists to represent a proliferation danger, it may be difficult to recruit a team with the breadth and depth of experience to pose a credible proliferation threat in terms of building a complete BW program. Ken Alibek is reported as stating that around 100 former Soviet scientists are capable of building an entire BW production facility,[31] the whereabouts and activities of most of whom are known.

Commentators warning of mass recruitments of BW specialists also often ignore the complex motivations, linked with concerns about national security and scientific prestige, behind scientists' contributions to the Soviet WMD effort. It may well be that, despite current difficulties, the lack of such motivations would prompt most scientists to refuse to work on offensive programs for foreign regimes. Nevertheless, a system should be developed to hold information on, and monitor the movements of, scientists working in the field of dangerous pathogens.

The military brain drain is only one aspect of the complex problem of technological security in the NIS. Comprehensive science and technology policies to guarantee the status of scientific institutions and personnel, a firm legal basis for intellectual property rights and the ownership of existing results of R&D, and an information infrastructure to underpin control over the sale of marketable technologies, including those that appear as a result of conversion of military-related production and the privatization of defense enterprises, are yet to be introduced. Although CTR programs cannot solve all of these problems, a deeper knowledge of

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30. L. Sandakhchiev, "Prospects for Development of the State Scientific Center Vektor," *Yadernyi kontrol*, no. 5 (September–October 2001): 82. One source states that staff at the Obolensk facility numbers around 1,000 out of more than 3,000 formerly employed; R. Scott Nolen, "Research Program Opens Doors of Russian Biomedical Facilities to U.S. Veterinarians," *Journal of the American Veterinary Medical Association*, December 1, 2001, at <http://www.avma.org/onlnews/javma/dec01/s120101b.asp>.

31. F. Guterl and E. Conant, "In the Germ Labs," *Newsweek*, February 20, 2002, <http://bulletin.ninemsn.com.au/bulletin/eddesk.nsf/All/1E2238A2CC82CD63CA256B640082C842?OpenDocument>.

the existing situation, as well as of the financial, organizational, and political structures underpinning dual-use biotechnology programs in the NIS are needed when thinking about how to deal with them. Creating a viable and sustainable pharmaceutical or biotechnology company from a former BW-related facility in particular may well be complex and costly, requiring careful planning and technical and financial management, and may not always be the best solution.

One obvious but vital point is that CTR programs alone can only begin to work as part of a broad, coordinated strategy aimed at BW nonproliferation, as Undersecretary of State for Arms Control and International Security John Bolton himself has acknowledged.[32] Measures include: strengthening the international ban on development and possession of BW embodied in the BWC by promoting voluntary declarations about activities; conducting bilateral and multilateral field trials of transparency; compliance measures at biodefense and industrial facilities (without a mutually agreed verification arrangement, the questions about Russia's military biological facilities engaged in offensive work in the Soviet period will remain unanswered); considering the draft proposal of the Harvard-Sussex Program on CBW Armament and Arms Limitation for a convention to make it a crime under international law to engage in prohibited BW activities; introducing a convention on physical protection of dangerous pathogens to strengthen oversight of laboratories conducting research in this field, since existing rules and guidelines are insufficient to prevent deliberate misuse of biotechnology research for destructive purposes; increased efforts on disease surveillance; pooling knowledge gained from intelligence activities; and reinforcing controls over transfer of pathogens themselves, including export-control procedures.[33]

On this last point, an authoritative source argues that the post–Cold War impetus for nonproliferation export controls has dissipated due to infrastructure weaknesses (limited sharing of licensing, enforcement, and intelligence information), inadequate threat assessments for list reviews (especially of dual-use G&T), inadequate harmonization of export-control systems (especially in enforcing compliance), lack of consensus regarding end-user controls, and inadequate recognition of the impact of new global models of research, commerce, and industry. U.S. failure to design new WMD export-control policies and provide leadership means that EU policies now may have greater influence in international standards.[34] This may be one sphere where CTR could provide the framework for a renewed joint U.S./EU/Russian effort, employing Russian expertise.

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32. John R. Bolton, *Beyond the Axis of Evil: Additional Threats from Weapons of Mass Destruction,* Heritage Lecture no. 743, May 6, 2002, at <http://www.heritage.org/library/lecture/hl743.html>.

33. See Jonathan B. Tucker and Raymond A. Zilinskas, "Assessing U.S. proposals to Strengthen the Biological Weapons Convention," *Arms Control Today,* April 2002; *Strengthening the Biological and Toxin Weapons Convention: Countering the Threat from Biological Weapons,* UK Foreign and Commonwealth Office, Cm 5484, April 2002, at <http://www.fco.gov.uk/Files/KFile/btwc290402,0.pdf>; G. S. Pearson, *Return to Geneva: The United Kingdom Green Paper,* Review Conference Paper no. 6, Department of Peace Studies, University of Bradford, at <http://www.brad.ac.uk/acad/sbtwc/briefing/RCP_6.pdf>.

34. R. Cupitt, "Export Controls, WMD Proliferation and Terrorism," *Monitor* [Center for International Trade and Security, University of Georgia] 8, no. 1 (Winter 2002): 12.

Initiatives under Way

New research, boosted by increased levels of funding over the last two or three years, is already under way at a number of facilities. Vektor, which has become a flagship for CTR in the BW sphere, obtained a number of ISTC grants in 2001, including for work on a therapeutic HIV vaccine, on drug-resistant tuberculosis in western Siberia and targeted delivery of antitubercular antibiotics, on Siberian tick-borne encephalitis viruses, on the variola (smallpox) virus genome and monoclonal and recombinant antibodies for variola, on measles and mumps, and on antivirals for orthopoxviral infections.

Sandakhchiev's proposal has also been taken up to establish an international center financed by grants from international organizations, government agencies, and free market investors, which would develop a system for monitoring emerging/reemerging infectious diseases, isolate and analyze pathogens and investigate their molecular epidemiology, carry out field expeditions to territories where they emerge, diagnose and confirm infection, develop new molecular techniques for diagnosis and characterization of emerging infections, carry out theoretical analysis and database compilation of primary structure of pathogens, develop recommendations on preventive measures to combat outbreaks of disease, and use the latest IT to facilitate work. An initial ISTC grant of $248,762 was obtained in 2001.

A series of ISTC projects is also now being dedicated to providing improved biosafety equipment and safeguards for the Russian variola collection maintained at Vektor. The building where the variola research is conducted has already received upgraded biosafety engineering and ventilation equipment; fiber optic Internet and communication networks have also been added, providing Vektor facilities with global information access. Total funding for these ISTC projects exceeds $4 million, provided by the Department of Health and Human Services and the Defense Threat Reduction Agency. The Nuclear Threat Initiative is also funding a feasibility study for manufacturing hepatitis vaccine at Vektor.

The culture both of security against proliferation and the transparency of R&D activity at this facility are consequently high. Similar support to key facilities at Obolensk, Serpukhov, and elsewhere is also developing rapidly. Among other types of activity, under an agreement with Uzbekistan the United States will spend $6 million dismantling the former BW testing site on Vozrozhdenie Island, removing buried anthrax and decontaminating the soil, as well as helping to upgrade security at NIS sites where dangerous agents and toxins are stored.

Projects and Activities That Could Be Pursued

Recent developments in the international sphere linked with concern over BW proliferation and bioterrorism should provide opportunities for continuing and expanding CTR programs in the biotechnology field via an integrated international effort with greater NIS involvement. More research is needed to assess feasibility, but several projects could be considered. There is considerable scope for further international collaboration on vaccines to combat the huge problem of emerging and reemerging diseases in the developing world. There is still a deficit of some vaccines and a need for more effective vaccines to reduce delivery costs. It may be possible to use more cost-effective NIS skills and involve NIS specialists more efficiently in the scientific and commercial network to produce lower-cost vaccines subsidized by international agencies. Russia in particular appears to have researched many of the diseases that recur in developing countries and may have the expertise to work on others; reports suggest it has already prepared the ground for large-scale inoculations with smallpox vaccines, as well as developing new smallpox vaccines and therapeutic agents.

Initiatives for joint research on epidemiology, prophylaxis, diagnosis and therapy of diseases associated with dangerous pathogens and related fundamental research, with initial programs on anthrax, melioidosis/glanders, plague, orthopox virus, viral hemorrhagic fevers and others, leading to work on other pathogens/areas of public health concern, could also involve the NIS. Supporting activities could include upgrading communications, improving safekeeping and use of collections and expanding exchanges of information on biosafety requirements and practices. To provide a specific example, the U.S. National Institute of Allergy and Infectious Disease (NIAID), the lead institute at the National Institutes of Health, has drawn up a research agenda involving seven new programs to counter potential bioterrorism pathogens, boosted by a $1.2 billion increase in funding.

Immunologists and microbiologists have been identified as particularly important to NIAID's ongoing work. This is the kind of program in which there is potential scope for NIS participation, especially in training young scientists. It has been estimated that the Russians have a 20-year lead on the United States in BW expertise and understanding. Collaborative research with Russian scientists on dangerous pathogens with the aim of improving U.S. defenses against BW threats is under consideration.

DOA is also considering plans to support projects to improve U.S. defenses against agricultural disease agents, for example foot and mouth disease and wheat rust. There is already a framework for this; the Committee on International Security and Arms Control (CISAC) Working Group on BW Control has in recent years designed arrangements for direct collaborative work between U.S. and Russian scientists for research, surveillance, and monitoring of new, emerging, and reemerging diseases. Linked with the above is enhancing a global epidemiological surveillance and response system.

The World Health Organization (WHO) already has a Global Outbreak Alert and Response Network, set up to detect and respond to natural outbreaks of infectious diseases around the world. One possibility is to improve and extend its activities. U.S. Senators Jesse Helms and Joseph Biden introduced the Global Pathogens Surveillance Act of 2002, which will authorize $70 million in 2003 and $80 million in 2004 to strengthen the disease surveillance capabilities of developing nations, which would help prevent and contain naturally occurring infectious diseases and improve forewarning of BW attacks. It may be that NIS could be involved in lab-to-lab cooperation on developing techniques to identify, diagnose, and track pathogens and on training and outreach activities.

One of the measures proposed in recent U.S. and UK policy documents is a universal system of standards on physical protection of dangerous pathogens across all types of facilities, including an international convention. As mentioned above, biosecurity has formed part of CTR assistance to the NIS, but enlisting their experience for third countries could also be useful. Effective promotion of nonproliferation export controls in the NIS, including training programs, might best be achieved by involving organizations in major international projects and commercial contracts with the developed market economies, alongside the intergovernmental cooperation that has developed over the last decade.

Apart from the specific U.S. initiatives described above, health ministers from the G-7 agreed in November 2001 to jointly explore cooperation in developing and procuring vaccines and antibiotics, support further the WHO disease surveillance network, share emergency preparedness and response plans, and improve linkages to laboratories working with or producing infectious and life-threatening pathogens. The European Commission's Joint Research Centre has initiated a bio-response working group, involving a network of specialists and laboratories, which is considering plans for developing and producing vaccines and for emergency response to terrorist employment of human, animal, and plant pathogens.[35] This is part of a broader EU assessment of knowledge and capacity regarding BW defense via better coordination of research activities among its members. Cooperation on security matters between the EU and Russia could be designed to involve Russia, and ultimately other NIS, much more extensively in these BW defense and nonproliferation initiatives.

From Co-option to Cooperation

New approaches should aim to combine nonproliferation and public health benefits with commercial benefits following from improving the stability of R&D in the NIS. Poorly funded and organized projects, involving little intellectual challenge and with poor long-term prospects, will not attract scientists. The difficulties involved should not be underestimated. Commercial opportunities do exist but are largely confined to task-specific R&D and are insufficient to fund a large microbiology and biotechnology effort in the NIS such as existed in the Soviet period. Any joint venture involving investment will be rigorously monitored by Western companies. Nevertheless efforts should be directed toward establishing commercial projects developing high-quality prototypes, quality-control systems leading to international current Good Manufacturing Practice certification, well-developed marketing and distribution systems, and providing access to U.S./Western business skills. This in turn should help to provide opportunities for overseas companies to become more active in the NIS via contact with specialists and access to expertise.

The Science Project Program, linked directly to scientific research, is the most comprehensive activity conducted by the ISTC, but there is a growing trend toward new collaborative programs devoting more resources to retraining and providing

35. *CBW Conventions Bulletin* [Harvard Sussex Program on CBW Armament and Arms Limitation] 55 (March 2002): 20–23. A recent article has recommended a common strategy on the EU's response to CBW to reaffirm nonproliferation measures adopted by the EU; D. Feakes, "The Emerging European Disarmament and Non-Proliferation Agenda on Chemical and Biological Weapons," *Disarmament Diplomacy* 65 (July–August 2002).

transferable skills—business management training, technology transfer and marketing, intellectual property protection, communication support, and other aspects of "soft technology," which forms an important part of commercially orientated science. ISTC funding for scientists' salaries and travel to conferences is being extended to funding salaries and travel for training and consultancy purposes for business-oriented employees. Commercializing scientific activity in this way via CTR may do more to reduce the pressure and incentive to maintain military-related facilities, as well as improving donor-recipient coordination.

Identifying Effective Means of Engaging NIS Governments and Other Entities

Engaging NIS governments, particularly Russia, is a huge and difficult, long-term task. It is a mere 20 years since President Ronald Reagan launched his attack on the Soviet "evil empire" and 10 years since President BorisYeltsin decreed the termination of Russia's offensive BW program. It will require a considerable political and intellectual effort to convince policy practitioners and elites, particularly in the defense establishment, that common interests outweigh residual defense concerns inherited from the Cold War.

September 11 has positively influenced views at the top of the U.S., European, and Russian administrations on the desirability of partnership: Witness the outcome of the June 2002 G-8 summit, at which President Vladimir Putin committed Russia to key nonproliferation principles. But there are still conservatives in both Washington and Moscow who are much more skeptical about wide-ranging cooperative security.

Several points might be made here. First is that progress has been and will continue to be cautious and incremental, and should be part of a concerted strategy by Western donors, taking into account all the political, security, economic, trade, and technology ramifications. Limited transparency of Russia's Defense Ministry facilities is probably the best that can be hoped for in the short term. It should be clear that instilling a nonproliferation culture is a good in itself; while Russia does not have a blameless record of compliance, improving consultation and negotiation procedures should be concentrated on, and certification of CTR assistance should only be withheld in its entirety as a last resort. The concept should be depoliticized as far as possible. Certainly, in promoting CTR one should deplore the tendency even of senior figures in the U.S. administration to send the message to Russia that it is considered an inveterate proliferator.

Second, when prioritizing potential CTR activities, both donor and recipient governments should seek agreement on what is an ideal, mutually acceptable scenario for the transformation of the former Soviet BW complex. This may consist of a small but vigorous, partly collaborative BW defense effort as permitted by the BWC, with results published in the open literature (the UK experience following the discontinuation of its offensive program could be instructive here[36]); closer involvement of NIS facilities in an international vaccines program and programs for the study of emerging and reemerging diseases; some conversion of former BW facilities to biotechnology/pharmaceutical production; joint ventures and other forms of commercial cooperation; and a core fundamental and applied biotechnology and life sciences effort research base, which should be further slimmed down and restructured to allow facilities to take advantage of any commercial opportunities, and supported by retraining programs. This represents a challenge for the developed market economies, and particularly the United States, to share some of their massive commercial and defense advantages in the biotech sphere.

Third, while much of this paper focuses on what CTR donors should be doing, recipient governments must also be encouraged to tackle the challenge of BW proliferation more vigorously. The question must be asked whether simply boosting funding would at the current time enhance security and transparency at NIS facilities. As President Putin acknowledged in his April 2002 state-of-the-nation address, economic measures to improve the investment climate and commercial-legal reforms to create a more favorable situation for science and high-tech industry are obviously required, but specific measures to match CTR funding among recipient states, especially for projects with commercial potential, should also be on the agenda.

The political matter of mixed jurisdiction among the Russian authorities is just as thorny. At present, responsibility for bio-demilitarization rests with the RF Munitions Agency, which is supposed to work with other government agencies including the Defense, Health, and Agriculture Ministries but which—in contrast to the chemical sphere—has no BW defense-related facilities subordinated to it. It is doubtful whether it could cope administratively if these facilities were transferred to its jurisdiction, but in any case the agencies in question are likely to resist strongly any attempt to encroach on their vested interests. The Russian government needs to overhaul the administrative capacity to absorb CTR programs and encourage agencies to take a more flexible and transparent approach in coordination with facilities.

More important in this respect than agency jurisdiction is allowing a greater role for parliamentary and public oversight. Striking a balance among democratic control of defense and security policy, greater provision of information in the public domain to allow nongovernmental contribution to the debate, and the need to maintain security in such a sensitive area is difficult for any country. Again, the experience of Western governments, parliaments and NGOs, while perhaps not transferable *in toto* to the NIS, could be instructive in helping to build state capacities in this area. The CTR program was not designed to address these problems, of course, but the larger picture needs to be considered when making nonproliferation policy choices.

Finally, revelations in recent months about the CIA facility in Nevada and its attempts to genetically engineer a Soviet-type anthrax "superbug," build a germ factory from commercially available materials, and build and test a Soviet-designed test bomb (one authority points out that this could have been revealed by a verifiable BWC, leading to speculation that in rejecting a verification protocol the United

36. See *Strengthening the Biological and Toxin Weapons Convention: Countering the Threat from Biological Weapons,* UK Foreign and Commonwealth Office.

States wants to keep some projects secret),[37] planned tests of warheads with live BW at the Edgewood CB Center in Maryland, and development of nonlethal agents for military use, do nothing for international confidence.

The Federation of American Scientists has reportedly criticized the extensive U.S. biodefense program, some activities of which are difficult to distinguish from an offensive program—a situation made worse by advances in genetic engineering. One can imagine a Russian defense establishment skeptical about allowing itself to be disarmed by the United States and Europe while such activities are going on. Elisa Harris argues, "Until now, there has been no comprehensive review of these secret U.S. biological defense activities, individually or in combination. The U.S. Congress should hold oversight hearings on the biological defense program to ensure that its scientific, legal and foreign policy impact are consistent with U.S. nonproliferation interests."[38]

Dividing the Task

The news from the June 2002 G-8 summit concerning the stated readiness of leading European countries, as well as Canada and Japan, to match U.S. CTR funding over the next decade indicates that, even if results fall short of expectations, the importance of sharing the burden commensurate with Europe's financial capacities is now widely accepted. It reflects the determination to take concrete action stated in the EU's General Affairs Council conclusions of April 15, 2002, which undertake to "support and enhance, within the EU financial possibilities and building on already existing initiatives in the Russian Federation and other CIS, co-operation programs for disarmament and non-proliferation."[39] Important here is the greater political role the EU appears to be assuming in CBW disarmament and nonproliferation policy, characterized by one commentator as a "quantum leap."[40]

EU and member states funding for CTR programs remains at a modest level compared with the United States, despite the impact on security thinking of September 11 and the anthrax attacks in the United States. An EU budget of around £21 million covers all ISTC activities, a relatively small proportion of which is directed toward the biotechnology sphere. Member states have expressed interest in the latter, particularly in public health and other civilian programs, but are unwilling to fund directly large projects in the former Soviet BW complex. The Russian government's insistence that no offensive BW R&D is going on has also meant that

37. G. S. Pearson, "The U.S. Rejection of the Protocol at the Eleventh Hour Damages International Security against Biological Weapons," *CBW Conventions Bulletin* [Harvard Sussex Program on CBW Armament and Arms Limitation] 53 (September 2001): 7.

38. Statement before the Senate Governmental Affairs Committee Subcommittee on International Security, Proliferation and Federal Services, February 12, 2002, at <http://www.clw.org/sept11/harristestimony2.html>.

39. See <http://ue.eu.int/newsroom/makeFrame.asp?MAX=1&BID=71&DID=70160&LANG=1&File=/pressData/en/gena/70160.pdf>; see also the EU country report in volume 3, *International Responses,* of Einhorn and Flournoy, *Protecting against the Spread of Nuclear, Biological, and Chemical Weapons*.

40. Feakes, "The Emerging European Disarmament and Non-Proliferation Agenda."

funding in this sphere has stalled; its own priorities appear to lie more in nuclear safety and CW stockpiles destruction. Private entities in Europe have shown some interest, but few concrete projects have as yet been identified. A UK source stated that projects concentrating on animal and plant rather than human pathogens might be more attractive. The EU itself would in any case have limited administrative capacity to handle large budgets for threat reduction activities such as those managed by U.S. agencies. Changing this situation, if increased funding is to be channeled through the EU, evidently poses a challenge.

Greater European involvement in a multilateral effort would bring political advantages, as there is still some resistance in Russia to U.S. involvement. One analyst has recommended expanding the scope of the EU's Joint Action Russia program[41] as the basis of an EU equivalent to CTR and a mechanism for coordinating bilateral arrangements between EU states and third countries.[42] It may also be timely for the EU to consider potential reciprocal benefits of greater cooperation with the NIS in civilian biotechnology. A recent EC consultation document has recommended a rethink of its strategy in this sphere in order to compete more effectively on the global stage.[43] There may be niches where the NIS could contribute to a transnational partnership with the EU, which would have an impact in the CTR context through greater commercialization of R&D. European assistance could also be targeted at specific initiatives for which the United States has prohibited funds, for example promoting retraining of scientists. The UK Resettlement Programme to retrain retired Russian army officers in civilian skills has proved a success[44] and might provide a model for a similar approach for former BW scientists.

There are also certain areas of comparative advantage where individual countries could contribute more to reducing the BW proliferation threat. For example the United Kingdom may, together with the United States, be best placed to contribute in view of its role in the trilateral initiatives in the early 1990s, its own BW defense expertise at DSTL Porton Down, and the strong intellectual basis provided by policy-related research in the Harvard Sussex Program and at the University of Bradford. Individuals from these two institutions have argued that the United Kingdom's biotechnology knowledge and government expertise have made a substantial contribution to progress on the BWC, and that the United Kingdom should lead efforts to increase international awareness.[45] At present UK bilateral assistance to Russia is going mainly to chemical weapons destruction in Russia, with some promised for nuclear demilitarization, although possibilities in the biotech sphere are being investigated.

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41. See <http://www.auswaertiges-amt.de/www/en/aussenpolitik/vn/nuklearpolitik/russland_htm>.

42. Feakes, "The Emerging European Disarmament and Non-Proliferation Agenda."

43. Commission of the European Communities, *Toward a Strategic Vision of Life Sciences and Biotechnology: Consultation Document*, COM (2001) 454 final, September 4, 2001, at <europa.eu.int/comm/biotechnology/pdf/doc_en.pdf>.

44. UK Ministry of Defense, *Defense Diplomacy*, Paper no. 1, at <http://www.mod.uk/issues/diplomacy/index.htm>.

45. UK Parliament Foreign Affairs Committee, *Weapons of Mass Destruction*, Eighth Report, July 25, 2002, p. 73.

In a situation where national governments in Europe are under economic pressure to cut defense-related spending, and where there is counter-pressure from NATO to increase spending on defense capabilities to meet new security challenges, the additional burden of sharing in CTR might appear unsustainable. It should, however, not be seen as an optional extra but should be factored into defense planning at a strategic level. Terence Taylor summarizes the argument:

> The leading edge of arms elimination and reduction is the resolution of the major political differences in the various regions of the world.... In policy terms this means that investment in processes which reduce the demand for [WMD] is likely to bring a higher return than reinforcing global monitoring regimes which deal only with the supply side. Given the nature of the developments of global trading, and the speed at which technology diffuses, the latter investment can bring only a very modest return at best; at worst single-minded devotion to this approach can undermine security.... However, pragmatic policies that support the dismantling of weapons of mass destruction, such as the U.S. Cooperative Threat Reduction (CTR) programme with Russia...is a substantial activity that enhances international security. The UK and its European partners have contributed to similar activities in Russia in a modest way, but substantially more resources could be devoted to this type of activity by the Europeans to good effect in reducing a major source of proliferation.[46]

Building Support

One analyst has recommended to the U.S. Senate that, in addition to increased funding, more information on WMD terrorism should be made available to scholars and analysts. Information is scattered or being withheld from the public domain, which can lead, especially where bioterrorism is concerned, to hysteria—the other side of the coin to complacency. The whole CTR concept was developed outside the executive, and the latter therefore should not hold a monopoly over information.[47] It is ultimately up to governments to coordinate and implement a response to the increasing challenge of proliferation, but the importance of NGOs and academic think tanks, both in donor and NIS countries, able to assemble the required expertise and think outside of traditional security parameters cannot be overstated. A media/public outreach program to highlight the risks from and limitations of bioterrorism should also be launched.

Building intellectual capital on threat reduction and BW proliferation issues, particularly post–September 11, educating key decisionmakers in national governments (especially defense ministries), parliaments, and the EU via a joint assessment of past CTR activities, sharing legislative, operational and technical

46. Ibid., pp. 80–81.

47. Jim Walsh, "Multilateral Non-proliferation Regimes, Weapons of Mass Destruction Technologies and the War on Terrorism," Testimony before the Senate Governmental Affairs Committee Subcommittee on International Security, Proliferation and Federal Services, February 12, 2002, at <http://www.senate.gov/~gov_affairs/021202walsh.htm>.

experiences to date, and establishing a network of European parliamentarians committed to developing legislation for threat reduction activities is a massive agenda.

The United States and Europe, with the support of Russia and the other NIS, should commission an independent, in-depth assessment of CTR in the BW sphere, taking into account the political, security, commercial, and technological issues involved and linking them with wider issues of biological arms control and developments in biotechnology. At their 2002 meeting, the G-8 summit leaders committed to establish a mechanism to review progress in the increased funding initiative, consult over priorities, identify project gaps or potential overlap, and assess consistency of projects with international security obligations and objectives. It is essential to do this in the BW-related sphere prior to committing increased funding and putting in place a long-term strategy for first, biosafety and biosecurity enhancement, and second, sustainable scientific and commercial cooperation.

Only by carrying out such an assessment can we ensure that the increased threat to international security presented by the potential proliferation of BW is properly understood and addressed.

CHAPTER 3

Russian Chemical Weapons Demilitarization

Successes and Challenges

Paul F. Walker
Global Green USA

Both the United States and Soviet Union unilaterally and reciprocally agreed some two decades ago to abolish their large and aging arsenals of chemical weapons. Both countries acknowledged several important liabilities associated with these dangerous stockpiles: the risk of proliferation, diversion, and terrorist theft; the obsolete nature of the weapons, many without modern launch systems; the high cost of maintaining security and safety of the stockpile sites; and the growing international pressure to establish an inclusive demilitarization and inspection regime.

In 1993, the international Chemical Weapons Convention (CWC), negotiated for more than 12 years, was opened for signature. Both the United States and Russia signed, along with 128 other countries. Four years later, after much political debate in Moscow and Washington, both countries ratified the convention. The CWC entered into force April 29, 1997, obliging the four acknowledged signatories holding chemical weapons stockpiles (United States, Russia, India, and South Korea) to abolish their arsenals by 2007, with a five-year extension option until 2012. All signatories, now expanded to 147, commit to halt all research, development, production, use, and transfer of chemical weapons, and to destroy all stockpiles, abandoned chemical weapons, and all production facilities.[1]

Over the past decade, bilateral and multilateral on-site inspections of chemical weapon stockpile sites have illustrated well how vulnerable some, if not all, of these sites are to infiltration, theft, and possible diversion to national and subnational groups. The use of chemical weapons by Iraq against Iraqi Kurds in Halabja in March 1988 and by the Japanese terrorist group, Aum Shinrikyo, in the Tokyo subway on March 20, 1995, has also illustrated the gruesome mass destruction potential of these deadly weapons. And the September 11, 2001, terrorist attacks in New York, Washington, D.C., and Pennsylvania have heightened concern about the vulnerability of stockpiles to aircraft and weapons attack. Most past risk assess-

1. The number of countries that have ratified, or acceded to, the Chemical Weapons Convention, is 147 as of October 27, 2002. See <http://www.opcw.org> for the latest list of member states.

ments have cited light aircraft and helicopter accidents, lightning strikes, and earthquakes in worst-case analyses; now the potential for intentional attacks with heavy, jet-fuel-loaded aircraft and missiles must also be taken into account.

The challenges for safe and environmentally sound destruction of chemical weapons stockpiles, however, are many and formidable. Chemical weapons—artillery shells, aerial bombs, rockets, landmines, submunitions, and bulk tanks—were primarily designed to be used in battle, not to be disassembled, destroyed, and partially recycled. Thus the question of technology choice is a major first obstacle. Because of the technical complexity, the cost of destruction has also become a major factor, escalating into the tens of billions of dollars for each country. Potential impacts on public health and the environment of local communities, most of whom were unaware prior to the 1990s of the danger lurking in their backyards, are also of major importance. And, of course, the political process for deciding on destruction programs, emergency evacuation procedures, and socioeconomic impacts of billion-dollar facilities employing thousands of workers is also key to a successful program.

Chemical Weapons Demilitarization

Russia has declared 40,000 tons of chemical weapons at seven stockpiles sites. Two of these at Kambarka in the Udmurt Republic and Gorny in the Saratov Oblast hold only lewisite, mustard, and lewisite-mustard mixtures—older, arsenic-based chemical weapons. The other five sites—Shchuch'ye in the Kurgan Oblast, Kizner in the Udmurt Republic, Maradikova in the Kirov region, Pochep in the Bryansk region, and Leonidovka in the Penza region—all hold a variety of newer and more deadly Russian nerve agents (VX, sarin, and soman, plus smaller amounts of lewisite, lewisite-mustard, and phosgene) in varied weapons configurations.

The United States, in comparison, has declared 31,500 tons of chemical weapons at nine sites: eight in the continental United States (Aberdeen, Maryland; Anniston, Alabama; Blue Grass, Kentucky; Newport, Indiana; Pine Bluff, Arkansas; Pueblo, Colorado; Tooele, Utah; and Umatilla, Oregon) and one on Johnston Atoll in the Pacific Ocean. These contain varied amounts of mustard and nerve agents, with a small amount of older lewisite.

Both countries had first proposed construction of regional destruction facilities. These schemes were halted due to public concern over transportation of live agent through communities and the realization by military authorities that environmental permits for transportation would be complex. The U.S. Congress banned transportation of chemical weapons early in the U.S. Army's demilitarization program, forcing plans to shift to on-site destruction. In Russia, the Ministry of Defense secretly constructed a centralized destruction facility in Chapeyevsk but was forced to change plans when the local community in 1989 vehemently protested the importation of chemical weapons into their region.

Thus, Russia and the United States began planning for seven and nine destruction facilities respectively. The United States committed itself in the mid-1980s to a program of incineration at each site, judging the high-temperature technology to be most mature and flexible to handle agent, explosives, propellant, metal parts, and dunnage (wood, fiberglass, and other weapons parts and contaminants).

The first prototype incinerator was constructed on Johnston Atoll 800 miles west of Hawaii to destroy chemical weapons that had been secretly removed from Okinawa and Germany; it began operating in the early 1990s and finished destruction of its stockpile in 2001. A second incinerator, constructed at Tooele, Utah, began operating in the mid-1990s and continues to burn the arsenal there of some 14,500 tons. Three additional incinerators have been constructed in Alabama, Arkansas, and Oregon and are scheduled to begin operations in the next two years. Of the remaining four U.S. chemical weapons stockpile sites, construction has begun at Newport, Indiana, and Aberdeen, Maryland, on neutralization plants; a decision for neutralization technology was made in March 2002 for Pueblo, Colorado, and construction should begin in 2003; and a technology choice for Blue Grass, Kentucky, will likely be made in late 2002. The United States has thus been successful in destroying some 7,500 tons of chemical weapons to date, almost a quarter of its stockpile.

Russia has had less success. To date only a few tons of phosgene from the Shchuch'ye stockpile site have been converted to commercial use. No major destruction of chemical weapons has taken place, although site preparation and facility construction has begun at two of the seven sites. Germany has supported construction of a prototype lewisite and mustard destruction facility at the Gorny stockpile and plans to begin destruction of some 1,100 tons of chemical agent in late 2002 or 2003. The United States has supported site preparation and engineering plans for a neutralization facility at Shchuch'ye, but facility construction has yet to begin because of recent funding cuts by the U.S. Congress and the refusal of the U.S. Department of Defense in 2002 to certify congressional conditions.[2]

The reasons for this tardiness in Russian chemical weapons destruction are many, but the primary one has been lack of financial support. Russia, upon signature and ratification of the Chemical Weapons Convention in the mid-1990s, made it abundantly clear to the United States, Europe, and other CWC signatories that it lacked sufficient funds to support a full demilitarization program. Both Europe and the United States assured Russia of their support. Since that time, the United States agreed to provide support for one CW stockpile site, committed to an estimated facility construction cost of $888 million, and has spent almost $240 million to date. Unfortunately, the U.S. Congress (primarily through the House Armed Services Committee) zeroed out requests by the Clinton administration in fiscal year 2000 and 2001 for $130 million and $35 million respectively for initial construction at Shchuch'ye and established six conditions on fiscal year 2002 funding of $50 million. The Bush administration, through Secretary of Defense Donald Rumsfeld, has refused to certify these conditions to date, precluding use of the 2002 monies.[3]

Twelve European countries, including the European Union, have also contributed or pledged more than $100 million to date for Russian chemical weapons destruction (primarily at Gorny and Shchuch'ye). Russia itself committed $25 million in 2000, the first hard budget figure available, and has expanded that to more than $100 million for 2001 and 2002, primarily targeted toward infrastructure development at the stockpile sites. Overall costs are estimated in the $6-billion to

$10-billion range for full Russian stockpile destruction, less than half the current $24-billion cost for U.S. chemical weapons demilitarization, but still a very large sum for the Russian federal budget today.

Another major obstacle in the Russian program has been technology development. In July 1994, a U.S. congressional and administration delegation to Moscow and Shchuch'ye proposed building an incineration facility at Shchuch'ye. This was flatly rejected by Russian officials as too complex and dangerous, and a joint technology development project was initiated shortly thereafter to try to help the Russian program along.

The Russian-proposed technology for Shchuch'ye was a two-stage process: neutralization of drained nerve agents with a caustic reagent, and subsequent solidification of the slightly toxic liquid product with asphalt ("bitumenization"). A

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2. There have been two sets of conditions established by the U.S. Congress, one for all Cooperative Threat Reduction (CTR) programs and another specifically directed at Russian chemical weapons destruction programs under CTR. The first set, general CTR conditions, requires the U.S. president to certify to Congress annually the following six conditions (Section 1203, National Defense Authorization Act for Fiscal Year 1994, H.R. 2401, Cooperative Threat Reduction Act of 1993):

"Assistance authorized by subsection (a) may not be provided to any independent state of the former Soviet Union for any year unless the President certifies to Congress for that year that the proposed recipient state is committed to each of the following:

(1) Making substantial investment of its resources for dismantling or destroying its weapons of mass destruction, if such state has an obligation under a treaty or other agreement to destroy or dismantle any such weapons.

(2) Foregoing any military modernization program that exceeds legitimate defense requirements and foregoing the replacement of destroyed weapons of mass destruction.

(3) Foregoing any use in new nuclear weapons of fissionable or other components of destroyed nuclear weapons.

(4) Facilitating United States verification of any weapons destruction carried out under this title, section 1412(b) of the Former Soviet Union Demilitarization Act of 1992 (title XIV of Public Law 102-484; 22 U.S.C. 590(b)), or section 212(b) of the Soviet Nuclear Threat Reduction Act of 1991 (title II of Public Law 102-228; 22 U.S.C. 2551 note).

(5) Complying with all relevant arms control agreements.

(6) Observing internationally recognized human rights, including the protection of minorities." The second set of conditions, specific to chemical weapons, requires the U.S. secretary of defense to certify to Congress the following six conditions (National Defense Authorization Act for 2002, Conference Report to Accompany S. 1438, Report 107-333, Title XIII, Cooperative Threat Reduction, Section 1308, Chemical Weapons Destruction):

"Section 1305 of the National Defense Authorization Act for Fiscal Year 2000 (Public Law 106-65; 113 Stat. 794; 22 U.S.C. 5952 note) is amended by inserting before the period at the end the following: 'until the Secretary of Defense submits to Congress a certification that there has been—

(1) information provided by Russia, that the United States assesses to be full and accurate, regarding the size of the chemical weapons stockpile of Russia;

(2) a demonstrated annual commitment by Russia to allocate at least $25,000,000 to chemical weapons elimination;

(3) development by Russia of a practical plan for destroying its stockpile of nerve agents;

(4) enactment of a law by Russia that provides for the elimination of all nerve agents at a single site;

(5) an agreement by Russia to destroy or convert its chemical weapons production facilities at Volgograd and Novocheboksark; and

(6) a demonstrated commitment from the international community to fund and build infrastructure needed to support and operate the facility.'"

July 1996 evaluation of this process determined that it successfully met a destruction efficiency of 99.9999 percent ("six nines") for both U.S. and Russian nerve agents (sarin [GB], soman [GD], and VX) on a laboratory scale, produced no extremely toxic or hazardous waste, and would stand up to independent peer review.[4] This Russian technology is continuing to undergo expanded engineering and development, as well as additional testing of potential environmental and health effects. Local and regional officials remain concerned that the waste generated may be hazardous and/or too expensive to store for the long term in the Kurgan region.

A third obstacle in Russia has been Russian bureaucracy. Under the presidency of Boris Yeltsin, the Russian Ministry of Defense was in charge of stockpile destruction. Although Russia approved the Federal Program for Chemical Weapons Destruction in March 1997, it was generally observed that little commitment and progress were made; this may have been due to the very limited annual military budget. Fortunately, President Vladimir Putin moved responsibility from the military to a newly created civilian agency, the Russian Munitions Agency (RMA), in the late 1990s and placed a respected minister from the military-industrial complex, Dr. Zinovy Pak, in charge.

In September 2000, Pak tasked his agency with elaborating a new overall concept for Russian chemical weapons destruction in order to try to lower costs by a third or more. This plan will now be designed around three primary destruction facilities at Gorny, Shchuch'ye, and Kambarka. The Shchuch'ye facility, partly at the urging of the U.S. Congress, will destroy all nerve agents, while the Gorny and Kambarka facilities will manage the lewisite and lewisite-mustard agents.[5] This raises the potentially difficult issue of transportation of weapons, agent, or neutralized agent from other nerve agent sites to the Kurgan Oblast. Although transportation was previously banned by Russian federal and state legislation, recent federal amendments have given life to this option again. Local and regional communities and officials, however, are questioning the potential risks.

3. The FY 2003 Defense Appropriations bill (H.R. 5010) included an amendment, initiated by Senator Richard Lugar, which may free up 2003 and prior year funds for Shchuch'ye construction by allowing the U.S. president to waive the chemical weapons conditions: "Section 8144. (a) The conditions described in section 1305 of the National Defense Authorization Act for Fiscal Year 2000 (Public Law 106-65; 22 U.S.C. 5952 note) shall not apply to the obligation and expenditure of funds for fiscal years 2000, 2001, 2002, and 2003 for the planning, design, or construction of a chemical weapons destruction facility in Russia if the president submits to Congress a written certification that includes—(1) a statement as to why waiving the conditions is important to the national security interests of the United States; (2) a full and complete justification for exercising this waiver; and (3) a plan to promote a full and accurate disclosure by Russia regarding the size, content, status, and location of its chemical weapons stockpile. (b) Expiration of Authority. —The authority under paragraph (a) shall expire on September 30, 2003."

4. U.S. Department of the Army, Program Manager for Chemical Demilitarization (in coordination with the Russian Ministry of Defense and the State Scientific Research Institute for Organic Chemistry and Technology), *Joint Evaluation of the Russian Two-Stage Chemical Agent Destruction Process: Final Joint Evaluation Technical Report*, Product Manager for Cooperative Threat Reduction, Aberdeen Proving Ground, Maryland, July 1996 (revised).

5. See condition no. 4 in the second set of conditions in this chapter's footnote 2, above.

On May 4, 2001, Russian president Putin also created a new State Commission on Chemical Weapons Destruction, chaired by Sergei Kirienko, the Putin representative (or "super-governor") in the Volga Region, in order to improve collaboration between the federal government, ministries, and regional administrations.[6] At least seven major responsibilities are included in the commission's mandate: (1) development of proposals for the Russian president and government on federal policy and international coordination for destruction of chemical weapons and former production facilities; (2) coordination of activities and information with local populations in stockpile areas; (3) consideration of legal issues for demilitarization activities and for citizen protection; (4) monitoring of the Russian chemical weapons demilitarization program; (5) oversight of funding; (6) prioritization of budgets; and (7) facilitation of international funding and technical assistance.

Public statements of President Putin, Zinovy Pak, Sergei Kirienko, and others, including recent visits of Pak and Kirienko to the United States, also lend credibility to a more serious Russian commitment to fulfilling Russia's legal obligations under the Chemical Weapons Convention and moving forward with the demilitarization program. The Russian government described the program in late 2000 as "one of Russia's most important international commitments." The May 2002 Moscow summit of Presidents Bush and Putin also emphasized the need for greater cooperation in accelerating the destruction of Russian and U.S. chemical weapons stockpiles.[7]

Lessons Learned

The process of chemical weapons demilitarization in both Russia and the United States has been shown to be technically challenging, politically complicated and demanding, and unpredictable in both cost and time. However, a number of important lessons can be drawn from this process over the past decade, which should help expedite it in the future.

- There is no "silver bullet" technology for destroying all stockpiles and all types of chemical weapons.

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6. Other members of the State Commission are Zinovy Pak, deputy chairman and director of the Russian Munitions Agency; A. Antipin, Putin representative in the Ural Region; D. Ayatskov, governor of the Saratov Oblast; Sergei Baranovsky, president of Green Cross Russia; N. Bezborodov, deputy chair of the Duma Defense Committee; O. Bogomolov, governor of the Kurgan Oblast; V. Botshkariov, governor of the Penza Oblast; A. Volkov, president of the Udmurt Republic; V. Volkov, Putin representative in the Central Region; A. Kvashnin, head of the Military General Staff; Yu. Lodkin, governor of the Bryansk Oblast; G. Mamedov, deputy minister of foreign affairs; V. Mosgaliov, deputy minister of economic development and trade; G. Petrov, deputy minister of health; N. Plate, first scientific secretary of the Russian Academy of Sciences; A. Poryadin, first deputy minister of natural resources; L. Safronov, deputy minister of machine industry, sciences, and technology; V. Sergeyenkov, governor of the Kirov Oblast; A. Ulyukayev, first deputy minister of finance; M. Faleyev, deputy minister of civil defense, emergencies, and liquidation of consequences of natural disasters; and N. Fyodorov, president of the Chuvash Republic.

7. The arms reduction treaty signed by Presidents Bush and Putin on May 24, 2002, stated the following: "We also intend to intensify our cooperation concerning destruction of chemical weapons." See *New York Times*, May 25, 2002, p. A7.

Both countries have sought to develop mature, cost-effective, and safe demilitarization technologies, which could be applied to all stockpiles. In the U.S. case, incineration was advocated by the Army and the National Research Council as the best solution for each of the nine stockpile sites. However, political opposition from several states, including Kentucky, Indiana, Maryland, and Colorado made it clear that incineration would have a very difficult time being permitted by state regulatory agencies and approved by local communities. Also, accidental releases of live agent from incinerator smokestacks at Johnston Atoll and Tooele, Utah, alarmed state regulators, environmentalists, and local citizens. The United States will now utilize four or more different technologies specifically suited to local stockpiles, weapons, and politics.

The Russian military has similarly pursued a single, two-stage neutralization and bitumenization process for nerve agent destruction, which has come under criticism from the Kurgan region for the amount of waste generated, the cost of long-term storage, and its potential long-term impacts on public health and the environment. Although a less contentious neutralization process has been developed for lewisite destruction, these are much smaller stockpiles with less significant local impacts.

It is clear from the past decade that a toolbox of technology options is needed for weapons demilitarization in order to provide choices to authorities and communities. Different geographic regions have varied resource constraints; for example, dry regions are skeptical of water-based processes, while wet regions question any landfill options. And chemical agents, energetics, and related materials respond differently to different processes. Mustard agent, for example, neutralizes very well with hot water, while nerve agents require a more caustic process. All of these processes have impacts on natural resources utilized; gaseous, liquid, and solid effluents produced; and safe management of environmental and health impacts.

- Demilitarization requires strong national leadership.

The destruction of weapons of mass destruction is controversial in many ways. The process is understandably perceived as potentially very dangerous by local communities. Although extremely important from a nonproliferation perspective, it sometimes is defined as more "environmental" than security-related and therefore can take lower priority on military funding ladders. When the U.S. House Armed Services Committee zeroed out administration funding requests for support of Russian chemical weapons destruction in fiscal years 2000 and 2001, it stated that Shchuch'ye was more an environmental problem for Russia than a security problem for the United States and Europe.

Since the tragedies of September 11, 2001, some members of Congress and the administration are beginning to realize that destruction of the Shchuch'ye stockpile of 5,400 tons of nerve agent, packaged in millions of man-portable artillery shells and hundreds of missile warheads, and located just north of Kazakhstan, is in fact a top nonproliferation and counterterrorism priority. Similarly, some Russian Duma members who previously placed higher priority on other competing national needs now realize that chemical weapons destruction must be a top priority for Russia. But this will only happen with strong leadership from the highest levels in Washington, Moscow, and other national capitals.

- International burden sharing for Russian weapons destruction is crucial.

The United States faces a demilitarization price tag of some $24 billion for destruction of the 31,500 tons in the U.S. chemical weapons arsenal. It has also committed to funding up to $888 million for the Russian program at Shchuch'ye. Yet destruction of the Shchuch'ye site alone is estimated to cost at least $1.6 billion, while the total Russian chemical weapons destruction program will likely surpass $6 billion. Russia is now committing more than $100 million annually to the program, but it is clear that another $5 billion or more will be necessary to complete destruction of Russia's 40,000 tons. The European Union, Canada, Finland, Germany, Great Britain, Italy, the Netherlands, Norway, Sweden, and Switzerland have all committed a total of some $100 million to Russia's efforts, but this is far from enough. The June 2002 announcement from the G-8 summit meeting in Canada that the G-8 members would commit to "up to $10 billion over 10 years," to be matched by the United States ("10 plus 10 over 10") to help Russia eliminate weapons of mass destruction is encouraging, but the international burden sharing must improve in terms of dollar amounts and numbers of participants in order to totally abolish Russia's arsenal.[8]

- Investment in local infrastructure and sustainable economies at demilitarization sites is also crucial.

Early in the U.S. Cooperative Threat Reduction (CTR) Program, Congress stated that all CTR monies should be spent only "inside the fence," that is, only on destruction facilities themselves. However, Russian sites are so limited in basic infrastructure—utilities, roads, housing, railroads, and services—that no facility can operate without considerable development of a local support economy. Local communities in both the United States and Russia recognize their leverage in these projects and understandably are interested in establishing sustainable economies as they transition from secret stockpile sites and closed cities to more public and civilian entities. Local Russian officials have stated often that they will not permit a "boom and bust" economy to be developed in which a destruction facility is built and operates for five years with a thousand workers, only to be shut down after the stockpile is destroyed. In the United States local officials have also argued for "impact fees" in order to make long-term capital investments in the community that will help sustain it far beyond the demilitarization program.

Although some observers argue that infrastructure investment is a Russian responsibility, it remains obvious that it is an integral part of the demilitarization

8. Commitments and pledges under consideration through 2001 (in U.S. dollars) included Canada, $224,000; European Union, $8.4 million; Finland, $893,000; Germany, $30.5 million; Great Britain, $17.1 million; Italy, $6.9 million; Norway, $878,000; Sweden, $1.7 million; Switzerland, $17.5–30 million; Netherlands, $10 million; and the United States, $888 million. These figures will likely increase with the June 2002 commitment by the G-8 to contribute up to $10 billion over the coming decade.

program and one that Russia cannot fully afford today. What is needed is a recognition that both development and demilitarization must go hand-in-hand; in practice, this means that government agencies, such as the U.S. Agency for International Development and the U.S. Cooperative Threat Reduction Program, must begin immediately to coordinate projects in the former Soviet Union.

- The United States must continue to play a leadership role in Russian weapons destruction.

  The Cooperative Threat Reduction Program, established in 1992 with the leadership of Senators Sam Nunn and Richard Lugar and many other supporters, has spent about $240 million to date for Russian chemical weapons destruction and more than 15 times that amount for nuclear and biological weapons destruction. No other country has the financial resources to play this leadership role. No other country has the post–Cold War responsibility to help abolish weapons of mass destruction. And after the tragedies of September 11, 2001, no other country has as much to lose should these weapons proliferate to potential enemies. Only with a continuation of the CTR and related demilitarization programs will other countries and allies feel confident that their relatively smaller efforts will contribute to a successful program.

  A strong U.S. role, not only financially but also managerially, also assures foreign investors and local communities that there will be quality control, good coordination, and accountability on the project. This is key throughout the lifetime of the project, not just in the construction phase.

- Neutral facilitation of the demilitarization planning and implementation process is needed.

  In a program of this magnitude, with potentially so much at risk and with so little trust between local, regional, and national authorities and offices, a neutral facilitator becomes absolutely key for the process to move forward efficiently and to preclude major roadblocks. The facilitation process managed by the Global Green/Green Cross Legacy Program at two demilitarization sites in Russia today includes local outreach offices, public hearings and educational forums, informational materials and media outreach, citizen advisory commissions, training sessions in public involvement and emergency management, and independent risk and health assessments. Such a process is a confidence-building model that promotes transparency, trust, consensus, rule of law, civil society, and in the end a successful program. Although government agencies and contractors can also play a strong role in public relations, a trusted, independent facilitator for public outreach and involvement is in most cases absolutely essential for these projects to succeed.

- The U.S. Congress can be both a facilitator and a roadblock in Russian chemical weapons destruction.

  In seeking to promote and guide the destruction of Russian weapons of mass destruction and in its constitutional role as appropriator of federal spending, the U.S. Congress has exerted much oversight of the Cooperative Threat Reduction Program. As the program celebrates its tenth anniversary in 2002, overall costs have surpassed $4 billion. Some legislators perceive this commitment as a wise investment in nonproliferation and disarmament of former Cold War enemies. Thousands of nuclear warheads and hundreds of launch systems, all formerly targeted at Western allies, have already been destroyed. Dangerous fissile materials have been secured. And former weapons scientists have been transitioned into civilian occupations. However, other legislators perceive the U.S. commitment as too unilateral, with little Russian and European reciprocation in major projects for international security enhancement; they also remain suspicious of Russian transparency and arms control implementation.

For these reasons the U.S. Congress has passed several CTR-wide conditions, as well as six conditions specific to Russian chemical weapons destruction. Also, some members and staff of the House Armed Services Committee have sought in the past three years to eliminate Defense Department requests for the CW destruction program. In fiscal years 2000 and 2001, as noted above, they were successful in cutting the full requests ($130 million and $35 million respectively), although in August 2001 their cut of $50 million for fiscal year 2002 was restored in full committee deliberations.

Congressional conditions can be a helpful facilitator at times in encouraging certain program directions. For example, two recent conditions have demanded that both Russia and the international community participate more actively in Russian weapons destruction; this has encouraged the Kremlin and Duma in Moscow to increase their annual funding and has also helped leverage European governments to commit additional or new funds.

However, conditions can also present roadblocks. The Congress has requested that the administration certify, for example, that Russia is fully abiding by both the Chemical Weapons Convention and the Biological Weapons Convention. Also requested is certification that Russia has fully declared the size of its chemical weapons stockpile. These issues are open to interpretation and political winds and are currently stalling critical funding for fiscal year 2002 and 2003.[9]

The Tasks Ahead

It is clear that Russia is fully committed to destroying its 40,000 tons of chemical weapons and implementing its legal responsibilities under the international Chemical Weapons Convention. Also clear is that the United States and European allies are committed to helping make this happen.

The U.S. experience in chemical weapons destruction provides some insight into how challenging, demanding, and costly this task will be for Russia. The United States began its destruction program more than two decades ago and first projected some $2 billion in program costs and completion by 1994. Program costs have grown to 12 times original estimates (not accounting for inflation), and schedules have slipped by 20 years. Most recent estimates project full destruction for the

U.S. by 2012 to 2015, although this may still change in light of new assessments of destruction approaches after the September 11 attacks.

The new heightened awareness of terrorist threats globally, and the stated desire of Al Qaeda and other terrorist organizations to obtain weapons of mass destruction, have intensified the importance of the safe and efficient elimination of chemical weapons stockpiles.

- Meeting the funding needs of the Russian chemical weapons destruction program.

  The United States spends more than $1 billion annually for its own chemical weapons destruction program. Russia is now appropriating well over $100 million annually for its own program. As noted earlier, this is a more than six-fold increase from prior years for Russia, but it is still insufficient to cover demilitarization costs.

  The Russian program, currently estimated roughly at $6 billion to $10 billion, will be less expensive than the U.S. $24-billion program. This is primarily

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9. The Bush administration has requested "waiver authority" in the fiscal year 2002 supplemental military appropriations bill and in the fiscal year 2003 authorization bill in Congress in order to waive the six general CTR conditions noted in footnote 2 above. The administration in late July 2002 also requested waiver authority for the six chemical weapons–related conditions and supported an amendment to the Senate FY03 Defense Appropriations bill by Senator Richard Lugar. The current Senate language from Section 1204, National Defense Authorization Act for Fiscal Year 2003, Senate Report 107–151, reads as follows (subject to conferencing with the House language):

> Waiver of limitations on assistance under programs to facilitate Cooperative Threat Reduction and nonproliferation: The committee recommends a provision, that would provide the President with permanent authority to waive the annual certifications required for both the Cooperative Threat Reduction (CTR) programs and the Freedom Support Act nonproliferation programs, as requested by the administration. The provision would amend section 1203 of the Cooperative Threat Reduction Act of 1993 (22 U.S.C. 5952) and section 502 of the Freedom Support Act (22 U.S.C. 5852) and provide the President the authority to waive the restrictions in any given fiscal year for any given country if such a waiver is important to the national security interests of the United States. If the President chooses to exercise the waiver for either the Cooperative Threat Reduction Act or Freedom Support Act preconditions, this waiver would be effective only when the President submits to Congress a report describing the activity or activities that prevent the President from making the certification or certifications required by the Act, and the strategy, plan, or policy of the President to promote the relevant State's future commitment to the preconditions.

The Lugar amendment (4435) to the Senate Defense Appropriations Bill FY2003, subject to conferencing with the House, amends Section 1305 of the National Defense Authorization Act for Fiscal Year 2000 (Public Law 106-65) by adding the following language: "(1) The limitation in subsection (a) shall not apply to funds appropriated for Cooperative Threat Reduction programs for a fiscal year if the President submits to the Speaker of the House of Representatives and the President pro tempore of the Senate a written certification that the waiver of the limitation in such fiscal year is important to the national security of the United States. (2) A certification under paragraph (1) for fiscal year 2003 shall cover funds appropriated for Cooperative Threat Reduction programs for that fiscal year and for fiscal years 2000, 2001, and 2002. (3) A certification under paragraph (1) shall include a full and complete justification for the waiver of the limitation in subsection (a) for the fiscal year covered by the certification." For the final appropriations language, see footnote 3, above.

for reasons of technology and national labor and capital costs—but nonetheless a daunting figure for the struggling Russian economy.

If one assumes that total programmatic costs will remain in the $6-billion range, that the U.S. will follow through on its commitment of almost $900 million for facility construction at Shchuch'ye, and that Russia will be able to fund at least $1 billion over the next decade, then the international community must provide $4 billion in support. To date, as noted earlier, only $100 million to $150 million has been spent and pledged. This leaves the demilitarization program desperately short of its goal.

It is readily apparent that more financial support is needed from more countries, and those countries already participating will need to increase and extend their support. A realistic goal would be for all European nations to participate in this task, along with most of the Mideast region and Japan. These countries all have much to lose should Russian chemical weapons be diverted to terrorist groups or regions in conflict today. The recent G-8 summit in Canada, noted earlier, pledged "up to $20 billion" for Russian weapons destruction and placed a high priority on chemical weapons abolition; if fully implemented over the next decade, this will be a major step forward in helping to ensure international security.

- Freeing up fiscal year 2002 Cooperative Threat Reduction funds.

Russia must recognize that CTR funds are subject to the democratic appropriations process in Washington and, as such, will come with certain political demands and conditions. On the one hand, Russia needs to be responsive to these requests; but on the other, the United States must be sensitive to the fact that this is a Russian program and it is very much in American security interests to destroy these weapons.

Facility construction at the Shchuch'ye chemical weapons stockpile is key to moving the Russian program forward. This effort, largely funded by the United States, has been stalled for almost three years now because of the elimination of fiscal year 2000 and 2001 funding from the CTR program for chemical weapons destruction. The FY 2002 budget included $50 million for Russian chemical weapons destruction, but these funds continue to be held up because of the refusal of the Defense Department to certify that Russia has fully and accurately disclosed the size of its chemical weapons stockpile. This has now caused another year of construction to be lost and, if not soon resolved, may force closure of the Shchuch'ye demilitarization project.

In the meantime, some of prior year CTR funds ($20 million) allocated to improved site security at Shchuch'ye have also been held up around congressional conditions. President Bush has given high priority to enhancing security at Russian chemical weapons sites and to destroying the Russian stockpile. The Shchuch'ye project must not be stalled any longer. There must be a delinking of political conditions and weapons destruction. This point was emphasized by National Security Adviser Condoleezza Rice in a letter to Senator Richard Lugar and others on July 30, 2002: "...[T]he Administration has urged the conferees to the FY 2003 Defense Authorization bill to provide the President the authority to waive the conditions on CTR chemical weapons destruction assistance, if he determines that to do so is in the national interest."[10]

- Developing and implementing a practical demilitarization plan in Russia.

Another congressional condition for continued CTR funding of Russian chemical weapons destruction is the production of a "practical plan" for demilitarization. Just as the United States has modified transportation planning, facility siting, and technology choices for weapons destruction over the past 20 years, so too Russia is faced with continued challenges to develop an affordable yet safe program for destroying its seven large stockpiles.

More than a decade ago, both countries moved away from centralized and regional facilities to a program of on-site destruction. This reduced risks of transportation yet increased costs of facility construction. Russia, very concerned that it cannot meet the costs of building seven separate destruction plants, has most recently proposed building three major facilities at Gorny, Kambarka, and Shchuch'ye. Facilities at Gorny and Kambarka would handle lewisite and mustard stocks, while Shchuch'ye would destroy all nerve agents.

Although likely reducing overall program costs, this new plan provides many challenges from a transportation perspective. Neither roads nor rails in Russia are in good condition in the stockpile regions, so transportation presents risks of accident, theft, and terrorist attack. In a National Dialogue meeting sponsored by the Global Green/Green Cross Legacy Program in Moscow in November 2001, Russian regional officials responded very skeptically to a federal official's remarks about moving chemical weapons stockpiles to the Kurgan Oblast.

The Russian Munitions Agency, along with other appropriate ministries and regional officials, must fully address these questions as planning moves forward. Also, the United States and other international supporters need to provide support and technical advice on risk and public health assessments for these regions and must also recognize that such plans are never written in stone for such demanding, complex, and long-term projects. Over time, plans predictably evolve as political, economic, and technical requirements change.[11]

- Providing international technical cooperation and exchange for nerve agent destruction.

Destroying dangerous and polluting weapons, which were never designed to be disassembled and recycled, is a challenging task. A large toolbox of applicable

10. U.S.-Russian discussions were initiated on February 26, 2002, to seek agreement on U.S. inspections of suspected Russian chemical weapons sites in order to allow Secretary of Defense Donald Rumsfeld to certify to Congress the "full and accurate" disclosure by Russia of the size of its chemical weapons stockpile. Six months later these meetings are continuing with no apparent near-term resolution in sight.

11. For a recent update on the Russian chemical weapons destruction plan, see the statement submitted to the Executive Council, Organization for the Prohibition of Chemical Weapons (OPCW), "Information on the Implementation of the Plans Related to Chemical Weapons Destruction in the Russian Federation," June 25, 2002, EC-29/NAT.3.

technologies has been found absolutely necessary to meet technical, environmental, public health, economic, and sociopolitical demands and constraints.

The United States and European allies have developed a wide range of destruction technologies using both low and high pressure, low and high temperature, and varied chemical and electrical processes. Although Europe has focused its destruction technologies primarily on mustard agent, given the large amounts of old and abandoned mustard-filled weapons from World War I, the United States has spent a great deal of time and money on the demilitarization of nerve agents, the bulk of post–World War II chemical weapons arsenals. Some of these technologies will be applicable to Russian nerve agents, which vary somewhat from U.S. nerve agents, and will be helpful in finalizing a practical plan for Russia, noted above.

The Russian-proposed technology for Shchuch'ye is a two-stage process—neutralization and bituminization. Although solidification of waste products with asphalt or concrete is common in many countries, it presents challenges in terms of volume and potential leaching for toxic waste landfills. The current Shchuch'ye plan is to store this waste—some 5 to 10 times the initial volume of the nerve agent—in a sealed, retrievable storage facility in the Kurgan region, an area with very high water tables. Local officials are concerned about the long-term costs of land allocation and safe maintenance; this concern is now magnified by the possibility of shipping four additional stockpile sites to Shchuch'ye, thus raising the amount of nerve agent destroyed from 5,400 tons to more than 30,000 tons. This could result in the storage of over 150,000 tons of toxic waste.

To finalize the nerve agent destruction process for Shchuch'ye and build regional, national, and international consensus on best practices, the United States, Russia, and Europe should organize an international working group to consider alternatives for the second processing stage at Shchuch'ye and for first-stage, pre-shipment processes at the other four nerve agent sites.

- Establishing local, regional, and national stakeholder involvement in decisionmaking.

It should come as no surprise that the dismantlement and destruction of weapons of mass destruction—nuclear, chemical, and biological—as well as the cleanup of conventional ordnance such as landmines and unexploded ordnance can be a very controversial, slow, and political process. Military authorities and contractors are tasked with specific timelines and budgets and grow impatient with public questions and complaints. Local and regional officials are most concerned about constituent interests. Citizens, public health officials, environmental activists, and nongovernmental organizations raise key issues concerning impacts on living environments. And arms controllers and diplomats point to legally binding treaty deadlines.

It is important to empower all of these stakeholders in the demilitarization process in order to produce not only the best and safest technical practices but also the most efficient and practical program that is not stalled by state regulatory processes or citizen protests and legal challenges.

A Russian model developed by the Global Green/Green Cross Legacy Program and implemented to date at two weapons demilitarization sites—Shchuch'ye and Votkinsk—in Russia involves local outreach offices, local Citizens Advisory Commissions (CACs), local public hearings and educational events, a proactive information campaign, U.S.-Russian training programs on public involvement and emergency preparedness, and independent risk and health assessments. This model, designed for implementation by a neutral, third-party facilitator, has been very successful in building consensus and trust in local and regional communities that continue to mistrust contractors and authorities, be they Russian or U.S. As a side benefit, this model also encourages development of civil society, rule of law, and democratic processes—all important in today's socioeconomic transitions in Russia.

As the Russian chemical weapons program expands to include all stockpile sites, it will be important that all stockpile regions and all regions included in a transportation plan be afforded full stakeholder involvement. The Legacy Program has also organized and promoted a national dialogue that meets annually in Moscow; this is where all sites and regions can meet with federal officials to better understand the national nature of the program.

Such an open decisionmaking process is critical to facilitating an efficient process that does not break down at critical moments. The 1989 Russian experience at Chapeyevsk, where local citizens stopped the opening of a central chemical weapons destruction facility, has illustrated the high risks of a secretive, noninclusive, and nontransparent process. Similarly, the U.S. congressional halt to facility construction at two stockpile sites in Kentucky and Colorado pending further development of non-incineration technologies has shown the importance of a strong public involvement process. Today, all U.S. chemical weapons stockpile sites have Citizens Advisory Commissions, with varying degrees of success in full stakeholder involvement; there are also more than 300 Restoration Advisory Boards (RABs) for closing military bases, most with major weapons cleanup issues.

Public involvement in weapons destruction processes must be seen by all authorities, in both Russia and the United States, as an integral part of the effort from the start. Only by building consensus early in the process can agreement be reached for a successful program.[12]

- Providing flexibility under international treaty deadlines.

The negotiators of the 1993 Chemical Weapons Convention agreed that 10 years should provide sufficient time for stockpile destruction, yet there was little understanding of when the convention might actually enter into force or how technically challenging the destruction process would actually be.

The four years from the initial signing of the CWC to its entry into force in April 1997 provided additional time for the major chemical weapons powers to

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12. For a U.S.-Russian discussion on public involvement in chemical weapons destruction, see the panel, "Facilitating Chemical Weapons Destruction: Public Outreach, Involvement, and Decision-Making," in the proceedings of the CWD2002 conference, The Hague, May 21–23, 2002.

further their destruction programs, but schedules have continued to slip. Although the United States has met all interim deadlines (1 percent and 20 percent) for stockpile destruction, it is now clear that it will not meet the 100 percent destruction target by 2007. Russia missed the first two interim deadlines, may miss its extended deadline of April 2003 for 1 percent (400 tons) of its 40,000-ton CW stockpile, and in December 2001 requested the convention-allowed, five-year extension to 2012 for full destruction.[13]

Given the complexity and cost of weapons destruction, signatories to the CWC must be responsive to deadline extension requests from all declared chemical weapons powers. Although all stakeholders are committed to efficient and timely destruction, especially in the post–September 11 world, arbitrary deadlines run the risk of unnecessarily threatening local public health and environmental standards. Russia, in particular, will likely need several years beyond 2012 to finish its destruction campaign. With sufficient international political and financial support, however, this large task can be accomplished successfully.

Conclusion

More than 70,000 tons of chemical weapons have been accumulated in the United States and Russia over the past half century. Smaller arsenals have been stockpiled in India and South Korea, and a dozen additional countries are suspected of non-declared chemical weapons stocks. Furthermore, hundreds of thousands of tons of old chemical weapons have been dumped at sea by all the major powers throughout the twentieth century, and Russia and the United States suspect hundreds of old burial sites on land as well. European nations continue to confront abandoned chemical weapons from World War I, and Japan is beginning a cleanup of old chemical weapons in China.

Fortunately, 147 countries, including the 4 noted above, have ratified the international Chemical Weapons Convention banning all development, production, and stockpiles of these deadly weapons. These signatories have agreed to destroy their stockpiles by 2007, 10 years after entry into force of the CWC (with a possible extension to 2012). Exploration and excavation of sea and land dumps will take many more decades of effort.

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13. The OPCW, at its Seventh Session of the Conference of the States Parties in October 2002, decided "to grant, in principle, an extension to the Russian Federation's obligation to meet two of the Convention's intermediate deadlines—for the destruction of one percent and of twenty percent of its Category 1 chemical weapons stockpiles. The Conference authorised the Executive Council to establish a specific date for the first deadline (1%) at its next session in December 2002, and to submit its recommendation for the second deadline (20%) to the Conference for adoption at its Eighth regular Session in October 2003." It also granted an extension to South Korea for meeting the 20 percent deadline and refused at this time to grant a five-year extension to Russia to 2012 for the 100 percent deadline. Most States Parties were supportive of a "step-by-step approach" to deadline extensions. See OPCW Press Release no. 65 (October15, 2002), <http://www.opcw.org/html/global/press_releases/2k2/pr65_2002prt.html>.

As of mid-2002, the United States has successfully destroyed some 25 percent of its 31,500 tons of chemical weapons at nine stockpile sites. Russia has destroyed less than 1 percent of its 40,000 tons at seven sites.

The enormous costs, the large technical and political challenges, the high risks of public health and environmental damage, and the potential threats of theft, terrorist attack, and proliferation all demand a multinational, cooperative effort to abolish these arsenals once and for all. Regional, national, and international security will be much improved, and a global taboo will be established for the first time on a whole class of weapons of mass destruction.

But the actual implementation of safe and environmentally sound destruction programs requires political, technical, and financial support for Russia from the whole international community. To date a dozen countries from Europe and the United States have committed and pledged about $1 billion to a projected $6-billion Russian chemical weapons destruction program. This must expand in both national participants and amounts by a factor of 4 to 5 for this abolition program to be fully successful. Full and swift implementation of the G-8's pledge of up to $20 billion to Russian weapons destruction would be a good place to start.

C H A P T E R 4

Controlling Nuclear Materials in Russia

Jon B. Wolfsthal
Carnegie Endowment for International Peace

Overview

Ten years after the collapse of the Soviet Union, Russia's nuclear complex remains the vulnerable home to hundreds of tons of directly usable weapons-grade nuclear material. Considerable U.S. security assistance to Russia has helped improve the security and accountability of large amounts of this material, but security upgrades for the entire complex are taking considerable time to implement, and the scope and pace of current efforts are not adequate to address the immediate security risks. Moreover, there are growing problems associated with the long-term sustainability of security upgrades put in place that risk undermining the benefits of security assistance provided to date. A much larger, broader, more comprehensive and sustained effort is required to ensure that the Russian nuclear complex is secured, that security is sustainable for the long term, and that excess nuclear materials are eliminated—the only step that can permanently reduce the proliferation risks the Russian nuclear complex poses.

To date, the amount of assistance from countries other than the United States has been poorly coordinated, dwarfed by the size of the challenge, and unsuccessful in addressing the critical proliferation risks at hand. Assistance from Europe should be increased, along with U.S. assistance, and focused on supporting overall efforts to create a smaller, more-secure complex in Russia. In particular, assistance from individual European countries should focus on direct relationships between Russian and European facilities to develop lasting relationships with Russian organizations. European organizations such as Euratom, and industry groups such as Cogema and BNFL, should also develop more concrete programs with their Russian counterparts to buttress U.S. activities in more sensitive areas of the Russian complex.

U.S. and European assistance to Russia's nuclear complex should seek to facilitate three goals:

- Establish a secure complex;
- Create a sustainable security culture for nuclear materials; and
- Reduce the scope of the fissile material problem.

Introduction

More than 10 years after the collapse of the Soviet Union, the state of Russia's nuclear complex continues to merit concern. In the wake of the September 11 terrorist attacks in New York and Washington, D.C., intense international attention has been focused on the possible acquisition and use by terrorists of nuclear weapons, as well as other weapons of mass destruction. Although the awareness of the threat may have changed, the nature of the threat and the manner in which hostile groups or state might acquire these capabilities is well understood. Russia remains the world's largest storehouse of nuclear weapons and materials—lethal legacies of the Cold War rivalry with the United States and Western Europe. These assets, and the inadequate security system that protect them, present the most attractive and likely target for would-be nuclear terrorists.

Today and for several years to come, the state of Russia's nuclear complex poses a serious risk of nuclear proliferation and an acute threat to international peace, security, and stability. A U.S. intelligence report to Congress in February 2002 confirmed: "[W]eapons-grade and weapons-usable nuclear materials have been stolen from some Russian institutes. We assess that undetected smuggling has occurred, although we do not know the extent or magnitude of such thefts."[1] According to Viktor Yerastov, chief of the Russian Ministry of Atomic Energy's (MINATOM) Nuclear Materials Accounting and Control Department in Russia, "quite sufficient material to produce an atomic bomb" was stolen from Chelyabinsk Oblast in 1998.[2] Commenting on that theft to the *Washington Post,* a U.S. official said that "given the known and suspected capabilities of the Russian mafia, it's perfectly plausible that Al Qaeda would have access to such material."[3]

Documented thefts of weapons-usable nuclear materials demonstrate that the risk is real, and evidence both before and after the September 11 attacks shows that a number of countries and subnational groups are highly attracted to acquiring nuclear weapons and materials that could be use to produce atomic or radiological weapons. Evidence that these countries and subnational groups continue to target the insecure Russian complex makes clear the need to improve conditions in Russia. The prolonged and dangerous combination of nuclear ambitions by states and subnational groups on one hand and the nuclear insecurity of the Russian complex on the other poses a security risk to all countries and to the international security structure as a whole.

Recognizing these risks, countries led by the United States have been cooperatively engaged with Russia to provide assistance to eliminate nuclear weapon launchers, secure and consolidate nuclear weapons and materials, and begin the long process of eliminating excess nuclear materials. Although the international response to this severe threat has helped reduce the security risks posed by these

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1. National Intelligence Council, *Annual Report to Congress on the Safety and Security of Russian Nuclear Facilities and Military Forces* (Washington, D.C.: CIA, February 2002).

2. Ibid., p. 2.

3. Barton Gellman, "Fears Prompt U.S. to Beef Up Nuclear Terror Detection," *Washington Post*, March 3, 2002, p 1.

materials, the overall effort has been erratic and shrinks in comparison to the task at hand.

Because of the assistance provided, security over several hundred tons of nuclear material has been improved, and 146 tons of nuclear weapons-grade uranium has been diluted and transferred to the United States for use as civilian nuclear power fuel. These successes hold important lessons for the future of these engagement programs—lessons that should be drawn upon in developing future initiatives and in broadening support to other funding countries. But as a recent U.S. intelligence report to the Congress pointed out, "Russia's nuclear security has been slowly improving over the last several years, but risks remain."[4]

In the words of a bipartisan report delivered to the U.S. secretary of energy in January 2001, "The 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."[5]

Work to address the remaining proliferation dangers posed by the Russian nuclear complex is proceeding in three central areas:

- Establishing a secure complex: Providing quick fix security upgrades and developing site and building-specific security systems, including physical protection and nuclear accounting. Programs to accomplish this goal include those run by the U.S. Department of Defense (DOD) to securely transport and store nuclear weapons, and the larger program run by the Department of Energy (DOE) to improve security over loose nuclear materials in the Russian military and civilian nuclear complex.
- Creating a security culture for nuclear materials: Training personnel and creating incentives for the long-term operation of secure nuclear facilities. This program also includes developing a new generation of security-minded experts and nuclear personnel in domestic industry for physical protection of nuclear materials.
- Reducing the scope of the fissile material problem: Facilitating the elimination of nuclear weapons, reducing the amount of fissile materials, and consolidating existing materials into fewer, better-secured facilities. These programs center on the elimination of excess plutonium and highly enriched uranium and the consolidation of the Russian nuclear complex.

These three steps are being pursued simultaneously, with the current emphasis placed on securing nuclear materials in place. Achieving the second two goals will require longer-term, sustained, and more widespread action, but only by creating a security mind-set within the nuclear complex and reducing the size of the Russian nuclear complex to a sustainable level can the security risks that currently exist be effectively managed in the long run.

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4. National Intelligence Council, *Annual Report to Congress on the Safety and Security of Russian Nuclear Facilities and Military Forces.*

5. U.S. Department of Energy, "A Report Card on the Department of Energy's Non-Proliferation Programs with Russia," Secretary of Energy Advisory Board, January 10, 2001.

Creating a Secure Complex

In Western countries, the physical protection of nuclear material relies on a multilayered system of security and accounting. At the heart of this concept are several layers of full-time and comprehensive physical barriers between the location of nuclear materials and the outside world. Each layer of protection is monitored by professional and well-motivated personnel and utilizes technical measures, such as nuclear material detection equipment and access controls, to ensure that nuclear materials are not removed without authorization or detection.

In addition to physical barriers, this system relies on a series of checks to ensure the reliability of personnel with access to nuclear materials, including (in various cases) prohibiting anyone from being alone with sensitive nuclear materials, background checks including polygraph tests, routine assessments of financial statements, personal habits, etc. This system is designed to protect against outside infiltration as well as insider theft and diversion.

The system also relies on graded categories of protection, designed to provide greater security for pure weapons-grade material than for less pure material.

Soviet/Russian Material Protection, Control, and Accounting

Unlike Western countries, the Soviet Union only geared its security for nuclear weapons and materials toward the threat of outsider infiltration and theft. Well-maintained security forces and perimeter patrols were sufficient in the overall context of the Soviet police state. Outside infiltration of sensitive facilities was controlled by a well-maintained, armed security force, and internal safeguards were upheld through loyalty to and fear of the state.

When the Soviet Union collapsed, so did the system of security over its nuclear materials. Security guards went months or years without pay and lacked even basic equipment (including boots and overcoats), to say nothing of reliable alarm and communication systems. Nuclear detection equipment to prevent unauthorized removal of nuclear materials was practically nonexistent and many facilities and buildings lacked even basic barriers to prevent access to nonapproved personal, including bars on windows, steel doors, or locks. Vast amounts of direct-use weapons material was left unprotected with poor accounting, creating a situation in which materials could be diverted without any means of detection even after the event took place.

Moreover, as the economic problems in the Russian nuclear complex continued, the nature of the security threat shifted from one focused on outside concerns to the threat of insider diversion. Low pay, low morale, and poor working conditions within the nuclear complex, combined with the ongoing efforts of some countries to acquire nuclear materials, raised the alarming prospect that people responsible for the safe maintenance of the Russian nuclear complex might be driven financially or politically to steal and sell sensitive nuclear materials. The Russian system was simply unprepared to respond to this new insider threat, and years after this reality became apparent, this is still the case for most materials and many facilities.

Estimates on Production

There is an inherent uncertainty in estimates of Soviet and Russia nuclear production, which itself is part of the security problem (discussed below). The U.S. government estimates that Russia possesses just over 1,300 tons of weapons-grade nuclear material, with 603 tons of nuclear materials outside of nuclear weapons, and perhaps another 700 tons of nuclear materials in weapons.[6] It is unclear whether this estimate has been adjusted to account for the 146 tons of highly enriched uranium (HEU) that has been down blended and shipped to the United States in the form of low-enriched uranium (LEU) as part of the HEU purchase agreement.

Unofficial estimates of the Soviet Union/Russia's production also vary. The most detailed estimates are those published by David Albright, Frans Berkhout, and William Walker, who estimate that Russia produced between 106 and 156 tons of weapons-grade plutonium (Pu) and between 720 and 1,395 tons of weapons-grade HEU, for a total range of 726–1,551 tons of high-grade, weapons-usable nuclear materials. These numbers, however, do not include non-weapons-grade materials that are of concern, including reactor-grade plutonium and irradiated HEU fuel from submarines and research reactors that, with some processing, could also be used for weapons.

Of all the security challenges and concerns surrounding the state of the Russian nuclear complex, perhaps none is as great as great as the fact that Russian officials and experts themselves have no accurate accounting of how much nuclear material was produced by the Soviet Union and Russia, and how much nuclear material remains in the country today. The Soviet system of nuclear accounting relied on handwritten records with little if any outside or centralized oversight. If a production plant made quota, no one asked questions. If more material was produced in a month than the amount the government required, the excess would be held in reserve in case a future month's production fell short. This loose accounting system renders even official numbers suspect.

In an environment in which security was based on allegiance to and fear of the state—and everyone was subject to state surveillance—this system was tolerable. After the collapse of the Soviet state, however, it presented the worst security and accounting challenge imaginable. For now, the best that Russia can hope for is to secure what it has in place and maintain an accurate record into the future. The barn door was already open; now the goal is to lock it shut. As a separate matter, of course, a process for establishing a reliable accounting of past production must be undertaken if the nature and size of the existing proliferation threat is to be firmly understood.

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6. U.S. Department of Energy (DOE), *MPC&A Program Strategic Plan*, July 2001 and January 1998.

Where Are These Materials?

Weapons-usable materials exist in both the Russian military and civilian complexes, but the security and accounting procedures in these systems vary, as do the programs under way to improve the security of their materials (see table 4.1).

Table 4.1. Russian Nuclear Facilities with More Than One Metric Ton of Weapons-Usable Nuclear Material

Military	Civilian
Arzamas-16 (HEU and Pu)	Beloyarsk NPP (HEU only)
Avangard (HEU and Pu)	Dimitrovgrad (HEU only)
Chelyabinsk-70 (HEU and Pu)	Elektrostal (HEU only)
Krasnoyarsk-26 (HEU and Pu)	Obninsk/IPPE (HEU and Pu)
Krasnoyarsk-45 (HEU only)	Kurchatov (HEU only)
Mayak (HEU and Pu)	Luch (HEU only)
Penza-19 (HEU and Pu)	Lytkarino (HEU only)
Sverdlovsk-45 (HEU and Pu)	Novosibirsk (HEU only)
Tomsk-7 (HEU and Pu)	Novouralsk (HEU only)
Zlatoust-36 (HEU and Pu)	

Source: Jon B. Wolfsthal et al., *Nuclear Status Report: Nuclear Weapons, Fissile Material, and Export Controls in the Former Soviet Union* (Washington, D.C.: Carnegie Endowment for International Peace, and Monterey, Calif.: Monterey Institute of International Studies, 2001).

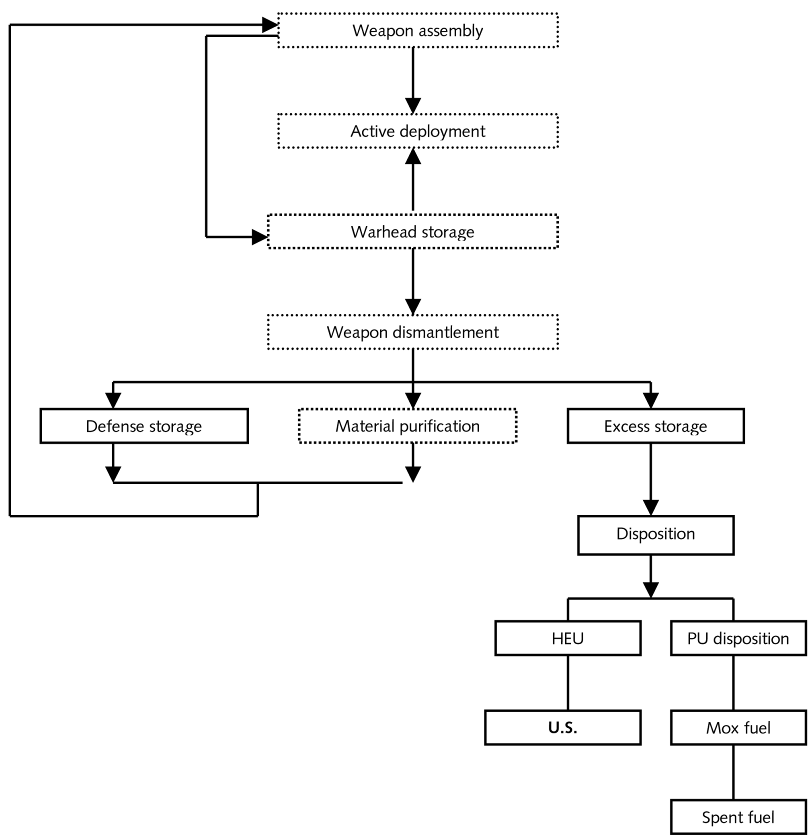
Russian Nuclear Materials

Russian nuclear materials exist in various states within the military complex (see figure 4.1). They include materials

- in deployed nuclear weapons (Pu and HEU)
- in stored active nuclear weapons (Pu and HEU)
- in inactive weapons in storage awaiting redeployment or dismantlement (Pu and HEU)
- released from dismantled nuclear weapons but available for weapons use (Pu and HEU)
- used as naval reactor fuel (HEU).

Nuclear materials are the essential building blocks of nuclear weapons, and Russia continues to maintain a formidable, albeit shrinking, nuclear weapons arsenal. In order to maintain this force of nuclear weapons, the complex also holds many additional tons of loose (outside of actual weapons) nuclear materials in many forms, including the cores of actual nuclear weapons and material in process (including metal and powder). Russia continues to disassemble weapons, remanufacture nuclear weapon cores, and rebuild weapons—resulting in large amounts of nuclear material being processed at any given time. This increases the security and accounting challenges, since nuclear materials are harder to control when in transit or in process.

Figure 4.1. Russian Defense Nuclear Material Flowchart



Note: Russian defense materials are contained in numerous forms, including in and released from nuclear weapons. Security over these materials is incomplete and inconsistent, creating vulnerabilities that affect the entire Russian nuclear security continuum. The dashed lines indicate areas where outside security assistance is either nonexistent, not yet complete, or of particular concern.

Nuclear Weapons

Russia is thought to possess approximately 20,000 nuclear weapons, although the exact number is not publicly known. There are concerns surrounding the security and accountability of these weapons, and large amounts of assistance have been provided to Russia to improve security in the storage and transport of these weapons, as well as in Russia's ability to track their exact whereabouts.

Russian nuclear weapons are deployed in at least 24 operational strategic weapons bases and stored in more than 100 storage facilities. No official numbers are available, but as a guide, the Department of Defense has publicly discussed its program to improve security at 123 weapons-related deployment and storage sites to help protect against the theft of nuclear weapons. Additional sites may exist and are beyond the scope of current cooperative activities. For example, the Department of Energy is working with the Russian Navy to provide quick fix and longer-term security upgrades at 42 facilities housing some 4,000 at-risk naval (tactical and strategic) nuclear weapons.

There are two broad concerns about the state of the Russian warhead storage complex: (1) overall security and (2) the lack of an established accounting system to track all weapons on active systems, in storage, or on their way to dismantlement.

Weapons Security

There are continuing concerns that, despite outside assistance, Russian warheads remain an acute security risk. In August 2001, an unidentified Russian officer claimed on Russian television that there were continuing security problems at weapon storage sites, due to personnel and funding shortages. He reported that in some cases, alarm systems only worked 50 percent of the time, reigniting concerns about the long-term effectiveness of provided assistance. Facilities storing tactical nuclear weapons remain a particular concern since these weapons are smaller, easier to transport, and lack internal deactivation devices, sometimes referred to as permissive action links (PALs).

The Department of Defense is engaged in a seven-part program to enhance the security of nuclear weapons in Russia. This program includes efforts to provide

- site security enhancements (i.e., quick fixes)
- security assessment, training, and logistics assistance (Security Assessment and Training Center)
- site security enhancements
- personnel reliability and safety assistance (Personnel Reliability Program)
- guard force equipment and training
- personnel reliability and safety equipment (i.e., dosimetry)
- nuclear weapons storage site support (Center for Technological Diagnostics).

The front line of these efforts is the provision of equipment and material needed to improve security at 50 national stockpile sites, 25 strategic rocket force locations, and 48 12th Main Directorate (responsible for nuclear munitions within the Russian Ministry of Defense and also known as the 12th GUMO) Air Force and Navy bases. Equipment provided under this program includes 50 kilometers of sensor fencing, 350 sensor alarms, and 200 microwave intrusion systems, as well as radio communication and fire suppression equipment. Shipment of this equipment began in October 1997 and continues, although installation of security upgrades is not yet complete.

DOD assistance has also helped create the weapons Security Assessment and Training Center at Sergeyev Posad, a facility built to assist the Russian Ministry of Defense with the design and implementation of security systems throughout the Russian nuclear complex.

Assistance is also being provided to ensure personnel reliability practices, additional site security enhancements beyond initial "quick fixes," guard force upgrades, improving dosimetry to improve the safety of security forces, and establishment of a center capable of certifying nuclear-weapons handling equipment in Russia. These programs are designed to provide initial security improvements and assist Russia in building the capacity to protect its nuclear arsenal over the long term.

The Department of Defense requested $40 million for these efforts for FY 2003, compared with a $56-million request and appropriation in FY 2002. The FY 2003 number is less than half the previously planned request for 2003 and raises concern that the planned requests for FY 2004 ($115 million) and FY 2005 ($115 million) will also be reduced. These originally planned increases were designed to accelerate the installation of security upgrades at Ministry of Defense sites and to move beyond the quick-fix upgrades being provided in the initial phase of the project. Given the reduced funding levels, the success of these plans is now in question.

Although these projects help to protect warheads in storage and transit, tactical nuclear weapons (TNWs) in storage continue to pose a significant security concern. U.S. intelligence reports highlight the poor and declining living conditions that could lead to the theft of a TNW by an insider at one of these storage locations.[7] Until adequate transparency measures are implemented to allow international inspections of TNW storage, concerns will remain high regarding the internal monitoring, protection, surveillance, and security of these weapons against diversion and theft.

Of particular concern are 52 sites operated by the Ministry of Defense; no access has been granted to carry out security assessments for providing and installing the equipment that would protect these sites from potential diversion and theft of weapons. The Security Assessments Training Center was established largely as a confidence-building measure to facilitate access to these areas, yet bureaucratic inertia and enduring suspicion that CTR is being used to gather intelligence have prevented the installation of equipment and fences destined for these sites.

It remains to be seen whether Russian premier Kasyanov's announcement on April 1, 2002, that U.S. experts will have access to some of these sites, and Russian chief of the general staff Kvashin's letter to U.S. under secretary of defense for policy Douglas Feith allowing access to eight of these sites, will break the current gridlock.[8]

The Department of Energy is also funding security upgrades over nuclear weapons within the Navy complex in Russia—a program that builds on the excellent cooperation between the Russian Navy and the U.S. Department of Energy in providing security for fresh naval nuclear propulsion fuel, also made of weapons-

7. Reflected in the testimony of George Tenet, director of the U.S. Central Intelligence Agency. Amy F. Woolf, "Nuclear Weapons in Russia: Safety, Security, and Control Issues," *CRS Issue Brief for Congress*, Congressional Research Service, November 5, 2001, p. 5.

8. Harold Smith, "Securing Russian Nonstrategic Nuclear Weapons," presentation at a CSIS roundtable discussion, June 19, 2002.

usable uranium. The Bush administration has requested $47.3 million in FY 2003 to help upgrade centralized storage sites.

Weapons Transport

The Department of Defense is actively involved in helping Russia improve and maintain its ability to safely and securely transport nuclear weapons. These efforts are critical to ensuring the reliable transport of weapons to elimination and storage facilities, key steps in facilitating the implementation of arms reductions agreements. The project is geared to procure transportation services on behalf of the Ministry of Defense to safely and securely transport tactical and strategic nuclear weapons from operational sites to central storage sites and dismantlement facilities. These activities began in January 2000 and have resulted in the secure transport of between 2,000 and 3,000 warheads per year, averaging approximately six to seven shipments per month. The pace may accelerate as Russia moves to implement the terms of the Treaty of Moscow, and the FY 2003 budget request by the Department of Defense included an increase over the previous year's appropriation from $9.5 million to $19.7 million.

Accounting of Weapons

To remedy the glaring vulnerability posed by the traditional paper-based Russian nuclear weapons accounting system, the United States has been helping the Russian Ministry of Defense develop an Automated Inventory Control and Management System (AICMS). This program involves the installation of computerized tracking equipment at 19 tracking nodes, including 2 central facilities, 4 regional facilities, and 10 field sites. The system is only entering its initial phase of operation, however, and it is unclear if programs in place will be sufficient to ensure the sustainability of these upgrades.

Protecting Loose Nuclear Materials

As noted above, the Soviet system for nuclear security that Russia inherited was and remains inadequate to securely manage the vast nuclear complex. The recognition that direct-use nuclear materials were poorly accounted for or protected, combined with the interception of nuclear materials leaking out of Russia in the early 1990s, led the United States to begin a formal effort to assist Russia in protecting its nuclear material.

Today, the United States is engaged in a broad-based effort known as the Material Protection, Control, and Accounting program (MPC&A) to improve the security at all sites known to possess direct-use weapons materials. Initiated in 1993 and run by the Department of Energy, MPC&A has now grown into one of the largest elements of cooperative threat reduction in the former Soviet Union, with a proposed budget of $233 million for FY 2003. The scope and progress of this program is impressive, despite the fact that it has continued to face delays in implementing even basic quick-fix upgrades to key sites. At its current pace, this program will complete basic security upgrades in 2006. This completion date was accelerated over the past year from the previous target date of 2008, but it leaves open the longer-term questions of bringing these facilities up to higher, international standards for nuclear material security.

The Military Complex

Russia possesses the largest nuclear weapons production complex in the world: dozens of facilities, hundreds of buildings, and hundreds of thousand of employees.

At the heart of this sprawling complex are four weapons production and disassembly facilities known as series production facilities. Located at Arzamas-16 (Sarov), Tomsk-7 (Seversk), Zlatoust-36 (Trekhgornyy), and Penza-19 (Zarechnyy), these facilities are responsible for the maintenance of all of Russia's nuclear weapons. They are among the most sensitive in Russia, and outside access is highly restricted. In the wake of the September 11 attacks and the new, closer U.S.-Russia relationship, increased access for U.S. personnel working on the MPC&A program has been arranged, but it is too soon to tell if the agreement will overcome longstanding access problems that have slowed the installation of security upgrades.

In addition to these four sites, Russia also operates three massive material processing sites at Mayak, Tomsk, and Krasnoyarsk-26. All told, DOE estimates these facilities house some 508 metric tons of highly attractive, weapons-grade nuclear materials. An additional 3.6 metric tons of highly enriched, weapons-grade uranium is stored at uranium facilities at Novouralsk and Zheleznogorsk.

The materials housed and processed at these facilities present acute security risks. Warheads cycle through these facilities on a regular basis, because Russian warheads were designed to be routinely dismantled and their weapons cores—or pits—remanufactured. Once weapons are disassembled or removed from operational status, their key components become harder to track and can be more easily diverted. When nuclear materials such as plutonium are purified, for example, they may be converted to powdered, metallic, or even liquefied forms.

The age of these serial production facilities indicates that they lack even the most basic modern tracking and accounting capabilities. Moreover, due to the lack of access given to U.S. personnel in the past, the overall state of physical protection and personnel reliability is uncertain. If the average findings within the weapons complex are any indication, the security vulnerability could be enormous.

Fissile Material Storage Facility

Most U.S. security assistance involves improving security at existing sites. Some upgrades also include helping with the construction of modest storage facilities. In one case, however, the United States is assisting with the construction of a massive, centralized storage facility for former weapons-origin nuclear material. Due for completion in 2002, the Mayak facility is designed to store 66 metric tons of nuclear material from dismantled nuclear weapons in 25,000 storage containers. The facility, however, is only eligible to receive nuclear materials that Russia has declared will never again to be used for defense purposes.

The security provided by Mayak will rival that of any facility in Russia. It will be operated under international monitoring and is being constructed largely with U.S.

financing, on the order of $1 billion. There is also an option to construct a second wing of the Mayak facility, capable of storing an additional 66 tons of material.

Plutonium Production Reactors

Another issue of concern within the Russian nuclear weapons complex is the fact that three production reactors, two at Tomsk and one at Krasnoyarsk, continue to produce a total of 1.5 tons of high-grade plutonium per year. Former Russian president Yeltsin had pledged that this plutonium would never be used for nuclear weapons, and the plutonium-bearing fuel coming out of these sites is being reprocessed and the resulting plutonium stored. The reactors continue to operate because they provide heating and electricity for the surrounding populations, and no alternative sources are currently available. The reactors were previously subject to agreement between the United States and Russia, which would have resulted in their shutdown and, later, conversion to avoid the production of weapons-grade plutonium. Safety, security, and scheduling problems led to the unraveling of this agreement in 2000, and the reactors are now slated to continue operation until at least 2008.

The goal of ending the production of plutonium from these reactors has recently been reinvigorated, and responsibility has shifted from the U.S. Department of Defense to the Department of Energy. New efforts are focused on developing new sources of energy for regions currently supplied by the three reactors. The FY 2003 budget request for this program is $49 million.

Navy Fuel

Materials used for naval fuel propulsion also pose a proliferation risk. Well over 100 tons of highly enriched uranium is slated for use in the propulsion of the Russian nuclear navy. This material is highly attractive to proliferants because of its ease of use and the small size of individual fuel rods. Security assistance is being provided to the Russian Navy by the Department of Energy to secure some 80 tons of direct use, highly attractive nuclear material at naval sites—presumably in the form of unirradiated naval fuel. This project is being funded at $8.5 million for FY 2003.

The Civilian Complex

In addition to the materials contained in the weapons complex, Russia also possesses large amounts of weapons-grade and weapons-usable nuclear materials as part of its civilian nuclear complex. These materials face extreme security vulnerabilities due to the depressed Russian economy and the long-term neglect of security at many civilian sites.

DOE has completed MPC&A work at 11 relatively small research facilities in Russia, but projects are ongoing at all large research facilities and multifunction production facilities. In addition, the MPC&A program office announced two new initiatives in 1999: the Site Operations and Sustainability Program and the Material Conversion and Consolidation Program.[9] The goal of the Site Operations and Sustainability Program is to make sure that the new MPC&A systems will be sustainable over the long term; the Material Conversion and Consolidation Program is designed to reduce the number of sites, buildings, and NIS states where weapons-usable material is located, and to convert that material from HEU to LEU.[10] The MPC&A program does not cover physical security at other facilities, however, such as nuclear power plants—some of which possess weapons-usable material and face serious accounting and security vulnerabilities.

Upgrades are further along in many civil sites as compared with the military complex, since many of these sites are less sensitive in nature and were used early on in the MPC&A program to establish a relationship of trust between U.S. and Russian officials. Much of the work at these sites involved providing physical protection at small, well-defined facilities such as research reactors or fresh-fuel storage sites. Moreover, because many of these facilities were end users and are not involved in the processing of nuclear materials, the task of establishing firm accounting and security procedures was generally fairly straightforward. However, many of these facilities face major funding shortfalls and find it hard to install and maintain modern security systems. As a result, the Department of Energy has launched a broader program of sustainability, consolidation, and material conversion for those sites where the nuclear material is no longer required. These sites in particular would benefit from closer relationships with European organizations and institutes.

Civilian Sites

The Department of Energy estimates that approximately 30 tons of highly attractive, proliferation-prone nuclear materials reside within the civilian nuclear complex in Russia.[11] The exact amount is not available, even through extensive research of public documents, and it is not clear that a precise figure is known even to Russian central authorities. The civilian sector encompasses a wider number and variety of facilities, and is harder to characterize than its military counterpart. At least nine sites hold more than one ton of direct-use, high-risk nuclear materials. The facilities include nuclear power and research reactors, nuclear fuel fabrication facilities, reprocessing sites, as well as scientific nuclear testing and research sites.

Several civilian facilities are involved in the bulk processing of direct-use nuclear materials for fuel in research and power reactors, as well for use in naval propulsion reactors. The two main fuel fabrication sites in this category—Novosibirsk and Elektrostal—are known to hold well over one metric ton of HEU each and process and handle the materials in forms that make its harder to accurately measure and track.

Work to improve physical protection at Elektrostal was one of the first projects undertaken by the Department of Energy. As a demonstration project, the department signed agreements with the site to improve the accounting and physical protection for the low-enriched uranium fuel production lines. At that time, the

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9. Kenneth B. Sheely and Mary Alice Hayward, "New Strategic Directions in the MPC&A Program," Paper presented to the 40th Annual Meeting of the Institute of Nuclear Materials Management, Phoenix, Arizona, July 25–29, 1999.

10. DOE, *MPC&A Program Strategic Plan*, July 2001; official DOE Budget Request, FY 2003, <http://www.energy.gov>.

11. DOE Budget Request, FY 2003.

HEU fuel fabrication lines, which produce fuel for Russian submarines and surface ships, were considered too sensitive to include. Initial work was completed in 1997, but the HEU production lines were not included until late 2001. Russian security officials blocked agreements to give U.S. personnel access to the HEU facilities to assess security requirements and ensure the installation of equipment—leading work at the site to be suspended for several years, during which time material was at risk. Current plans call for completing quick-fix upgrades by 2006.

The Novosibirsk plant is also involved in the production of HEU fuel, but only for research and power reactors. The less sensitive nature of this fuel made it easier for U.S. personnel to gain the necessary access to ensure the effective implementation of security assistance. Work at this site, which includes a new secure storage facility as well as security upgrades to the HEU fuel production lines, is scheduled for completion in 2002.

Research Reactors

Most civilian sites possessing weapons-grade nuclear materials operate small to medium-sized research reactors. These facilities can be used for material testing, medical and industrial isotope production, science experiments, and even the production of precious gems. The fuel used to operate most of these reactors contains highly enriched uranium, and many of them operate on weapons-grade material. Because the facilities are not of a particularly sensitive nature, many of them have been receiving security assistance since the early years of the MPC&A program.

Spent fuel from research reactors contains significant amounts of weapons-usable uranium. Many facilities continue to house spent fuel on site for many years. In addition, because of the low power levels created in these reactors, the fuel is not as intensely radioactive as fuel from power-generating reactors. Fuel from such facilities will drop below what the International Atomic Energy Agency (IAEA) considers to be a self-protecting level of radioactivity (100 rem per hour at 1 meter) within only a short time (months or a couple of years). The long-term disposition of this fuel is a security concern, and this fuel could be an attractive target for theft.

Since 1978, the United States has been pursuing a program to develop low-enriched uranium fuels that can be used in reactors now using weapons-grade material. This Reduced Enrichment for Research and Test Reactor program has resulted in the successful conversion of several dozen research reactors over its 24-year history. The Soviet Union had also pursued a similar development program and had tested and validated the use of 36 percent enriched uranium fuel, reducing the need for all reactors to use weapons-grade materials. Funding for this program was eliminated in the late 1980s, due to funding shortfalls.

In the mid-1990s, the United States began funding Russia's efforts to develop low-enriched fuel for Russian-built reactors, in order to reduce the commerce and transport of weapons-grade uranium. This ongoing program involves several key Russian institutes, including the Kurchatov Institute and Bochvar. The program aims to develop and certify low-enriched uranium fuels for use in Russian-designed research reactors both in and out of Russia, including reactors previously supplied to North Korea, Libya, and others. The Department of Energy is requesting $8.5

million to pursue efforts to convert Russian reactors and facilitate the return of spent fuel from Russian-origin reactors for FY 2003.

Reducing the Scope of the Fissile Material Problem

Material Conversion and Consolidation

Begun in 1999, the Material Consolidation and Conversion program seeks to minimize the long-term security risks posed by civilian nuclear materials by housing them in fewer sites and converting them to non-weapons-usable forms where possible. By the end of 2010, according to DOE budget documents, the program intends to convert 29 metric tons of HEU to LEU and remove all proliferation-prone material from 55 buildings.[12] This program holds the promise of providing better security over a smaller number of building and facilities, thus lowering the risk of diversion.

The process of blend down and consolidation, however, is complicated since the removal of nuclear materials from research facilities could lead to their shutdown. In many cases, facilities continue to operate or remain relevant merely by their possession of nuclear materials—a nuclear badge of honor. Removal of nuclear materials from these sites, therefore, may require a combination of incentives including conversion to other work, reemployment training for site personnel, and outright purchase and transfer of nuclear materials. Substantial support from non-U.S. actors may be required to keep this process energized.

FY 2003 budget plans call for completing security upgrades at three additional sites, bringing the total to 14 of 18 large-scale civilian sites covered by DOE activities, and continuing work at the four remaining sites (Novosibirsk, Elektrostal, Bochvar, and Dimitrovgrad). Sustainability assistance will be provided to the 14 secure sites already completed.

In the long run, it will be difficult to sustain widespread international funding for Russian security assistance. At the end of the current process, Russia must be able to provide for the security of a downsized and sustainable nuclear complex. This complex will need to reflect the changed international security environment, and this will require the elimination of huge amounts of nuclear weapons material now excess to Russian defense needs.

Plutonium Disposition

The United States and Russia have both declared large amounts of former defense-purpose plutonium to be "excess" to defense needs. President Clinton announced that he had designated 50 metric tons of plutonium to be excess on March 1, 1995,[13] and President Yeltsin declared that "up to" 50 tons of plutonium would be made excess through the nuclear disarmament process[14] in 1997. Collectively, this mate-

12. Ibid.

13. President Clinton, speech at the Nixon Center for Peace and Freedom, March 1, 1995.

14. Statement delivered by MINATOM minister Milhailov at 41st IAEA General Conference, September 26, 1997.

rial is enough to produce tens of thousands of nuclear weapons, and both countries have pledged to take steps so that the material is never again used in nuclear weapons.

These amounts represent significant fractions of the plutonium produced in both countries, although both will possess large stocks of weapons-usable materials even after these amounts are dispositioned. Russia is believed to have produced up to 150 metric tons of plutonium, although the actual figures have never been released.[15]

At the June 2000 summit in Moscow, the United States and Russia agreed to each dispose of 34 metric tons of their excess weapons plutonium. The two approved methods under the agreement are irradiation of plutonium in a nuclear reactor and immobilization of plutonium with high-level radioactive waste (in either glass or ceramic form). The bilateral political agreement calls for both countries to "seek to" begin operation of "industrial-scale" facilities no later than December 2007, at a disposal rate of two metric tons of plutonium per year.[16] There have been several major problems looming over implementation of the agreement, including technical and political challenges in the U.S. program and a lack of financing on the Russian side.

The Bush administration had seriously considered ending its disposition efforts in favor of long-term storage of Russian plutonium and, instead of pursuing existing technologies, investigating the design and construction of advanced reactors for plutonium disposal. Unfortunately, these new reactors would take at least two decades to design, develop, and build, increasing the time during which Russian plutonium would remain vulnerable. Indeed, this strategy was specifically rejected by the National Academy of Sciences in 1994 and by the Department of Energy's own nonproliferation study of plutonium disposition, as failing to address the "clear and present danger" posed by the existence of these materials in Russia.

Meanwhile, Russia has stated that it does not possess the funds required to carry out the disposition alone and would simply store the material if international support does not materialize. The United States has already agreed to provide $400 million to support Russian plutonium disposition,[17] but estimates suggest that the entire Russian effort, including construction and operation of facilities, could cost $1.7 billion.[18] The first Bush administration budget, submitted to Congress in April 2001, cut funding for the Russian component for plutonium disposition from $39 million in 2001 to $15 million in 2002.[19] Moreover, funding has up until now been

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15. The actual number may not even be known in Russia. The U.S. Congress appropriated $500,000 for Russia to conduct an internal plutonium inventory. Moreover, U.S. production amounts were subject to a margin or error of approximately one ton of plutonium.

16. Department of Energy, Office of Fissile Materials Disposition, "Strategic Plan," June 2000.

17. Walter Pincus, "Bush Targets Russian Nuclear Programs for Cuts," *Washington Post,* March 18, 2001, p. A23.

18. Department of Energy, Office of Fissile Materials Disposition, "Preliminary Cost Assessment for the Disposition of Weapons-Grade Plutonium Withdrawn from Russia's Military Programs," April 2000.

19. Russian American Nuclear Security Advisory Council (RANSAC), "Analysis of CTR Funding," internal document, November 2001.

unsteady for U.S. plutonium disposition, drastically reduced from earlier program requirements over the same period. Russia will not dispose of its excess plutonium unless the United States does so as well. Although the original U.S.-Russia agreement recognized "the need for international financing and assistance" in order for Russia to implement its plutonium disposition plans,[20] no formal funding plan has emerged. The United States plans to expend $97 million in FY 2003 to support these efforts—a mere fraction of the total projected cost.

HEU Disposition

On February 18, 1993, Presidents Clinton and Yeltsin agreed that the United States would purchase 500 metric tons of Russian highly enriched uranium from dismantled Russian nuclear weapons.[21] The program was meant to reduce the risk of theft of Russian nuclear material and speed the dismantlement of Russian nuclear weapons by freeing up storage space for released nuclear materials. Under the program, Russia dilutes or "down-blends" weapons-grade HEU into low-enriched uranium, which cannot be used directly in nuclear weapons. This process takes place under intrusive monitoring arrangements. Russia then ships the material to the United States for fabrication into fuel for nuclear power reactors. The entire program was designed to take place over 20 years and was originally expected to pay Russia $12 billion for material and services. The agreement has since been renegotiated to make the amount paid contingent on market forces, meaning that Russia will make less than the amount originally envisioned.[22]

The pact is carried out by executive agents appointed by the two governments—the privatized U.S. Enrichment Corporation (USEC) and Techsnabexport (TENEX), the commercial arm of the Russian Ministry of Atomic Energy (MINATOM). As of September 2001, the United States (through USEC) had purchased 125 metric tons equivalent of HEU (3,650 tons of LEU fuel) from Russia—enough material to produce 5,000 nuclear weapons—for which Russia had received more than $2 billion dollars.[23]

Russia may possess 1,000 additional metric tons of HEU not covered by this purchase agreement, much of which could become excess to Russian military needs. Numerous experts have called for an expansion of the HEU agreement to include the purchase of larger amounts of HEU. The economic considerations of such a move are complicated by the fact that USEC lacks a financial incentive to expand its purchases. This conflict between national security and financial considerations is a major point of contention among experts and government officials. There are no official plans to expand the scope of the purchase agreement, although the issue is reportedly under review by the Bush administration. To date, this pro-

20. White House Fact Sheet, June 4, 2000.

21. For a complete review of this program, refer to Jon B. Wolfsthal et al. *Nuclear Status Report: Nuclear Weapons, Fissile Material, and Export Controls in the Former Soviet Union* (Washington, D.C.: Carnegie Endowment for International Peace, and Monterey, Calif.: Monterey Institute of International Studies, 2001).

22. Thomas Neff, "Privatizing U.S. National Security: The U.S.-Russian HEU Deal Risk," *Arms Control Today* (August–September 1998).

23. USEC press release, September 26, 2001.

gram has resulted in the elimination of 146 tons of HEU, the equivalent of over 5,800 nuclear weapons.

Assessment and Opportunities

Because of the scope of the technical challenges and financial strains facing the Russian nuclear complex, clearly the risk of nuclear proliferation will persist for many years. The extent and seriousness of that threat, however, can be mitigated by a concerted and expanded effort to secure nuclear weapons and materials, reduce the sites where materials are maintained, and eliminate excess weapons and fissile materials. There is a decade of proven experience, both good and bad, to guide efforts toward these ends. Opportunities for expanding current programs clearly exist—including increasing the scope and funding of ongoing activities, as well as expanding into areas left untouched by current efforts.

Expanding and Accelerating Steps to Create a Secure Complex

Efforts to upgrade security at facilities housing weapons-usable materials have proven successful, but much more can and should be done to speed the process. U.S. assistance should be matched by parallel European programs working under or in coordination with U.S. programs. European experience in protecting and handling nuclear materials could be put to use in Russian facilities, just as the U.S. experience has informed activities in Russia. Given the recently initiated work by U.S. personnel at sensitive weapons sites and the need to upgrade security at these high-risk sites as quickly as possible, European assistance should be focused on upgrading security at civilian sites where access is a less difficult issue. If needed, European personnel from scientific and security bodies could even act in tandem with U.S. projects, granting them access under existing Russian-U.S. arrangements. Teams of European MPC&A experts dispatched to civilian sites to install and maintain security upgrades, working under currently existing arrangements, would free up U.S. personnel to focus on sensitive, high-priority projects such as serial production facilities.

Any efforts to integrate European and U.S. security efforts will require much closer coordination between the United States and Europe. A working-level experts group should be formed to ensure seamless cooperation, ensuring that common goals, standards, legal protections, and arrangements are followed by parallel efforts.

It would also be helpful, however, for European agents and institutes to develop direct and lasting relationships with Russian civil sites, as this would further the second goal of creating a security culture and a more sustainable system of nuclear material security. This work could also include sites not currently covered under MPC&A programs, such as nuclear power plants or research reactor spent-fuel storage sites. U.S. efforts have (with minor exceptions) only focused on sites containing weapons-usable nuclear materials. Civilian power plants, however, have recently become an issue of concern with the increased focus on the risks on international terror. European assistance, in addition to working with civil sites with direct use materials, could also include upgrades to security at civilian nuclear power plants.

Initiatives could include

- establishing joint programs between European and Russian institutes to protect nuclear materials;
- creating joint projects between Russian and European nuclear power plants to facilitate training and security upgrades; and
- creating European security assistance programs to take over some responsibilities from the United States, allowing increased U.S. focus on high-priority weapons sites.

Creating a Sustainable Security Culture for Nuclear Materials

Unfortunately, upgrades provided with outside assistance can deteriorate over time. The lack of resources and the overall pressures within Russian society are complicating efforts to develop a sustainable security culture. Over the long term, a number of steps will be required, including extensive training and contact with Western, professional nuclear security officials, companies and organizations, as well as sufficient resources and the development of indigenous capabilities to protect nuclear materials.

Further steps toward building a sustainable security culture include the following:

- Developing national standards for the protection of nuclear materials. This could be done with the help of European and U.S. legal and regulatory experts and involve exchange programs, education efforts, and even joint drafting projects to establish a responsible Russian national code for the protection of nuclear materials. Lead agencies could include the U.S. Nuclear Regulatory Commission (NRC), Euratom, and the IAEA.
- Specific training programs for nuclear material security experts. There are extensive opportunities within Europe to facilitate this goal. Scholarships at European graduate and technical universities in the fields of nuclear material protection, engineering, health, physics, and other related fields could be arranged and funded by local, federal, and EU bodies. Provision of funding and technical support to the growing number of technical programs offered in Russia would also advance this goal.
- Dedicated financial resources to train and employ nuclear security personnel at facilities housing nuclear materials. Given the low costs of employment in Russia, European- and U.S.-based facilities, institutes, and even industries could develop funding programs to help sustain Russian security upgrades and operations.
- Empowered regulatory agencies able to require key levels of security and impose fines, revoke nuclear material handling licenses for noncompliance with national standards. This would involve expansion of ongoing activities between the Russian regulatory organization Gosatomnadzor (GAN), the EU, and NRC.

Reducing the Scope of the Fissile Material Problem

In the final analysis, the best way to prevent nuclear weapons-usable materials from being a proliferation risk is to render them difficult or impossible to use. In the case of highly enriched uranium, this process involves the dilution of the uranium's isotopic composition. For plutonium, the process is more complex and involves making the material hard to access and relatively unattractive for use in weapons—specifically, by immobilizing the plutonium with highly radioactive waste products or irradiating the plutonium in reactors to encase it as spent fuel.

As discussed above, both approaches are being pursued with modest but limited success. The uranium disposal program has produced the most concrete results by far, but even this program has opportunities for expansion and acceleration.

A first priority is developing a firm accounting of Russia's HEU production and holdings. This work could be undertaken in cooperation with U.S. or European counterparts, but it is within the means of the Russian Federation, as long as sufficient incentive is provided (for example, an expansion of the HEU purchase program or modified offshoots of that effort). Options include

- European governments purchasing and paying for the blend-down of excess HEU beyond the 500 tons covered by the United States (this may need to involve a commitment to store down-blended uranium for an extended period to avoid extreme impacts on the uranium market)
- Paying Russia to down-blend excess uranium for use in Russian reactors, reducing the impact of the program on the Western uranium market
- Providing additional financial incentives for Russia to accelerate down-blending of the 500 tons of uranium intended for purchase by USEC.

The issue of plutonium disposition remains one of the most challenging on the Russian threat-reduction agenda, especially given the sizable costs associated with building and operating the facilities Russia requires to irradiate its excess plutonium. More extensive and complete proposals for this work exist elsewhere, but at their core, these efforts require countries including the United States and those in Europe to accept that the continued existence of large amounts of excess and poorly guarded plutonium in Russia constitutes a long-term and unacceptable security risk to all countries and to fund efforts to eliminate these materials accordingly.

The involvement and contributions of counties with extensive experience in plutonium fuel utilization, including France, Belgium, and the United Kingdom, along with key corporations, such as Cogema and British Nuclear Fuels Limited (BNFL) are critical if this effort is to be undertaken with any level of sustainability and seriousness.

CHAPTER 5

Nuclear Weapons Dismantlement Assistance in Russia

Ian A. Woodcroft
Center for Strategic and International Studies

Introduction

This chapter analyzes the historical development, success, and challenges of U.S. Cooperative Threat Reduction (CTR) programs for nuclear weapons dismantlement in the former Soviet Union since their inception in 1991. Although CTR efforts to dismantle strategic nuclear weapons, launchers, and launch platforms to internationally defined arms reduction levels have been largely successful, much work remains to be done. Despite the more positive Russian-Western partnership against terrorism after the September 11, 2001, attacks on New York and Washington, ongoing and future nuclear weapons dismantlement activities will remain tested by political, bureaucratic, legal, technical, and environmental issues that exacerbate the inherent tensions in donor-recipient (assistance) relationships between the international community and Russia.

Future international assistance programs will have to solve several difficult issues in the area of nuclear weapons dismantlement if the proliferation threats from these weapons are to be successfully countered. Current activities will have to be enhanced to meet new nonproliferation objectives, and the international community, in partnership with Russia, also will have to secure a second phase of dismantlement objectives if it truly wishes to prevent proliferation of nuclear weapons, technologies, and expertise to rogue nations and terrorist groups.

The most obvious step is downsizing the Russian nuclear weapons complex—a subject beyond the scope of this chapter. International assistance to help expand the Russian naval nuclear fuel cycle and bring about the rapid destruction of all decommissioned nuclear submarines and associated radioactive waste in the Russian fleet is also an urgent priority. There is also a need for a transparent warhead dismantlement regime in Russia to resolve the complex issues surrounding the destruction of surplus Russian nonstrategic nuclear weapons. The expansion of the dismantlement effort to ensure the verifiable destruction of all Russian nuclear warheads surplus to security requirements would eliminate the proliferation threat these warheads hold in storage and provide a new level of confidence for continued U.S. and Russian nuclear force reductions.

These new efforts will be essential to build effectively on nonproliferation successes in nuclear weapons dismantlement to date—but they will require significant financial, technical, and political support from the international community.

CTR in Belarus, Kazakhstan, and Ukraine

With the dissolution of the Soviet Union on December 25, 1991, Belarus, Kazakhstan, Russia, and Ukraine inherited not only political, economic, and social turmoil but also, collectively, the world's largest nuclear arsenal. At the end of 1991, there were approximately 35,000 intact nuclear warheads in the former Soviet Union, or FSU, with 29,600 stockpiled and 5,400 awaiting dismantlement.[1] Russia held the vast majority of these weapons and also possessed the command and control structures for the whole Soviet nuclear force, including nuclear weapons in the other FSU states. Russia also retained the lion's share of Soviet nuclear infrastructure, remaining the world's largest nuclear superpower.

The other nuclear successor states also held significant nuclear forces, with a combined count of 3,354 strategic nuclear weapons on their territories and more than 10,000 nonstrategic weapons spread across the FSU.[2] The retention of these nuclear weapons in Kazakhstan, Belarus, and Ukraine was uncertain, however, because of significant ideological, economic, and political problems. By clearing an alternate path, CTR assistance proved a critical tool in the international community's efforts to establish a framework for the denuclearization of these states from 1991 to 1996.

CTR Implementation in Belarus

Within Belarus, eight CTR implementing agreements were signed directly relating to the safe dismantlement of nuclear weapons and infrastructure.[3] These agreements provided for projects to ensure the safety of weapons of mass destruction (WMD) materials in transit or storage within Belarus; the Department of Defense's (DOD) Strategic Offensive Arms Elimination (SOAE) and Weapons Protection Control Activities (WPCA) programs; environmental restoration of strategic rocket forces facilities and sites; the disposal and dismantlement of conventional equipment associated with nuclear forces; the provision of equipment for emergency response and training for nuclear weapons removal; the conversion of military sites; and the installation of verifiable safeguards against the proliferation of WMD.

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1. Natural Resources Defense Council, "Table of USSR/Russian Nuclear Warheads: 1971–96," <http://www.nrdc.org/nuclear/nudb/datab10.asp> (accessed January 31, 2002).

2. Ibid. For a breakdown of strategic forces withdrawn or dismantled within the FSU, see Jon B. Wolfsthal et al., eds., *Nuclear Status Report: Nuclear Weapons, Fissile Materials, and Export Controls in the Former Soviet Union* (Washington, D.C.: Carnegie Endowment for International Peace, and Monterey, Calif.: Monterey Institute of International Studies, 2001), pp. 51–53.

3. For the texts of the CTR implementation agreements with Belarus, see U.S. Embassy in Belarus, "Cooperative Threat Reduction Agreements," <http://www.usis.minsk.by/html/ctr.html> (accessed February 12, 2002).

A total of $78 million in assistance was obligated for CTR activities in Belarus. Approximately $16.2 million went toward nuclear weapons destruction and dismantlement activities in Belarus. Other nuclear weapons removal and dismantlement work included the return to Russia of 81 SS-25 intercontinental ballistic missiles (ICBMs) and their warheads by 1996, freeing Belarus of WMD. The remainder of CTR destruction and dismantlement monies were disbursed in the preliminary stages of eliminating these SS-25 fixed launch sites remaining in Belarus, as demanded by START I, and the elimination of 1,000 metric tons of liquid rocket fuel and 9,000 metric tons of oxidizer stored at these sites for SS-25 ICBMs.[4]

The remaining $61.8 million of CTR funds disbursed in Belarus were for demobilization, demilitarization, and chain-of-custody projects. An amount of $15 million was disbursed to site restoration projects under Project Peace, which built housing for Belarusian military families in Grodno, funded job retraining programs, and provided equipment and funding for defense conversion in several Belarusian weapons factories and military facilities.[5] A further $940,000 went toward the creation of a continuous communications link between Belarus and the United States to enable Belarus to fulfill its reporting obligations under the START and Intermediate-Range Nuclear Forces (INF) treaties.

An amount of $23 million also went to the Industrial Partnering Program (IPP) and the Defense Enterprise Fund; an additional $1 million went to the International Science and Technology Center (ISTC) and defense and military contracts. These projects were part of a concerted effort to foster defense conversion of WMD infrastructure in Belarus. Of the remaining $14.8 million, money was allocated to prevent and rapidly respond to accidents involving nuclear weapons and related materials in Belarus, provide for nuclear-related materials protection control and accountancy, and improve Belarus's export-control regime.[6]

In analyzing the implementation of CTR assistance for nuclear weapons and infrastructure dismantlement and destruction within Belarus, it is apparent that, although Belarus is now nuclear weapons free, significant unfinished work remained after human rights abuses by the Lukashenko administration led to the premature suspension of CTR assistance in 1997.

Divergent opinions between donor and recipient hampered efforts to build a balanced and trusting CTR project partnership. Belarus resented the fact that CTR contracting work went to U.S. companies (as part of the CTR commitment to provide U.S.-based jobs). Further, CTR destruction and dismantlement operations were viewed skeptically by Belarus as narrow in scope, providing limited social and economic benefit.

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4. Wolfsthal, *Nuclear Status Report*, p. 53.

5. Including BELOMO, Integral, the 140th Tank Repair Facility in Borisov, and others. See U.S. Embassy in Belarus, "Current Status of CTR Program," <http://www.usembassy.minsk.by/html/ctr_status.html> (accessed March 4, 2002). For funding, see U.S. Defense Threat Reduction Agency (DTRA), *CTR 2001 Strategic Plan*, June 2000, p. 44.

6. Nuclear Threat Initiative (NTI), "Belarus: CTR Developments: Cumulative Funding through 1997," <http://www.nti.org/db/nisprofs/belarus/forasst/fundbel.htm> (accessed March 4, 2002).

In contrast, Project Peace and the Industrial Partnering Program in Belarus moved forward quickly in implementation because of their broader scope in dealing with the full effects of demilitarization as part of denuclearization. But if these projects escaped Belarusian mistrust, they worried U.S. critics who opposed the expansion of CTR activities from narrow dismantlement objectives.

Despite some progress, the domestic climate within Belarus proved largely inhospitable to CTR projects. Domestic volatility hampered the coordination of CTR activities. Political unpredictability led to a large turnover of those administering CTR activities in Belarus's bureaucracy, causing delays and gridlock. Sharing and coordination of information between CTR officials in Belarus also left much to be desired. With Lukashenko's growing authoritarianism, and in the absence of broader economic and domestic reforms in Belarus, CTR assistance was suspended in 1997, having disbursed only $55 million of a possible $78 million.[7]

CTR Implementation in Kazakhstan

Agreements within Kazakhstan provided for emergency response equipment, SS-18 silo elimination assistance, and communications links to meet START I and INF requirements, and the conversion of WMD industry to civilian production.[8] This facilitated successful SOAE assistance efforts to remove and dismantle nuclear weapons and associated infrastructure in Kazakhstan.

CTR assistance required $98.3 million for complex weapons dismantlement and removal activities resulting in

- 1,400 strategic nuclear weapons returned to Russia, including 104 SS-18s;
- 147 silos and silo structures eliminated in Derzhavinsk, Leninsk, Semipalatinsk, and Zhangiz-Tobe;
- 7 heavy bombers dismantled and 40 returned to Russia;
- 194 nuclear test tunnels sealed.[9]

The primary CTR nuclear weapons dismantlement project operating in Kazakhstan between 1994 and 2000 was the SS-18 Intercontinental Ballistic Missile Silo Elimination Project, which provided equipment to Zhangiz-Tobe, Derzhavinsk, Balapan, and Leninsk for the elimination of 104 SS-18 silo launchers, 16 launch control silos, 2 SS-18 training silos, and 16 other silo structures. The project received $42.3 million to carry out these tasks.

The Unified Fill Facility/Nuclear Warhead Storage Elimination Project was the second-largest funded CTR nuclear weapons dismantlement project, receiving $31.2 million from 1997 to 2000, to provide equipment and services at Derzhavinsk, Zhangiz-Tobe, and Chagan for the elimination of nuclear weapons infrastructure—including two unified fill facilities and three nuclear weapons stor-

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7. Ibid.

8. U.S. Defense Threat Reduction Agency (DTRA), "CTR Assistance—What It Does: Kazakhstan," <http://www.defenselink.mil/pubs/ctr/kazakhstan.html> (accessed February 12, 2002).

9. Wolfsthal, *Nuclear Status Report*, p. 51.

age sites, as well as neutralization, decontamination, demilitarization, demolition, salvage operations, propellant elimination, and logistics services.

Other CTR nuclear weapons dismantlement activities in Kazakhstan included the sealing of 194 test tunnels through the Nuclear Testing Infrastructure Elimination Project. This project cost $19.5 million and sealed test tunnel holes at Degelen Mountain tunnel complex and Balapan test field to ensure against a rapid resumption of nuclear testing within Kazakhstan. The Strategic Bomber Elimination Project in Kazakhstan dismantled 7 Bear G heavy strategic bombers that remained in Kazakhstan, following the return of 40 strategic bombers to Russia, for $2.7 million. Finally, the Emergency Response Project in Kazakhstan provided equipment and training to enhance safety and accident response capability for nuclear weapons being transferred for dismantlement in the country.

Although nuclear weapons dismantlement activities within Kazakhstan have been concluded successfully, their initial implementation was encumbered by delays on both sides. The SS-18 Ballistic Missile Silo Elimination Project suffered a two-year gap between the launch of the project and the awarding of contracts for silo dismantlement. Russian sensitivities over the dismantlement of its silos in Kazakhstan also initially slowed progress, as did local resentment over the fact that the dismantlement efforts relied primarily on foreign personnel, limiting local specialist involvement to low-grade aspects of dismantlement work. From 1995 on, however, CTR dismantlement projects in Kazakhstan began to accelerate, in no small measure because Kazakhstan accepted the narrow purpose of such activities and did not insist that projects provide broader social assistance.

CTR Implementation in Ukraine

CTR implementation agreements have provided vital financial and technical assistance for strategic arms dismantlement efforts within Ukraine. A total of $560 million was provided for the completion of projects under the Strategic Nuclear Arms Elimination Ukraine (SNAE) Program run by DOD.[10] Achievements include

- 1,900 strategic nuclear warheads returned to Russia by June 1996;
- 111 SS-19 ICBMs eliminated by February 1999;
- 55 SS-24 missiles disassembled;
- 196 ICBM silos and silo structures eliminated;
- 43 heavy bombers eliminated with 11 transferred to Russia;
- 3,810 metric tons of fuel stored from 110 SS-19 ICBMs.[11]

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10. U.S. Defense Threat Reduction Agency (DTRA), *Cooperative Threat Reduction Program Plan FY 2001,* January 2000, p. 33. For 2001 and 2002 actual appropriations, see Steve LaMontage, *Summary of Major U.S. Nonproliferation Programs for FY 2002* (Washington, D.C.: Center for Arms Control and Non-proliferation, 2002), p. 1.

11. Wolfsthal, *Nuclear Status Report*, p. 52. Updates from U.S. Defense Threat Reduction Agency (DTRA), CTR Program, "FY 2002 Amended Budget Submission: Former Soviet Union Threat Reduction Appropriation," June 2001, p. 9, <http://www.dtic.mil/comptroller/fy2002budget/budget_justification/pdfs/operation/fy02pb_ctr.pdf>.

CTR activities in Ukraine initially helped implement the Trilateral Agreement between the United States, Russia, and Ukraine in ICBM dismantlement and silo elimination. This work was conducted through the SS-24 Intercontinental Ballistic Missile Early Deactivation (Fast Aid) Project, which supplied equipment including cranes, utility vehicles, batteries, tires, and petroleum products to ensure the return of all strategic nuclear warheads to Russia by June 2, 1996.[12] Stemming from this project, the Non-Deployed Intercontinental Ballistic Missile (ICBM) Elimination Equipment Project supplied similar equipment and logistical support to Ukraine in 1999 to allow for the elimination of 43 ICBMs and 5 launch control centers.[13]

These projects were complemented by five other projects dismantling START-accountable ICBMs and silos in Ukraine. The SS-19 Intercontinental Ballistic Missile Neutralization and Dismantlement Facility Project, establishing the Dnepropetrovsk dismantlement facility in January 1996, had enabled the destruction of all 142 SS-19 ICBMs and their 130 associated silos by the start of 2002, at a total cost of $54 million.[14] The SS-24 Intercontinental Ballistic Missile Disassembly, Storage and Elimination: Disassembly and Elimination Project similarly dismantled all 55 SS-24 ICBMs at the Pavlograd Mechanical Plant by the end of February 2002.[15]

The SS-24 Intercontinental Ballistic Missile Disassembly, Storage and Elimination: Storage Project provided secure storage for SS-24 ICBMs at Pervomaysk and Mikhailyenki before their elimination at Pavlograd and also provided a third storage facility at Pavlograd in 2001 for SS-24 motor stages resulting from dismantlement activities and awaiting elimination at the Pavlograd fuel disposal facility.[16] The SS-24 Intercontinental Ballistic Missile Silo Elimination Project will complete destruction and rehabilitation of all 46 SS-24 launch silos and the five launch control centers (LCC) that operated these sites by December 2002, completing all SS-24 infrastructure dismantlement work in Ukraine.[17]

With the complete elimination of launchers in Ukraine, DOD efforts have focused on infrastructure dismantlement activities. In the area of missile propellant disposition, there was a need to defuel 130 SS-19 missiles and dispose of 5,000 metric tons of liquid propellant at the Khmelnytsky, Pervomaysk, and Shevchenkovo missile bases.[18] Further activities under the SNAE program seek the complete elim-

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12. U.S. Defense Threat Reduction Agency (DTRA), "SS-24 Intercontinental Ballistic Missile Early Deactivation (Fast Aid)," <http://www.dtra.mil/ctr/project/projukr/ctr_ss24_fastaid.html> (accessed February 18, 2002).

13. DTRA, "Non-Deployed Intercontinental Ballistic Missile (ICBM) Elimination Equipment," <http://www.dtra.mil/ctr/project/projukr/ctr_nondeploy.html> (accessed March 20, 2002).

14. DTRA, "SS-19 Intercontinental Ballistic Missile Neutralization and Dismantlement Facility," <http://www.dtra.mil/ctr/project/projukr/ctr_ss19_disman.html> (accessed March 20, 2002).

15. DTRA,"SS-24 Intercontinental Ballistic Missile Disassembly, Storage and Elimination: Disassembly and Elimination," <http://www.dtra.mil/ctr/project/projukr/ctr_ss24_elim.html> (accessed March 20, 2002).

16. DTRA, "SS-24 Intercontinental Ballistic Missile Disassembly, Storage and Elimination: Storage," <http://www.dtra.mil/ctr/project/projukr/ctr_ss24_storage.html> (accessed March 20, 2002).

17. DTRA, "SS-24 Intercontinental Ballistic Missile Silo Elimination," <http://www.dtra.mil/ctr/project/projukr/ctr_ss24_silo.html> (accessed March 20, 2002).

ination of solid propellant in 163 disassembled missile motors through the SS-24 solid propellant disposition facility at Pavlograd.[19] Toward this end, the CTR program launched the SS-19 Intercontinental Ballistic Missile Liquid Propellant Disposition Project and the SS-24 Intercontinental Ballistic Missile Propellant Disposition Facility Project in 1998 and 2000. The disposition of liquid propellant from SS-19s was completed in May 2000, with the SS-24 solid propellant disposition facility beginning operations in April 2002.

Only three other CTR assistance projects in Ukraine are engaged in nuclear dismantlement activities under the new program heading of Weapons of Mass Destruction Infrastructure Elimination Ukraine (WMDIE), established earlier in 1995. The Bomber and Air Launched Cruise Missile (ALCM) Elimination Project has started to assess the scope of airbase infrastructure elimination work at former heavy bomber bases at Uzin, Belaya, Mikhailyenki, Tserkov, and Priluki, and has already seen the elimination of a group of eight Tu-22M backfire bombers and their associated ALCMs.[20] The WMDIE program has awarded a contract for the elimination of the Raduga national nuclear stockpile site.[21] Finally, the Unified Fill Facilities and Nuclear Weapons Storage Area Elimination Project has begun work on the elimination of eight liquid missile-fuel storage facilities in Ukraine. These efforts will address remaining WMD infrastructure dismantlement needs in Ukraine. They received $6 million for FY 2002 and seek appropriations of $9 million for FY 2003.[22]

Successful donor-recipient partnership in Ukraine was encouraged by the fact that CTR dismantlement activities in Ukraine have rehabilitated nuclear weapons infrastructure after dismantlement. This has proven a powerful psychological, political, and economic reason for Ukraine to dismantle its Cold War nuclear legacy. Having suffered Chernobyl and severe economic strains, Ukraine was more than willing to pursue dismantlement activities if they were followed by comprehensive efforts to rehabilitate nuclear sites, provide for the economic well-being of those directly affected by base closure, and address environmental concerns.

Another spur to a positive partnership was the CTR Strategic Rocket Forces (SRF) Housing Project undertaken between 1996 and 1997, which provided housing in Ukraine for SRF officers from 13 demobilizing SRF regiments prior to the elimination of ICBM silo launchers and missiles.[23] Although now forbidden by

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18. DTRA, "SS-19 Intercontinental Ballistic Missile Liquid Propellant Disposition," <http://www.dtra.mil/ctr/project/projukr/ctr_ss19_completed.html> (accessed April 9, 2002).

19. DTRA, "SS-24 Intercontinental Ballistic Missile Propellant Disposition Facility," <http://www.dtra.mil/ctr/project/projukr/ctr_ss24_facility.html> (accessed April 9, 2002).

20. Thomas E. Keunning, Jr., "Cooperative Threat Reduction Program" (slide presentation for DTRA given at Carnegie Endowment for International Peace, Washington, D.C., April 5, 2002).

21. DTRA, "Weapons of Mass Destruction (WMD) Infrastructure Elimination: Warhead Storage," <http://www.dtra.mil/ctr/project/projukr/ctr_wmd_infra.html> (accessed June 10, 2002).

22. Center for Arms Control and Non-proliferation, "Summary of Major U.S. Nonproliferation Programs; Fiscal Year 2003 Budget Request," <http://www.ceip.org/files/projects/npp/pdf/FY03Request.pdf> (accessed August 28, 2002).

23. DTRA, "Strategic Rocket Forces (SRF) Housing," <http://www.dtra.mil/ctr/project/projukr/ctr_srfhousing.html> (accessed June 10, 2002).

Congress, rehousing activities provided critical impetus at a critical time for nuclear dismantlement in Ukraine, by absorbing some of the social costs of nuclear dismantlement as well as addressing proliferation concerns posed by these officers.

Despite these positive forces, CTR implementation in Ukraine has not escaped the technical and political problems that have slowed CTR assistance across the FSU. At a government-to-government level, implementation has been hampered by a lack of coordination between U.S. and Ukrainian bureaucracies, blamed on poor internal coordination within Ukraine, the constant changing of project managers on U.S. CTR projects to Ukraine, and differences of opinion on how CTR assistance funding should be allocated. Ukraine has pushed for social and defense conversion activities, while the United States prefers strictly defined dismantlement projects.[24]

At a technical level, the establishment of the solid propellant disposition facility at Pavlograd best illustrates difficulties of implementation, where construction was delayed by 18 months over disagreements on its technical design. Ukrainians have claimed that U.S. project managers lack the necessary expertise to oversee the facility's construction and have complained about contracting arrangements. Meanwhile, the United States has alleged that Ukrainian experts estimated exorbitant prices for the construction of the Pavlograd facility, especially monies to be spent on wages, and that the technical process the Ukrainians proposed was unsatisfactory.[25] Resolution of these difficulties, however, could be the last hurdle to be overcome before the completion of CTR assistance to Ukraine for nuclear weapons dismantlement.

CTR Assistance in Russia

The size of international assistance efforts required for nuclear weapons dismantlement within Russia far exceeds those efforts in other FSU nuclear weapons states. In August 2002, it was estimated that Russia possessed approximately 18,000 strategic and nonstrategic nuclear warheads, of which 8,400 were operational and 9,600 held in reserve or awaiting dismantlement.[26] As agreed by the May 24, 2002, Strategic Offensive Reductions Treaty (SORT), the number of operationally deployed Russian nuclear warheads will be reduced to between 1,700 and 2,200 by December 2012, adding around 6,000 more nuclear weapons to those in reserve or awaiting dismantlement over the coming years.[27]

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24. For a more detailed description of CTR implementation problems in Ukraine up until 1997, see Kostayantyn Hryshchenko, "Reducing the Nuclear Threat through Joint Efforts: The View from Ukraine," in John M. Shields and William C. Potter, eds., *Dismantling the Cold War: U.S. and NIS Perspectives on the Nunn-Lugar Cooperative Threat Reduction Program* (Cambridge, Mass.: MIT Press, 1997).

25. Volodymyr Chumak, "Strengthening Cooperative Threat Reduction with Russia: Country Report Ukraine" (unpublished manuscript).

26. Robert Norris et al., "NRDC Nuclear Notebook: Russian Nuclear Forces," *Bulletin of the Atomic Scientists* (July/August 2002), <http://www.thebulletin.org/issues/nukenotes/ja02nukenote.pdf> (accessed August 14, 2002).

27. White House Press Release, "Text of the Strategic Offensive Reductions Treaty," <http://www.whitehouse.gov/news/releases/2002/05/20020524-3.html> (accessed August 14, 2002).

Although Russia no longer needs to meet START II treaty limits,[28] CTR projects face significant challenges over the next 10 years in achieving their baseline dismantlement objectives and incorporating the new reductions outlined in the SORT treaty. CTR baseline figures currently aim for the deactivation of a further 7,330 nuclear warheads, 1,819 missiles, 1,184 missile launchers, 108 bombers, and 24 SSBNs by 2012.[29]

On June 17, 1992, the United States and the Russian Federation signed an agreement on Safe and Secure Transportation, Storage, and Destruction of Weapons, and Prevention of Proliferation of Weapons, providing an umbrella to start CTR assistance for nuclear weapons dismantlement in Russia. A host of implementing agreements were negotiated to facilitate this assistance through SOAE and WPCA activities. The umbrella agreement was expanded in 1995, and in June 1999 agreement was reached to extend its duration and continue dismantlement activities until June 2006.[30]

As of mid-2002, CTR efforts in Russia are estimated to have deactivated 5,970 nuclear warheads (including those removed from other FSU states) and dismantled

- 389 ICBMs;
- 89 silos;
- 1 ICBM mobile launcher;
- 322 SLBMs;
- 396 SLBM launchers;
- 24 SSBNs;
- 47 bombers.[31]

The SOAE program has been the primary source of CTR assistance for nuclear dismantlement in Russia with approximately $1.1 billion being appropriated for SOAE activities to date. The SOAE program has already enabled Russia to reduce its START-accountable nuclear warheads to below 6,000 by the December 2001 deadline. SOAE projects remain well funded, receiving $133 million in FY 2002 for large-scale projects in the fields of missile dismantlement, liquid and solid missile propellant elimination, ICBM launcher and silo elimination, heavy bomber dismantlement, SLBM elimination, and SSBN dismantlement. The reduction in the FY 2003 budget request for SOAE activities to $70 million reflects the fact that some of these projects are winding down and disbursing monies from previous years.[32]

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28. These limits would have required the rapid elimination of approximately 1,100 missiles, 550 launchers, 34 bombers, and 17 SSBNs from July 2002 to 2007.

29. DTRA, "CTR Scorecard," July 2002, <http://www.dtra.mil/ctr/ctr_score.html> (accessed August 20, 2002).

30. NTI, "Russia: Nunn-Lugar Cooperative Threat Reduction (CTR) Program," <http://www.nti.org/db/nisprofs/russia/forasst/ctr/programs.htm> (accessed August 17, 2002).

31. DTRA, "CTR Scorecard."

32. William Hoehn, "Analysis of the Bush Administration's Fiscal Year 2003 Budget Request for U.S.-Former Soviet Union Nonproliferation Programs," RANSAC Report (April 2002), p.11.

Missile Dismantlement, Silo and Launcher Destruction

Four SOAE projects have been designed to implement missile dismantlement and associated launcher destruction efforts in Russia. The Solid Propellant ICBM/SLBM and Mobile Launcher Elimination project eliminates ballistic missiles that use solid fuel propulsion and associated launchers. The Liquid Propellant ICBM and Silo Elimination Program and the Liquid Propellant SLBM Elimination Program have similarly been designed to eliminate liquid fuel propulsion missiles and launchers for ICBMs and SLBMs. Finally, the SLBM Launcher Elimination and SSBN Dismantlement project seeks to eliminate SLBM launch tubes as part of general SSBN dismantlement activities.

The Solid Propellant ICBM/SLBM and Mobile Launcher Elimination project includes activities in operating and maintaining missile disposition facilities, the refurbishment of Russian disassembly facilities, and the equipping and operation of mobile launcher elimination facilities. Activities beginning on this project in 1999 have facilitated the destruction of 10 SS-N-20 missiles through open burning, upgraded the Bryansk SS-24 rail-mobile launcher elimination facility, and destroyed 11 SS-N-50s through open burning. The project is currently in the process of providing mobile launcher elimination facilities to dismantle 62 SS-24s and 39 rail mobile launchers; constructing missile disassembly facilities, open burning sites, and rail mobile launcher elimination facilities for the destruction of up to 360 SS-25s; and installing disassembly and open burning support for the destruction of 50 SS-N-20s. The project is also scheduled to begin operation of a weapons disassembly plant at Perm in 2003 and an additional solid propellant disposition facility by 2005.[33]

The Liquid Propellant ICBM and Silo Elimination project will attempt to eliminate more than 600 ICBMS and their associated silos by 2007. This project is well advanced in its operational stage, having already eliminated more than 330 ICBMs and their associated silos through CTR assistance since 1995. Work in destroying ICBMs has, most notably, included the upgrading of the Surovatikha elimination and dismantlement facility for the dismantlement of SS-17s and SS-18s. Upgrades have also been undertaken at Piban'shur elimination and dismantlement facility for the dismantlement of SS-17s and SS-19s. Prior to 1998, the CTR program also provided metal-cutting and earth-moving tools, cranes, and scrap-metal handling equipment to dismantlement facilities at Surovatikha, Piban'shur, Uzhur, Yedrovo, and Perm.[34]

The Liquid Propellant SLBM Elimination project has been working at locations in Sergiev Posad, Revda, Krasnoyarsk, and Yuzhnorechensk to dismantle and eliminate 602 SLBMs. The project has dismantled and eliminated around 300 of these weapons, assisting in the refurbishment of SLBM elimination facilities at these

33. DTRA, "Russia Programs: Solid Propellant Intercontinental Ballistic Missile/Submarine Launched Ballistic Missile (ICBM/SLBM) and Mobile Launcher Elimination," <http://www.dtra.mil/ctr/project/projrus/ctr_icbm_slbm_elim.html> (accessed August 15, 2002).

34. DTRA, "Russia Programs: Liquid Propellant Intercontinental Ballistic Missile (ICBM) and Silo Elimination," <http://www.dtra.mil/ctr/project/projrus/ctr_icbm_silo_elim.html> (accessed August 16, 2002).

locations. The project has also provided railcar maintenance, unloading cranes, and facilitated recertification of handling equipment to ensure safe transport and unloading of missiles before dismantlement.[35]

At the same time, several concerns have arisen in the development of these projects. Although there has been no evidence that CTR missile dismantlement activities leak missile technology, security assistance is being provided to these facilities to help prevent theft and diversion. And environmental concerns have also threatened to slow dismantlement activities, including potential toxic contamination from open burning of missiles and facility-based destruction.[36]

CTR missile dismantlement projects have attempted to address this fear through the installation of comprehensive waste management systems at dismantlement facilities, but the issue remains a prominent local and regional concern. Even more troubling has been the growing surplus of highly toxic liquid and solid propellant collected from ICBMs and SLBM dismantlement. This propellant has overtaken storage capacity in Russia, slowing CTR efforts to eliminate strategic ballistic missiles and posing a growing environmental threat within Russia as degenerating storage conditions increase the likelihood of release and contamination of the local environment.

Missile Propellant Elimination

Currently, U.S. CTR assistance projects are providing processing systems to eliminate 100,000 metric tons of missile propellant, including 70,000 metric tons of oxidizer and 30,000 metric tons of liquid rocket fuel, along with 916 solid rocket motors containing 17, 494 metric tons of solid propellant from eliminated nuclear missiles.[37] The accumulation of these propellants has led to a backlog in the missile destruction cycle, slowing dismantlement and generating significant environmental risks. To address this backlog and provide a more effective missile dismantlement cycle in Russia, the U.S. CTR program has created two SOAE propellant disposition projects.

The Liquid Propellant Disposition Systems Project was designed to meet capacity shortfalls in Russian propellant disposition through the construction of processing systems to dispose of liquid rocket fuel and oxidizers and provision of transport and loading equipment to facilitate the safe transfer of these propellants. The project has already provided equipment for the storage and transportation of liquid propellant including 125 flatbed railcars, 670 tank containers, and 7 cranes, with logistical support and maintenance for this equipment until September 2006. Since 1999, two commissioned systems at Krasnoyarsk have been disposing of liquid propellant oxidizers. Two further processing systems, due to become

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35. DTRA, "Russia Programs: Liquid Propellant Submarine Launched Ballistic Missile (SLBM) Elimination," <http://www.dtra.mil/ctr/project/projrus/ctr_slbm_elim.html> (accessed August 16, 2002).

36. John Lepingwell and Nikolai Sokov, "Strategic Offensive Arms Elimination and Weapons Protection, Control, and Accounting," *Nonproliferation Review* (Spring 2000), <http://cns.miis.edu/pubs/npr/vol07/71/lep71.pdf> (accessed February 21, 2002).

37. DTRA, "Russia Programs: Liquid Propellant Disposition System," <http://www.dtra.mil/ctr/project/projrus/ctr_liquid_prop.html> (accessed August 16, 2002).

operational in Krasnoyarsk by the third quarter of FY 2002, will also begin the elimination of the estimated 30,000 metric tons of surplus rocket fuel in Russia. Two other facilities for oxidizer elimination have been proposed for Krasnoyarsk and Aleksin, in the Tula region, and are hoped to become operational in 2004.[38]

The project has suffered several setbacks in its implementation, as the original conversion sites it had planned for Sergiyev Posad, Krasnoyarsk, and Nizhnaya Salda were reduced to the operation of two facilities in Krasnoyarsk. The commencement of liquid disposition efforts was further delayed by the Russian government's inability to provide necessary infrastructure, such as electric power, to these facilities. Although railcars, cranes, and containers supplied by the United States have addressed concerns regarding Russian transport capacity to ship liquid fuel to elimination facilities, reports that storage capacity has been reached for liquid fuel underscore the urgency of installing additional facilities.

The Solid Propellant Disposition Facility Project has built a complex at Votkinsk to eliminate, in a way that is environmentally safe, the approximately 17,464 metric tons of solid propellant and 916 solid rocket motors needing destruction in Russia. The contract for design of this facility was awarded to Lockheed Martin in 1997, which estimated that the facility could completely dispose of solid fuel and motors within four years, starting in December 2000 and finishing in December 2004. Because of delays, however, the contract for the construction of this facility was only awarded in April 2002, to Bechtel, for its complete construction and certification by 2005.[39]

The site at Votkinsk suffered delays as a direct result of local opposition groups, who cited environmental concerns similar to those at a previously designated site for solid propellant disposition in Perm. In the case of Votkinsk, a local referendum found that 95 percent of the public was opposed to the building of such a facility in 1997.[40] CTR project coordinators worked hard to highlight the self-contained and environmentally conscious design and future operation of the Votkinsk facility and were able to mollify public concerns; construction resumed in 2000. More recently, however, construction has been delayed again by the refusal of President George Bush to certify congressional conditions placed on CTR assistance projects.

Despite these holdups, it seems that construction at Votkinsk will eventually progress. Questions remain, however, as to whether this facility will provide the necessary capacity to tackle increased dismantlement activities associated with further reductions. As a result, both the United States and Russia have considered the use of CTR assistance to establish a second facility at the original Perm site.[41]

Heavy Bomber Elimination

Heavy bomber elimination in Russia was, as in Ukraine and Kazakhstan, a straightforward and highly successful effort. The project oversaw the elimination of 42

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38. Ibid.

39. DTRA, "Russia Programs: Solid Propellant Disposition Facility," <http://www.dtra.mil/ctr/project/projrus/ctr_solid_prop.html> (accessed August 19, 2002).

40. Lepingwell and Sokov, "Strategic Offensive Arms Elimination."

41. Ibid.

Russian heavy bombers at Engels Air Force Base. CTR supported Russian heavy bomber dismantlement through the provision of elimination equipment including cranes, metal-cutting tools, and scrap-metal handling equipment in a period between September 1994 and November 1995, at a total cost of $10.4 million.[42]

SSBN Dismantlement

SSBN dismantlement is a complex activity with many stages of operation. Dismantlement and destruction activities can only be undertaken under strict safety conditions and with adequate storage for spent nuclear fuel and low-level radioactive waste (LLRW). Although there is significant expertise in Russia to carry out these tasks, adequate infrastructure did not exist under the Soviet administration to undertake large-scale dismantlement activities. This has prompted the creation of CTR assistance projects to facilitate the dismantlement of SSBNs.

CTR efforts in this field have already succeeded in dismantling 24 SSBNs and are on track to eliminate 42 SSBNs by 2007. The SLBM Launcher and SSBN Dismantlement project has provided equipment and contracts to improve infrastructure and prepare shipyards for dismantlement operations, remove launch tubes from SSBNs, store LLRW from dismantlement operations, dispose of nuclear submarine reactors, decontaminate dismantled submarines, and finally scrap the remainder of these vessels. These activities have taken place at Nerpa Ship Repair Yard, SevMash Production Association, and Zvezdochka State Machine Building in the Northern Fleet, and Zvezda shipyard in the Pacific Fleet. More than $350 million had already been appropriated for efforts to dismantle SSBNs at these facilities by FY 2002.

Two projects have also been established to dispose of low-level radioactive waste and manage spent nuclear fuel arising from SSBN dismantlement activities. The Low Level Radioactive Waste Volume Reduction Project is designed to reduce thousands of cubic meters of LLRW produced through CTR SSBN dismantlement activities each year. This includes a volume of 1,500 m^3/year of low-level radioactive waste produced in dismantling SSBNs at Zvezdochka and SevMash; 5,000 m^3/year of radioactively contaminated water at Zvezdochka and Zvezda; and 400 m^3/year of solid low-level radioactive waste produced through liquid LLRW reduction activities at these facilities. The project also has built an interim storage facility for 1,500 m^3 of LLRW at Zvezda. The U.S. CTR assistance program has spent a total of $39.1 million on these efforts.[43]

The Spent Naval Fuel Disposition Project has been a more expensive endeavor, costing just under $100 million by the end of FY 2002.[44] This project was designed in response to Russian requests for U.S. help in managing spent naval fuel generated through SSBN dismantlement. The project has completed efforts to provide long-term capabilities at Zvezdochka and Zvezda, now defueling up to 8 subma-

42. DTRA, "Russia Programs: Liquid Propellant Disposition System," <http://www.dtra.mil/ctr/project/projrus/ctr_liquid_prop.html> (accessed August 16, 2002).

43. Defense Threat Reduction Agency (DTRA), *Cooperative Threat Reduction Multi-Year Program Plan FY 2001* (Washington, D.C.: U.S. Department of Defense, January 2000), p. 14.

44. Ibid., p. 15.

rines a year. The project has also provided urgent repairs to increase defueling capabilities at shipyards, including contracting and certifying three Russian nuclear defueling ships. Now, it is seeking to procure up to 384 Arctic Military Environmental Cooperation (AMEC) dry storage casks for the safe interim storage of spent naval fuel. The project is also proposing to reprocess spent fuel from up to 15 SSBNs and to store spent fuel from 17 SSBNs, pending the signing of a spent naval fuel (SNF) amendment to the SOAE implementing agreement with Russia.

These projects, though in many ways a flagship for CTR attempts to dismantle strategic nuclear weapons systems in Russia, have drawn significant criticism. The main argument, raised primarily at a local and regional level within Russia, is that SLBM launcher and SSBN dismantlement activities have neglected and compounded acute environmental threats stemming from decommissioned SSNs and SSGNs awaiting dismantlement. This complaint is compounded by the negative effects that U.S. program orientation, narrowly directed at military goals of SSBN dismantlement, has had on local economies reliant on SSBN bases.

Lessons Learned

Despite many hurdles, over the last 10 years the U.S. CTR program has succeeded in addressing nonproliferation goals in nuclear weapons and infrastructure dismantlement. The program's initial victory in securing the inherited nuclear arsenal from Ukraine, Belarus, and Kazakhstan has been followed up by continual improvement at all stages of dismantlement. Even just a quick look at the number of warheads, ICBMs, SSBNs, and other destructive legacies of the Cold War that have been secured by CTR illustrates the tremendous success of the program: almost 6,000 deactivated warheads, 400 ICBMs, 300 SLBMs, 24 SSBNs, and 50 bombers. Given the residual animosity between parts of the U.S. and Russian establishments that has plagued CTR at many stages, these successes are impressive.

The CTR program's ability to overcome legal, financial, technical, and political barriers has been essential to its success. From access and transparency issues to the contracting procedures CTR uses, the ability to adapt and evolve may be the program's most valuable asset.

Several examples illustrate this dynamism. Transparency and accessibility issues have been a consistent challenge in pursuing nuclear dismantlement goals. As discussed above, CTR had to immediately confront the tension between nonproliferation objectives and genuine Russian national security concerns. However, CTR initiatives for transparency in strategic offensive arms dismantlement activities—such as effective transparency and accounting procedures in continuous program management, audit and examination visits, and analysis, examination, and information-gathering activities—have overcome secrecy and mistrust in establishing the effective and proper use of CTR equipment. According to the 2001 report of the General Accounting Office (GAO), it is estimated that at least 95 percent of assistance provided by the Department of Defense for CTR activities is being used as intended.[45]

That said, stumbling blocks remain. Access is sometimes denied by Russian officials, most often at sites involving the elimination of strategic offensive arms. The 2001 GAO report points out that in a period of about one year, nine requests for auditing and examination were denied, all of which were at sites of strategic offensive arms elimination. Taken in context, however, the degree to which CTR equipment can be verified is quite high: During that same 12-month period, 361 other sites were approved for U.S. inspection.[46] CTR audit and examination teams have had successful access to some restricted offensive arms sites to monitor dismantlement of launchers and storage of fissile materials and have been provided time-stamped photographs by the Russian government for further verification at restricted sites. DOD is currently negotiating with MINATOM to continue audit and examination efforts and avoid future violations and has enhanced its auditing and examination practices based on General Accounting Office (GAO) recommendations.

The same pattern of program adaptation and evolution can be seen in CTR contracting policy. Contracting is a vital component of overall CTR success; contracting of services represented more than two-thirds of the $2.8 billion of funding provided to DOD between 1992 and 2000. Initially, most of the contracts were awarded to U.S. companies. However, this policy discouraged much needed economic cooperation and capacity building in Russia. Over time, DOD has shifted a good deal of equipment production for program materials to Russia and Ukraine via subcontracting. In addition to increasing financial incentives for Russia, this shift in contracting has created competition between indigenous contractors, which has reduced overhead by 40 percent to 60 percent and resulted in shorter project time. A fully open selection process for both parent and subcontracts would maximize these nonproliferation and financial benefits.

Despite the adaptability of the CTR program, significant challenges remain. As mentioned above, more progress must be made to increase transparency and accounting capacity in Russia. Significant portions of the nuclear weapons complex remain off-limits to reliable auditing and accounting procedures; in the case of tactical nuclear weapons, these off-limit sites are significant proliferation threats. Moreover, problems regarding implementation of existing taxation and liability protections for CTR contracts in Russia must also be addressed to facilitate assistance. Despite recent changes in Russian legislation providing considerable tax exemptions, subcontractors for CTR activities are still vulnerable to value-added tax and payroll taxes, which increase overall project costs. Russian unwillingness to protect CTR contractual personnel from liability complicates program implementation, slowing work progress and damaging incentives for the international community to provide further support. To maximize the potential of the planned increase in European funding contained in the "10+10 over 10" initiative, taxation and liability problems should be resolved without delay.

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45. U.S. General Accounting Office (GAO), "Cooperative Threat Reduction: DOD Has Adequate Oversight of Assistance, but Procedural Limitations Remain," June 19, 2001, p. 6.

46. Ibid., p. 9.

In addition to transparency and financial barriers, the "mission creep" tendency of CTR projects has drawn frequent criticism—directed specifically at CTR activities dealing with nonnuclear components of the dismantlement process, such as missile propellant disposition or transportation costs. Some critics take this complaint even farther, arguing that the finances freed up by this mission creep have allowed the Russians to focus their investments on new nuclear weapons advances. The objection to mission creep is understandable but misplaced. Most times, these "nonnuclear" dismantlement activities are vitally important to the health of the overall project. Furthermore, improvements in project cost forecasting can guard against this problem in the future.

Tasks Ahead

This chapter's two primary recommendations—completing dismantlement of the nuclear fuel cycle and establishing a warhead dismantlement regime—build on the progress of CTR programs while adapting them to the realities of the contemporary Russian nuclear landscape. However, additional assistance is needed to accomplish these objectives. Unofficial State Department estimates have put the cost of creating a warhead accounting regime at $1 billion, while Russian authorities have estimated the cost of comprehensive general-purpose submarine dismantlement in Russia to be around $4 billion.[47]

Recent developments provide a powerful argument in favor of funding and implementing these two proposals. The aftermath of the September 11 terrorist attacks has greatly increased global interest in securing Russia's most vulnerable nuclear assets. The status of the naval nuclear fuel cycle and unaccountable warheads both require additional assistance to prevent theft, diversion, or environmental catastrophe. The aforementioned SORT agreement also greatly increases the need for comprehensive warhead transparency in order to prevent an influx of vulnerable retired warheads. Finally, the G-8 proposal to increase European involvement in cooperative threat reduction offers a unique opportunity to utilize European expertise and interest in SSN and SSGN dismantlement to further nonproliferation goals and environmental commitments in this area. The European commitment to match the U.S.$10 billion contribution is encouraging. However, as projects like the Votkinsk solid propellant elimination program demonstrate, addressing the problem effectively requires concrete proposals with vigorous implementation schemes.

The Need to Address Problems in the Russian Naval Fuel Cycle

The legacy of the decaying Soviet nuclear fleet provides numerous challenges for both Russia and the international community. It is estimated that between 60 and

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47. Confidential conversation with State Department official, October 2002; Russian Federation, *Proliferation Prevention and Destruction of Hazardous Facilities and Materials,* May 2002, p. 11 (for information regarding this Russian government report, which is not widely available, contact this chapter's author, Ian Woodcroft).

70 tons of highly enriched uranium (HEU) naval fuel are currently contained in 130 Russian nuclear submarines, icebreakers, cruisers, and decommissioned submarines.[48] Inadequate storage and reprocessing facilities at all stages of the Russian naval fuel cycle have been further overwhelmed due to accelerated decommissioning, lack of domestic funding, and limited foreign aid. Forty thousand spent-fuel rods now overflow from Russian naval yards, providing an arguably greater environmental and proliferation threat than decommissioned submarines awaiting dismantlement.[49] The lack of storage and reprocessing facilities to handle an increasing volume of intermediate and low-level solid and liquid waste has provided additional concern. Inadequate transportation, dilapidated and limited equipment, lack of technical expertise, and funding constraints have compounded this situation. Comprehensive action must be taken now to address these problems and avert the impending proliferation and environmental catastrophe this dismantlement bottleneck represents.[50]

The Need for an Improved Naval Fuel Cycle

Nuclear submarines within Russia are now in a state of accelerated decommissioning. In 1989, there were 197 Russian submarines in service, with 20 decommissioned and awaiting dismantlement.[51] By late 1998, this figure had changed to 61 submarines in service with 110 to 115 decommissioned subs awaiting dismantlement (all with nuclear reactors still installed). The cost of continued storage of these vessels is considerable, draining scarce Russian resources that could be better devoted to dismantlement.

In 1999, MINATOM announced ambitious plans to further increase dismantlement activities, proposing the complete dismantlement of all decommissioned submarines by 2005.[52] Thirty-six decommissioned SSBNs are currently under dismantlement through CTR activities and another six SSBNs are under contract, with 87 decommissioned SSNs and SSGNs only now beginning to receive limited international dismantlement aid.[53]

The cost of dismantlement is approximately $6 million per general-purpose submarine and $15 million per SSBN. Most submarines contain two reactors with

48. James Clay Moltz, "Russian Nuclear Submarine Dismantlement and the Naval Fuel Cycle," *Nonproliferation Review* (Spring 2000).

49. Charles Krupnick, *Decommissioned Russian Nuclear Submarines and International Cooperation* (Jefferson, N.C.: McFarland, 2001), p. 75.

50. Only 3 to 6 boats a year can be dismantled through the nuclear fuel cycle. James Clay Moltz and Tamara C. Robinson, "Dismantling Russia's Nuclear Subs: New Challenges to Nonproliferation," *Arms Control Today* (June 1999); <http://www.armscontrol.org/act/1999_06/subjun99.asp?print> (accessed January 10, 2002).

51. Krupnik, *Decommissioned Russian Nuclear Submarines*, p. 23.

52. MINATOM has lengthened this timetable to 2007. See Bellona Foundation, "150 Nuclear Subs to be Scrapped," Bellona News Story, May 22, 2000, <http://www.bellona.no/imaker?id+116925&sub=1> (accessed, January 20, 2002).

53. Vernon J. Ehlers, rapporteur, *General Report to the NATO Parliamentary Assembly Science and Technology Committee: Safeguarding the Nuclear Weapons Complex in Russia and the Newly Independent States* (Brussels: NATO Parliamentary Assembly, October 2001), <http://www.nato-pa.int/publications/comrep/2001/au-220-e.html#2> (accessed January 10, 2002).

210 to 215 fuel assemblies that possess around 400 kg of uranium in total. Enrichment levels of this uranium range from 20 percent to 90 percent.[54] These vessels are currently dismantled at Nerpa, Zvezdochka, Zvezda, and Sevmash naval shipyards.

Safety dangers have beset both the active and decommissioned submarine fleet in recent years. The sinking of the *Kursk*, *Kosmolets*, and *Murmansk Fjord* submarines along with reports of a submarine collision at Avachinski in the Pacific Fleet have reinforced fears that sunk or damaged reactors could lead to reactor criticality in vessels at sea or laid up.[55] The culture within the Russian Navy is plagued with a host of vulnerabilities that degrade safety standards far below acceptable Western norms: inadequate salaries, poor training, supervision and management, a lack of adequate equipment, and understaffing. The salary for sailors of Russian nuclear vessels, for example, is only $50 a month, with officers paid $150 a month and with staffing of decommissioned vessels at only one-third of operational levels.

These factors have been exacerbated by the shift of jurisdictional responsibilities for dismantlement from the Navy to MINATOM, causing the release of 10,000 naval personnel from active duty. MINATOM has subsequently failed to increase federal funding of dismantlement activities.[56] Without sufficient funding, safety standards will continue to diminish, leading to the increased possibility of the criticality of a submarine reactor through deliberate action, technical failure, accidental withdrawal of control rods, defueling, fire, or explosion. The September 1998 attempt of a Russian serviceman to destroy his Akula Class SSN is a more extreme example of this threat. In another case, in September 1995, electricity was cut to a nuclear submarine in Murmansk, due to unpaid bills, and power had to be forcibly restored to avoid loss of cooling that could have damaged or destroyed reactor fuel.[57] These threats can only be solved once the bottleneck in spent naval fuel storage and liquid waste disposal is addressed.

Spent Naval Fuel Storage

The approximately 40,000 nuclear spent-fuel assemblies contained at Russian naval facilities are split between the Northern and Pacific Fleets—25,000 to 30,000 within the former and 10,000 in the latter.[58] In the Northern Fleet, these assemblies are held at the three naval facilities of Zapadnaya Litsa, Gremikha, and Severdovinsk. For the Pacific Fleet, the Shkotovo waste site and Kamchatka naval base hold assemblies in storage. Holding capacity has been reached and surpassed within both fleets.

Andreeva Bay, the Northern Fleet's primary storage facility (located at Zapadnaya Litsa), contains approximately 21,640 spent nuclear fuel assemblies, the

54. Krupnick, *Decommissioned Russian Nuclear Submarines*, p. 62.

55. Ibid., pp. 24 and 74.

56. Cristina Chuen and Michael Jasinski, "Russia's Blue Water Blues," *Bulletin of the Atomic Scientists* (January/February 2001), <http://www.cns.miis.edu/pubs/other/boas_sub.htm> (accessed January 10, 2002).

57. Howard Gethin, "Chubais' UES Pulls the Plug on Satellite-control Station," *Russia Journal Weekly,* February 1, 2002, <http://www.russiajournal.com/printer/weekly5688.html> (accessed February 7, 2002).

58. Krupnik, *Decommissioned Russian Nuclear Submarines*, p. 75.

equivalent of 93 reactor cores, stored in three temporary concrete storage tanks and in containers placed in the open on a storage pad; it is estimated that between 40 percent and 50 percent of these assemblies are damaged.[59] Originally designed for solid waste storage, these tanks are at storage capacity, have been technically obsolete for more than 15 years, and are thought to contain integrity flaws owing to damage from extreme weather conditions. Many fear that the close proximity of fuel assemblies in these facilities could lead to criticality and to an explosive chain reaction, setting off an international environmental disaster. This is of particular concern to Norway, only 30 miles away. In addition, containers are openly stored on contaminated ground at Andreeva Bay. These assemblies already contaminate their surrounding environment. Compounding the spent-naval-fuel storage problem are the approximately 2,000 spent-fuel assemblies that remain damaged and unacceptable for reprocessing at Gremikha.[60] The Northern Fleet also has six PM supply ships, containing around 4,000 spent-fuel assemblies, in its service.[61] Three barges packed with fuel assemblies are more than 25 years old and in very poor condition at Zvezdochka shipyard in Severdovinsk.

These problems are mirrored in the Pacific Fleet, where Shkotovo and Kamchatka are reaching their respective spent-fuel storage capacities. This backlog has been created through increased decommissioning and slow shipment to the Mayak reprocessing facility. Spent fuel at Shkotovo is stored in shallow burial sites that remain prone to runoff in heavy rain.[62] At Kamchatka, the situation is even worse, with water leakage into sealed cells and no account of some buried spent-fuel materials. Of the six floating workshops designed to transfer and temporarily store fuel from refueled or dismantled submarines in the Pacific Fleet, one is in need of repair, two have been removed from service with fuel aboard, and another is out of service and in danger of sinking.[63] Measures to reduce these environmental hazards to allow for continued and future dismantlement are a growing priority for the international community.

The primary means that has been developed to address spent-fuel overflow at Russian naval facilities is a comprehensive interim container storage system. Two projects were pursued to provide containers for the on-site storage and transportation of spent fuel. Each container system was designed to provide a short-term fix in securing this spent fuel until long-term storage or reprocessing options are developed.

The Arctic Military Environmental Council (AMEC), whose primary contributors are Norway, Russia, and the United States, has funded six initiatives with a combined initial expenditure of approximately $18 million. AMEC's container ini-

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59. Vladislav Nikiforov, "Norwegian Experts Enter Nuclear Waste Site: First in the History Secret Nuclear Site in Andreeva Bay Was Opened for Western Experts, after the Funding Had Been Promised," May 2001, <http://www.bellona.no/en/international/russia/navy/northern_fleet/storage/20648.html> (accessed October, 15, 2002).

60. Nordic Nuclear Safety Research, "Radioactive Contamination: Spent Nuclear Fuel," <http://www.arctic.uit.no/straalevern/contamination/contamination.html> (accessed October 23, 2002).

61. Ibid.

62. Kopte, *Nuclear Submarine Decommissioning and Related Problems*, p. 26.

63. Krupnick, *Decommissioned Russian Nuclear Submarines*, p. 152.

tiative has been by far the largest of its project endeavors. These containers were designed as a transport alternative/supplement to current Russian TUK 18 containers used in the shipping of nuclear waste. Each container weighs 45 tons and can ship 95 fuel assemblies on current TK-VG-18 railcars designed for nuclear waste rail transportation. The containers are designed for long storage periods on easily assembled concrete pads at nuclear bases before transport to permanent storage facilities or to reprocessing facilities. Cask development and pad construction activities for this project were completed in October 1999 and July 2000 respectively.[64]

The second container project, part of a joint U.S.-Russian initiative, involved the adaptation of much larger RBMK civilian nuclear fuel containers to hold naval nuclear fuel. These containers, almost double the size and weight of AMEC containers, hold more than three times the number of fuel rods held by their smaller AMEC counterparts. This, like the AMEC project, has conformed to rigorous IAEA standards but has been hampered in implementation by licensing and taxation problems. Furthermore, both projects have only provided limited assistance to meet Russia's current or future spent-fuel interim storage needs. The Russian government estimates that it will require approximately $1.3 billion to safely store, transport, and reprocess this fuel from now until 2012.[65]

Ship Defueling

The international community has also invested in activities to dispose of accumulated fuel from nuclear defueling vessels in Russia. These vessels, designed to remove and transport spent nuclear fuel from nuclear submarines to storage facilities, pose a significant environmental threat and logistical barrier to dismantlement. Already at storage capacity, the vessels are unable to offload spent nuclear fuel into equally overcapacity land storage facilities. There is now concern with regard to the transport capacity of these varied and largely outmoded ships. Even the three relatively new Project 2020 Malina class ships, designed to store 1,400 fresh and spent-fuel assemblies and provide liquid waste treatment facilities, have faced significant technical and operational problems.

These problems have been compounded by an inability to fund the commissioning of additional service vessels, such as the Project 2020 Malina ship under construction in Ukraine since 1990.[66] Although fuel now stored on these vessels can be removed once sufficient storage and reprocessing capabilities are created, the construction of new vessels would both improve defueling activities and circumvent the time needed to defuel and repair vessels. The international community must formulate a plan of action to increase the number of these vessels, possibly providing Russia with funds to facilitate the commissioning of the Ukrainian constructed Malina class ship.

64. AMEC, "Program Plan and Report on Proposed Obligations for the Arctic Military Environmental Cooperation Program FY 1999," <https://osiris.cso.uiuc.edu/denix/Public/Intl/AMEC/RTC/feb.html> (accessed February 10, 2002).

65. Russian Federation, *Proliferation Prevention,* p. 11.

66. Igor Kudrick, "New Naval Nuclear Fuel Transport Ship Stuck in the Ukraine," Bellona News Story, February 18, 1998, <http://www.bellona.no/imaker?sub=1&iid=12174> (accessed February 20, 2002).

Similar projects could include action with regard to the fleet of Russian nuclear icebreakers that have generated significant nuclear waste. These eight nuclear-powered ships, including the problematic and damaged Lenin icebreaker, require assistance because their Atomflot owners do not possess the technological expertise to remedy this situation.

The Lepse Project epitomizes international efforts in this area and provides a critical test for international cooperation and partnership with Russia. The *Lepse*, a 50-year-old former icebreaker located at Atomflot, holds 624 spent-fuel assemblies, many in damaged condition.[67] Norway, France, the European Commission, the United States, Russia, and the Nordic Environment Finance Corporation have been in deep discussion over the vessel's situation, expending significant expertise and resources to help safely resolve the danger. The lead companies in developing removal technologies are headed by SGN from France in partnership with AEA technology from the United Kingdom.

This project is an important symbol of international cooperation in Russia. At present, $13 million has been set aside for testing and development of related technologies in this area, and there has been a clear and successful division of tasks among fuel retrieval, management of retrieved fuel, handling of solid and liquid waste disposal, and final vessel conversion. However, similar to many other program experiences, consistent problems with taxation, liability, and local concern, owing to the proximity to Murmansk, have delayed the project. Although begun in 1997 and originally designed for completion within four years, the Lepse Project is not yet in the implementation stage.[68]

If these hurdles can be overcome and the project completed, it will demonstrate the potential of enhanced cooperation between nations and international organizations in reducing threats in Russia. The success of this project could catalyze other spent-fuel cooperative projects in the Northern Fleet.

In September 1997, the Industrial Group, composed of BNFL Engineering of the United Kingdom, Kvaerner Maritime of Norway, SKB of Sweden, and SGN, was contracted by the European Commission, Norway, and Sweden to look at more permanent storage alternatives. Proposals included completing the wet storage facility at Mayak, an additional dry storage facility at Mayak, completing the wet storage facility at Murmansk, and building a new dry storage facility in the Russian Northwest of Western design, as well as significant use of storage containers at Andreeva Bay and Murmansk for interim storage.[69]

Five years on, proposals by MINATOM to complete wet-water pool storage at Mayak for spent nuclear fuel have been deemed unsafe by the Industrial Group and unable to meet international safety standards. Meanwhile, MINATOM has opposed the Industrial Group's dry storage plans at Mayak, stating they were never on the agenda primarily because of local resistance in Chelyabinsk. Instead, it has now been decided that a dry spent-fuel storage site will be built at Murmansk, named

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67. Bellona Foundation, "The Lepse Project," Bellona Fact Sheet, <http://www.bellona.no/imaker?sub=1&id=12836> (accessed February 15, 2002).

68. Krupnick, *Decommissioned Russian Nuclear Submarines*, p.149.

69. Ibid., p. 165.

the Federal Environmental Spent Fuel Store. The Scandinavian countries, the UK, and the EU will fund this site. The Industrial Group is also looking to secure interim and long-term security of spent fuel in containers at Murmansk, Polyarny, Gremikha, and Severodvinsk.

Reprocessing for Spent Naval Nuclear Fuel

Currently, there is no reprocessing of spent naval fuel within Russia. The Mayak reprocessing facility has three lines of production—the first for naval and marine reactors, the second for Soviet commercial reactors, and the third for research and high-level HEU. The working capacity of this plant is 1,000 fuel assemblies per year, woefully inadequate to address the backlog of up to 40,000 spent-fuel assemblies lying unused at Russian naval bases. The limited reproduction undertaken at this facility was halted by Gosatomnadzor (GAN) in early 1997, when a lack of funding stopped the installation of a permanent vitrification plant to handle high-level radioactive waste.[70]

MINATOM's plans to upgrade the facility, even if instituted, will be of little benefit to renewed reprocessing of spent naval fuel. Reprocessing of such fuel at Mayak produces technical difficulties unique to this fuel that make reprocessing a less favorable option. It appears commercially untenable as well, as Mayak's reprocessing capacities could be more profitably used in securing more lucrative international spent-fuel reprocessing contracts.[71] Thus, environmentally safe long-term storage of spent nuclear fuel from naval and other sources that pose no proliferation threat are more viable options.

Solid Waste Storage

The Northern and Pacific Fleets are estimated to produce 6,000 to 7,000 cubic meters of solid radioactive waste (SRW) annually.[72] Within the Northern Fleet, 8,000 cubic meters of solid radioactive waste are stored at 10 naval facilities; much of it still remains in the open.[73] Currently, only one incineration plant at Zvezdochka treats this waste; its capacity is 40 kilos per hour, and it operates for only one month a year. MINATOM estimates that three facilities will be needed to process solid waste from the Northern Fleet, and currently efforts continue toward constructing a new solid low-level waste disposal facility at Novaya Zemlya. These concerns are mirrored in the Pacific Fleet, where since 1959, more than 5,000 containers of solid low-level waste, 34 ships filled with waste, and two defueled nuclear reactors have been dumped in the Sea of Japan.[74]

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70. Ibid., p. 84.

71. Ibid.

72. "Decommissioned Nuclear Submarines Still Pose Threat to Seas," *Russia Journal Weekly,* April 19, 1999, <http://www.russiajournal.com/printer/weekly813.html> (accessed February 28, 2002).

73. Krupnik, *Decommissioned Russian Nuclear Submarines*, p. 81.

74. Susanne Kopte, *Nuclear Submarine Decommissioning and Related Problems*, BICC Paper 12 (Bonn: Bonn International Center for Conversion, August 1997), p. 27.

AMEC is developing an ambitious program to address the Northern Fleet's threat to the Arctic environment with a safe, secure, and sustainable SRW treatment and storage capacity. One project is currently focused on establishing a mobile pre-treatment facility as part of broader goals to assess SRW treatment options, technologies, and ultimate design and construction of treatment systems. Another project is developing self-sustaining production capabilities in Russia through procurement awards to Russian firms for both concrete and steel containers to store SRW, as part of overall AMEC project goals of sustainability.

The original estimate for treatment alone was more than $100 million for the construction of facilities that would incinerate, decontaminate, compact, and cement solid waste. This approach has been limited to the establishment of a central processing facility. However, the revised cost estimates for building this facility—between $20 million and $42 million—are still far in excess of AMEC's financial resources.[75]

There is also a need to finance the containment of SRW on military bases, where several modular interim storage buildings are required to hold newly developed storage containers. The estimated cost of these buildings, which have been designed to protect against severe environmental conditions and need to be equipped with both radiation detection equipment and personal protective equipment, is $7.4 million per facility, based on the Russian-built facility at Andreeva Bay. There is a significant need for these facilities for both the Northern and Pacific Fleets.

Liquid Waste Storage and the Zvezda and Murmansk Initiatives

Russia's Northern and Pacific Fleets generate 10,000 to 12,000 cubic meters of liquid waste annually.[76] Atomflot is able to process between 1,000 to 1,500 cubic meters of this waste per year, but liquid waste is building up in the Northern Fleet. More than 2,500 cubic meters are now in storage at Severodvinsk construction facility and the nuclear waste storage ships Imandra, Lotta, Lepse, Voladarskii, and Serebryanka. Within the Pacific Fleet approximately 8,000 cubic meters of liquid waste is being stored in three floating workshops, four floating storage facilities, three onshore storage tanks at Sysoev Bay, and at two interim storage sites at Primore and Kamchatka.

These storage capacities are inadequate and have prompted the international community to move to increase processing capacity in the Northern and Pacific Fleets to 5,000 and 7,000 cubic meters annually. The two primary international assistance programs, the Bolshoi Kamen waste-processing barge and the Murmansk Trilateral Initiative, provide an interesting comparison. The first Pacific Fleet project at Zvezda has stemmed initially from international efforts, as compared with the Murmansk Initiative, which stemmed from Russian efforts and adopted a

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75. For a description of the potential operational aspects, see Andrew Griffith et al., *Stabilization and Storage of Solid Radioactive Waste from the Russian Navy's Northern Fleet under the AMEC Program*, Arctic Military Environmental Cooperation, <http://web.dandp.com/AMEC/stabilizationamec.html> (accessed February 10, 2002).

76. "Decommissioned Nuclear Submarines Still Pose Threat to Seas," *Russia Journal Weekly,* April 19, 1999, <http://www.russiajournal.com/printer/weekly813.html> (accessed February 28, 2002).

more advisory role. Both initiatives have almost been completed with the knowledge that their success has addressed current Russian naval liquid waste treatment needs—at notably different levels of expenditure, however.

In 1993, the Japanese government promised support for a liquid waste-processing barge at Zvezda dockyard in Bolshoi Kamen in return for Russian adoption of the London Dumping Convention. The dumping issue was of significant concern to the Japanese government; especially given fishing interests in the area and the ecological effect that dumping would have on marine life of the Sea of Japan. After initial difficulties, agreement was finally reached on the barge contract with the Russian Duma's State Committee on June 11, 1996. Through this contract, Japan provided $25 million to international firms Babcock and Wilcox, ChemNuclear from the United States, and AEA from the United Kingdom.[77] AO Amur Shipbuilding Plant performed the actual construction of the barge, under subcontract from the Japanese Tomen Corporation.

From the inception of this contract, however, construction of the barge has been fraught with difficulties. A local referendum that found 94 percent of participants in favor of halting construction was voided because voter turnout was below 50 percent of the population. Costs for this project have run over, with Babcock and Wilcox reporting that the initial $25-million contract exceeded its budget by $8 million.[78] American contractors have blamed this situation on intentional delays, design changes, funding issues, and unnecessary construction designed to keep international capital flowing into Zvezda. These problems are further enforced by suspicion, secrecy, and an unwillingness of the federal government or the regional or city councils to discipline the project's managing authorities. On the Russian side, groups involved at various stages of the project have complained about delays in receiving technical data in construction. Japan has rejected two pleas for additional funding on the project and officially views the delays caused by these problems as "disappointing." However, despite these problems, the facility is now being tested and is expected to meet the total requirements of the Pacific Fleet's liquid waste reprocessing needs—a significant accomplishment.

Within the Northern Fleet, the Murmansk Trilateral Initiative among Norway, the United States, and Russia was designed to increase the treatment of liquid radioactive waste at the Atomflot facility from 1,200 cubic meters annually to 5,000 cubic meters, with the possibility of Russia increasing this to an additional 15,000 cubic meters a year as the decommissioning of vessels increases. This site is now in an active testing period; Norway and the United States have completed funding of approximately $6 million, with Russia providing an additional $0.6 million.

The project was an initial three-year proposal put forward in Norway's Plan of Action, which involved Brookhaven National Laboratory and Raytheon from the United States and NKPA from Norway. Costs have been kept at visibly reduced levels through heavy emphasis on using Russian labor and contractors. Heavy taxation

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77. Krupnick, *Decommissioned Russian Nuclear Submarines*, p. 147.

78. Russell Working, "Nuclear Waste Project Drags on at Bolshoi Kamen," *Vladivostok News,* January 14, 2000, <http://vn.vladnews.ru/Arch/2000/ISS207/text/biz1.html> (accessed February 20, 2002).

was uniquely avoided by channeling funds through Nuclide, an agency of MINATOM, and the ISTC, both of whom had already established tax waiver arrangements with Russia. Liability was governed by Russian acceptance of the Vienna and Paris conventions on nuclear liability and by an evolving Russian regulatory system.

The project was repeatedly affected by these regulatory systems, having to change building specifications in accordance with introduced radiation standards, which increased project costs. Despite this, the initiative illustrated a more positive experience resulting from its greater emphasis on Russian project ownership with Western partners.[79] In the light of this successful cooperation, the project will move into its next phase of construction of a storage facility for secondary waste from reprocessing.

Land Transport Capacity for Spent Fuel

During the Cold War, TUK-11 and TUK-12 fissile material containers were transported by train from the Northern and Pacific Fleets to Mayak for reprocessing. These containers were banned by GAN in 1993 because of their vulnerability to low temperatures in storage, the potential for rupture in a rail collision, and their failure to meet IAEA standards.[80] Shipments now have to be made with TUK-18 containers and new AMEC containers that meet these requirements, weighing 40 tons each and possessing seven compartments for five to seven fuel assemblies. Russia has 40 to 50 of these containers, which can be transported on TK-VG-18 railway cars carrying three containers each.

Unfortunately, the new containers have proven too heavy for Russia's road and rail system on the 30- to 40-day journey to Mayak from the Northern and Pacific Fleet. The lack of TK-VG-18 railway cars, combined with the length of this journey, demonstrates a shortcoming in the naval fuel cycle handling capacity that must be addressed. Japan has undertaken an effort to strengthen and improve rail infrastructure in the Pacific Fleet for enhanced transportation to Mayak, while Norway and the United States have funded creation of six TK-VG-18 railway cars.

Since it is now believed that Mayak will not be used to store and reprocess naval spent fuel beyond that already contracted for U.S. CTR activities, problems of ownership have arisen with regard to these Norwegian railcars, destabilizing the Norwegian commitment to new spent-fuel storage efforts in Murmansk. While transportation capacity needs to be increased rapidly, agreement on a coherent plan regarding transport would promote far greater international engagement on this issue.

Next Steps

In May 2002, a Russian government report entitled *Proliferation Prevention and Destruction of Hazardous Facilities and Materials* outlined a plan to address these

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79. "The Facility for Treatment of Low-Level Liquid Waste in Murmansk, Russia—Now in an Active Test Period," *NRPA Bulletin*, June 13, 2001, <http://www.nrpa.no/dokumentarkiv/StralevernInfo10_2001.pdf> (accessed March 2, 2002).

80. Krupnick, *Decommissioned Russian Nuclear Submarines*, p. 81.

problems over the next 10 years.[81] The report estimates that $4 billion—double the amount of a recent U.S. State Department estimate—will need to be spent during the period to effectively dispose of nuclear ships and vessels as well as secure and rehabilitate radioactively hazardous sites. This plan envisions the safe transport of nuclear ships and vessels to dismantlement yards; their unloading and dismantlement; the safe management of spent nuclear fuel in storage, transportation, and reprocessing; the safe storage and long-term storage of reactor compartments; the safe management of toxic waste from these ships and vessels in storage and dismantlement; the physical protection of radioactively hazardous sites; and the containment of nuclear submarines with affected nuclear reactors.

It is essential that the international community enter into dialogue with Russia on this plan. G-8 nations must match their Kananaskis pledges with deeds. Achieving these goals will require significant commitments of assistance over the next decade. The sooner these pledges are transformed into new projects within Russia, the sooner the dangerous environmental and proliferation threats of the nuclear fleet can be addressed.

The Need for a Transparent Warhead Dismantlement Regime in Russia

Transparency and verification are essential to ensuring the safety and dismantlement of nuclear warheads and to furthering nonproliferation and arms control objectives. The implementation of a transparent warhead dismantlement regime would define the nature of warhead reductions and storage, the status of surplus fissile materials, security of the stockpile, and public and legislative awareness of the security concerns posed by nondeployed nuclear weapons awaiting dismantlement. However, in implementation, these efforts must be weighed against legitimate national security concerns regarding the intrusiveness of such transparency and verification efforts. This dilemma has been widely recognized as a major impediment to comprehensive threat reduction over the last decade.

In the past, U.S.-Soviet arms control agreements like START I and II have ignored warhead dismantlement, transparency, and irreversibility agreements in favor of dismantlement and monitoring constraints on delivery vehicles. This has made sense in the short term, as delivery vehicles are more easily accountable, expensive to reproduce, and a better reflection of a nation's operational capability.[82] Further, compromise on counting delivery vehicles instead of warheads avoided difficult negotiations that would impede the progress of reductions to U.S. and Russian nuclear arsenals. Concerns over warhead dismantlement rates and verification were secondary to economic and security issues pertaining to oversized U.S. and Russian nuclear forces directly after the Cold War. Now, however, for the deep

81. See note 47, this chapter.

82. Steve Fetter, "A Comprehensive Transparency Regime for Warheads and Fissile Materials," *Arms Control Today* (January/February 1999), p. 1.

unilateral cuts announced by Presidents Bush and Putin to be successful, it is essential that a transparent warhead dismantlement regime be devised.

Despite some progress in warhead transparency, verification, and dismantlement activities, Russia currently receives no direct international assistance for dismantling nuclear warheads. It is estimated that establishing an international regime to effectively tackle this problem could cost between $500 million and $1 billion a year.[83] This regime would have to address asymmetries between U.S. and Russian warhead complexes, production capabilities, and stockpile compositions that threaten "regime breakout," along with resolving practical problems regarding intrusiveness and information sharing, operational impacts, and dismantlement timetables.[84]

Further, the new regime would have to provide Russia with adequate funding incentives to allow for such open and increased transparency. Broad strategic concerns between the United States and Russia hinder the establishment of such a regime; they will take time to resolve. In the long term, increased funding and reciprocal transparency between the United States and Russia will ensure that, incrementally, a warhead dismantlement regime can be built to address arms control, nonproliferation, and national security concerns. Specific recommendations for achieving this goal will be outlined at the end of this chapter.

Broad Strategic Concerns

Several interrelated U.S. and Russian asymmetric strategic concerns warrant the establishment of a warhead dismantlement and transparency regime, yet simultaneously hinder its creation. The United States currently holds an upload hedge of 10,000 pits in storage, estimated to increase to 15,000 by 2012.[85] This hedge is a reflection of U.S. concerns over superior nuclear weapons production capacity within Russia; the fear that Russia's higher levels of weapons-grade fissile materials used for the continued production of nuclear weapons for stockpile maintenance purposes could be used for rapid reconstitution of warheads; the coinciding threat that higher peacetime production levels of nuclear warheads to address technical

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83. Without an international monitoring regime, this figure could drop to $100 million to $150 million a year for a robust bilateral U.S.-Russian monitoring regime. It must be noted that the U.S. Department of Energy (DOE) has, however, spent approximately $25 million appropriated for DOE requests to enhance research and development efforts in enhancing transparency and preparing the Pantex facility for reciprocal warhead dismantlement verification inspections. See Kenneth Luongo, "Options for Increased U.S.-Russian Nuclear Nonproliferation Cooperation and Projected Costs," RANSAC, October 2001, p. 7, <http://www.ransac.org/new-web-site/index.html>. Also see, DOE Nuclear Nonproliferation Budget 2002, <http://www.nn.doe.gov> (accessed January 10, 2002).

84. For a detailed discussion of these practical problems, see Oleg Bukharin and Kenneth Luongo, *U.S.-Russian Warhead Dismantlement Transparency: The Status, Problems, and Proposals*, PU/CEES Report No. 314 (Princeton, N.J.: RANSAC, April 1999), <http://www.ransac.org/new-web-site/pub/reports/transparency.html> (accessed February 12, 2002).

85. For future size, see "Faking Nuclear Restraint: The Bush Administration's Secret Plan for Strengthening U.S. Nuclear Forces," *NRDC Backgrounder,* February 13, 2001, <http://www.nrdc.org/media/pressreleases/020213a.asp> (accessed March 1, 2002). For current size, see Robert S. Norris et al., "NRDC Nuclear Notebook: U.S. Nuclear Forces, 2001," *Bulletin of the Atomic Scientists* (March-April 2001) <http://www.thebulletin.org/issues/nukenotes/ma01nukenote.html> (accessed February 20, 2002).

problems with the Russian stockpile could be used to mask warhead buildups; and the continued problems posed by the unknown status of the Russian tactical nuclear weapons (TNW) arsenal.[86]

Russia remains concerned about this U.S. nuclear edge and also about the economic disparity between Russia and the United States, which would provide the United States with a significant advantage in rebuilding its nuclear arsenal after the completion of any significant dismantlement activity. It is conceivable that Russia or the United States could eventually direct enough resources to rebuild the nuclear weapons complex of the Cold War if international relations dramatically soured; more threatening for Russia is that the quick U.S. buildup of more expensive launcher systems, combined with the activation of stockpiled strategic warheads, would lead to rapid breakout from such a regime.

Russia is unwilling to discuss further transparency and verification efforts without including the U.S. hedge in talks because of the lack of irreversibility associated with any regime that would incorporate the hedge. U.S. concessions on transparency on this issue, combined with lucrative funding incentives for Russia to adopt reciprocal transparency measures, would allow for significantly increased access to warheads and their dismantlement facilities. This would increase understanding of the nuclear warhead production cycle in Russia, enhance arms control efforts, and allow for greater verification to ensure nonproliferation objectives. However, the production capacity and overall nuclear complex size in Russia undermine both of these objectives.

Production capacity in Russia dramatically surpasses that of the United States, where "no current capability exists to build and certify plutonium pits at present."[87] Higher Russian pit production reflects its stockpile maintenance philosophy, which relies on the more liberal use of fissile material, and nuclear warhead life spans of 10 to 15 years compared with 25 to 30 years in the U.S. arsenal.[88] A side effect of this is a large-scale Russian warhead breakout potential in times of increased crisis.

Additionally, the higher level of weapons-grade fissile material used for this maintenance and replacement creates a need for a far greater military fissile material stockpile, which is vulnerable to theft and diversion. It is also feared that warhead replacement activities could be used to hide increases in the nuclear weapons stockpile that still remains significantly higher than that of the United States when accounting for TNWs.

Further asymmetries exist between nuclear weapons complex size and control, production capacities, and stockpile size that hamper the creation of an effective

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86. The U.S. hedge is further maintained in U.S. nuclear policy owing to the emerging nuclear threat of China and the nature of America's own stockpile stewardship efforts. Unlike Russia, the United States relies on only limited production, with the nuclear hedge being the primary source of materials for maintaining the effectiveness of the operational arsenal through reconstitution of nuclear warhead parts.

87. U.S. Department of Defense, *Nuclear Posture Review 2001,* classified document leaked to William Arkin and the *Los Angeles Times;* for excerpts, see "Nuclear Posture Review," January 8, 2002, <http://www.globalsecurity.org/wmd/library/policy/dod/npr.htm>, p. 30.

88. Russia is now attempting to extend the lifespan of newer nuclear weapons entering into service to approximately 25 years.

warhead dismantlement and transparency regime. The Pantex dismantlement facility in Texas is the only dismantlement facility operating in the United States, with the Oak Ridge Laboratory managing disassembled HEU secondaries. In comparison, Russia has four "serial production" facilities located at Arzamas-16, Sverdlovsk-45, Zlatoust-36, and Penza-19, with warhead dismantlement work ceasing at Arzamas-16 and Penza-19 by 2003.[89]

The fact that dismantlement activities take place at more than one site within Russia means that any future verification regime will need a larger presence within the Russian nuclear weapons complex, a position that will most likely be untenable to Russia without U.S. commitments to greater openness of its own facilities and assurance of the minimal characteristics of any verification regime employed in Russia.

U.S. control of dismantlement facilities and operations falls solely under the control of the Department of Energy. In Russia, however, both the 12th Main Directorate and MINATOM control warhead dismantlement activities. This has lead to interagency conflict and disagreement that further slows the establishment of a warhead dismantlement regime.

The operational impacts and funding incentives for arranging dismantlement and verification activities must also be considered. Efforts to conceal and separate highly classified elements of the dismantlement process, nonessential for monitoring activities, will reduce operational impacts of such activities but prove costly. In the U.S. Pantex example, all operations at the facility have to be closed down during inspections, which cost an estimated $8.5 million per year to prepare for and host.[90] These costs will most likely be higher with regard to Russian facilities and a serious disincentive to the establishment of an effective transparency regime unless international assistance is available.

The History of Government-to-Government and Lab-to-Lab Initiatives

The history of government-to-government relationships between the United States and Russia in the field of warhead dismantlement and transparency has been tarnished by mistrust and failure. The implementation of a comprehensive chain of custody has been the clear goal of U.S. policy over the last 10 years. Failure to implement this chain, despite large-scale political efforts, has left both countries jaded. The impact of this failure at the government-to-government level has been lessened, however, by U.S. Department of Energy (DOE) successes in securing certain levels of HEU transparency. Through agreement at the strategic level, combined with the development of lab-to-lab activities, the United States and Russia have begun to break down operational hurdles, which has led to new possibilities in exploring warhead dismantlement cooperation.

The United States has continued to push for a radiation-based monitoring system, arguing that an effective transparency and monitoring regime should start with the tagging, sealing, and measuring of warheads for radiation comparison with previously established warhead identification templates. Before disassembly,

89. Bukharin and Luongo, *U.S.-Russian Warhead Dismantlement Transparency.*
90. Ibid.

the disassembly area would be checked for other radiation sources to allow for the masking of sensitive materials, while clarifying that there were no undeclared materials present. During the transfer of warheads to the dismantlement site, measurements of radiation signatures, the inspection of tags and seals to ensure against tampering, and observation of radiation signatures before entry into the dismantlement facility would take place.

Although inspectors would not be allowed to enter the dismantlement facility during this process, they would be allowed to monitor all materials entering and leaving the dismantlement plant that are stated not to contain fissile materials and could ensure that there are no attempts to hide fissile materials or warheads. After the completion of dismantlement activities, inspectors would be allowed to take measurements of radiation signatures to match contained fissile warhead components with templates of those warheads that entered the facility for dismantlement. Combined with the tracking of key unclassified materials associated with warheads before entry into the site, this would ensure that outgoing radioactive materials were the dismantled remnants of these warheads. A final sweep of the dismantlement facility and incorporation of these procedures with transparency efforts in the storage and disposition of fissile materials would complete the chain of custody.

The Russian government has moved from lack of interest to mistrust on this U.S.-led issue of transparency and warhead dismantlement. Russia has been particularly concerned with the high level of intrusiveness involved in random or designated facility inspections, the establishment of monitoring facilities, warhead fingerprinting, and the general scope of verification activities throughout the chain-of-custody proposal. This has been manifested in past Russian dissatisfaction regarding gamma-ray spectrum analysis experiments conducted by the United States, concerns over U.S. computers used by Russia in nuclear materials accounting, and recent efforts to hinder the continued work of the lab-to-lab programs by the Russian security services (FSB). Further, there has been unwillingness in Russia to undertake data exchanges, such as the provision of warhead aggregate numbers, including both strategic and tactical nuclear weapons.

Data exchanges on the Russian fissile material stockpile have also been denied after initial commitments to reveal both plutonium and highly enriched uranium figures—as have facility-specific studies of the flow, cost, and operational impact of dismantlement verification activities and reciprocal unclassified facility walk-through activities. The common theme underlying inaction is that Russia is naturally concerned about activities that could jeopardize national security interests and does not possess the resources to undertake such activities regardless. Overcoming these concerns has proven astronomically difficult.

In 1994, the U.S. Congress amended the Atomic Energy Act allowing for the legal negotiation of an "Agreement for Cooperation."[91] This laid the foundation for significant U.S. efforts through the Safeguards Transparency Initiative (STI) to establish government-to-government transparency agreements with Russia. The initiative had the key goals of providing a stockpile data exchange, spot checks, reciprocal inspections, and expanding the scope of dismantlement transparency

91. Bukharin and Luongo, *U.S.-Russian Warhead Dismantlement Transparency.*

activities. In March 1994, what is now referred to as the mutual reciprocal inspections (MRI) agreement was signed, allowing for the inspection of plutonium and HEU from Russian and U.S. dismantled weapons. Within the Agreement for Cooperation, an initial agreement was also reached on the scope of future dismantlement transparency in a limited chain of custody.

In September 1994, Presidents Clinton and Yeltsin announced Russian and U.S. agreement for a detailed information exchange on aggregate warheads, stocks of fissile materials, and their safety and security. These three agreements provided the cooperative framework for the STI and were further expanded in the May 1995 Clinton-Yeltsin summit, where commitments to MRI and stockpile data exchanges were restated in conjunction with the announcement that "other cooperative measures to enhance confidence in reciprocal declarations on fissile material stockpiles" would be pursued.[92]

However, by later in 1995, these efforts had been all but abandoned. Russia called off negotiations pending a policy review, unofficially believed to reflect unwillingness among elements within MINATOM, the Ministry of Defense, and the FSB to move forward on such a sensitive issue, especially with upcoming elections and Yeltsin's ill health. The talks never resumed.

Despite setbacks, government-to-government attempts to find agreements on greater warhead transparency continue. In March 1997, the proposed START III framework announced at Helsinki stated that measures should be pursued "relating to the transparency of strategic nuclear warhead inventories and destruction of strategic nuclear warheads…to promote the irreversibility of deep reductions including prevention of a rapid increase in the number of warheads."[93] Further, two government-to-government initiatives have successfully begun to address transparency concerns. The first concerns the HEU Transparency Implementation Program, established as part of the HEU Purchase Agreement through the DOE. In February 1993, the transparency program was negotiated to monitor nonproliferation aspects of the purchase of 500 tons of weapons-grade uranium for blend-down and use in civilian power reactors. The primary goals of the program are to ensure that this HEU is extracted from dismantled nuclear weapons. The same HEU is oxidized, down-blended to LEU, and delivered to the United States where it is fabricated into fuel for commercial nuclear power reactors. Within Russia, these activities take place at the Mayak Production Association and Siberian Chemical Enterprises (SchE), where HEU metal is changed into HEU oxide. SChE and the Electro Chemical Plant (ECP) in Zelenogorsk then process HEU oxide into uranium hexafluoride. These plants and the Ural Electrochemical Integrated Plant (UEIP) down-blend the uranium hexafluoride into LEU before shipping it to the U.S. Enrichment Corporation's Portsmouth Gaseous Diffusion Plant.[94]

This effort has succeeded at several levels: in monitoring the annual conversion of 30 metric tons of weapons-grade HEU into LEU, completing 22 of 24 planned special

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92. Fetter, "A Comprehensive Transparency Regime," p. 2.

93. Ibid., p. 4.

94. National Nuclear Security Administration, *FY 2002 Proposed Budget* (Washington, D.C.: U.S. Department of Energy, 2001).

monitoring visits to Russian facilities, maintaining and staffing a Permanent Presence Office at the Ural Electrochemical Integrated Plant, completing agreement on installation of the U.S. blend-down monitoring system, and initiating the first annual inventory verification visit to a natural uranium feed material storage site. Further, this DOE program has collected and evaluated monitoring data to assess and validate continued and increased assistance, and conducted three transparency review committee meetings to negotiate and enhance transparency measures with MINATOM.[95]

Russia, the United States, and the IAEA have also made some progress toward international monitoring of excess fissile material. In September 1993, President Clinton announced that 12 of the 225 metric tons of U.S. fissile material would be placed under international IAEA safeguards, as recommended by the G-8 leaders. At the G-8 summit, President Yeltsin also agreed to place 40 tons of plutonium and a larger quantity of HEU, to be stored at Mayak storage facility, under IAEA safeguards. To facilitate this, a trilateral initiative was established in 1996 to discuss technical issues relating to classification, as well as broader issues such as the funding of these new IAEA activities, how to ensure irreversibility of these efforts, and the range and scale of such IAEA monitoring.

The May 1997 IAEA Model Protocol calls for this range and scale of monitoring activities to be dramatically increased, but there has been little agreement on its expanded role within the trilateral forum. Indeed, the forum still has not provided a suitable answer on how it is going to monitor those fissile materials to be stored at Mayak. Solutions to these problems have been hindered primarily by technical difficulties related to Russian concerns over classification, exacerbated by the multilateral rather than bilateral nature of this initiative. Failure to establish sufficient government-to-government cooperation on transparency and classification led to the development of lab-to-lab initiatives in the period from 1996 to 1998.

More than 40 lab-to-lab warhead dismantlement transparency contracts have now been signed with Russian nuclear laboratories.[96] These efforts have sought to define the weapons dismantlement process, identify and demonstrate transparency measures to provide a chain of custody, and develop successful transparency techniques to identify and monitor plutonium and HEU in storage. Notable successes have included the participation of delegations from dismantlement facilities in technical interchange meetings in May 1998, the development and demonstration of radiation measurement technologies at Arzamas-16 including the "Passport System" for the measurement of warhead radiation signatures, and the "Radiation Mark System" to tag and monitor weapons during dismantlement.

Chelyabinsk-70 has facilitated experiments to detect the presence of high explosives during dismantlement, destroy high explosives after dismantlement, and destroy nuclear warhead casings to confirm the irreversibility of this dismantlement. Significantly, in March 1999, the All-Russian Scientific Research Institute of Technical Physics at Chelyabinsk-70 demonstrated a hypothetical model of a

95. Ibid.

96. These include contracts with Chelyabinsk-70 (Snezhinsk), Arzamas-16 (Sarov), the Russian Research Institute of Pulsed Techniques (Moscow), and the Russian Institute of Automatics (Moscow). Representatives from Sverdlovsk-45 (Lesnoy), Penza-19 (Zarechnyy), and Zlatoust-36 (Trekhgornyy) have also shown interest in these experiments.

potential Russian dismantlement facility at Sandia National Laboratories to assess and evaluate various transparency technologies throughout the dismantlement process. For this technical cooperation to move from the testing and demonstration phase into actual use, however, new avenues for funding and increased project support will be essential.

Next Steps

Now is the ideal time to move toward transparent warhead dismantlement and verification, as lab-to-lab initiatives reach maturity and warhead dismantlement dialogue has once again been opened at the strategic level. Recent statements by Russian officials have shown their intent to engage the United States on this issue as part of the deep reciprocal cuts announced by Presidents Putin and Bush. In an interview for *Izvestia* on January 18, 2002, General-Colonel Yuriy Baluyevskiy, first deputy chief of the Russian General Staff called for "the removal and dismantlement of nuclear warheads"; and in an interview on Russian TV channel ORTs "Novosti" that aired January 30, 2002, he declared that "in the Draft Treaty, which we laid on the table during our talks in Washington, there are new proposals that are directed to ensuring precisely the liquidation of the carriers and the warheads alike."[97]

It is apparent that problems and sensitivities at the strategic and operational level have hindered efforts to establish a transparent warhead dismantlement regime. However, technical projects to instill confidence in monitoring activities should receive increased funding, and fissile material assistance projects in Russia should look for ways to provide additional support to dismantlement activities—based on Russian acceptance of transparency requirements—in the field of warhead dismantlement. These steps should lead to the gradual erosion of barriers at the strategic and operational level.

Recommendations

The Need to Address Problems in the Russian Naval Fuel Cycle

- Honor new funding pledges outlined at the G-8 summit in Kananaskis, expanding international assistance efforts to facilitate increased general-purpose submarine dismantlement activities.

There are now numerous international initiatives to improve submarine dismantlement within the Russian naval nuclear fuel cycle. Funding for submarine dismantlement has largely stemmed from the U.S. CTR program, which has provided $454.2 million toward SLBM launcher elimination, SSBN dismantlement, low-level radioactive waste volume reduction, spent naval fuel disposition, and liquid propellant elimination.[98] Norway is the largest contributor for activities in the

97. Center for Arms Control, Energy and Environmental Studies, "Verifiable Elimination of Nuclear Warheads: What Lies behind Russian Proposals?" February 20, 2002, <http://www.arms-control.ru/start/w-control.htm> (accessed March 10, 2002).

98. DTRA, *Cooperative Threat Reduction Multi-Year Program Plan FY 2001*, p. 17.

dismantlement of general-purpose nuclear submarines; it has already committed $50 million to Russian radwaste projects and is likely to contribute more. The United Kingdom is also heavily involved in funding submarine dismantlement activities. In the Pacific, Japan has provided approximately $29 million, primarily for the construction of the Landysh treatment and disposal facility for low-level radioactive liquid waste, and has also pledged to use an additional $35 million to $38 million on submarine dismantlement activities.[99] Sweden, Finland, and the EU have also provided funding in this area through the Tacis fund.

These efforts are minimal, however, against the backdrop of an estimated $4 billion still needed to facilitate general-purpose nuclear submarine dismantlement through 2012 and the "10+10 over 10" pledge made in Kananaskis in 2002. The flow of G-8 nations' assistance in this area will have to be dramatically increased over this period if the shortfall is to be met and G-8 funding pledges are to be honored. In addition, countries outside the G-8 should sharply increase international assistance to secure against the immediate environmental and proliferation dangers this nuclear threat poses. In the South Pacific, Korea, Australia, and New Zealand should bolster Japan's already considerable efforts. Within the Arctic region, assistance should stem from the EU, Norway, the United Kingdom, and the Netherlands. More limited contributions from nations who suffer the same environmental threats should also be pledged.

■ Remove barriers that impede the implementation of international projects aiding the dismantlement of nuclear submarines.

Increased funding for these activities will only be forthcoming if hurdles to implementation of general-purpose submarine dismantlement projects are overcome. This will require a two-way commitment between Russia and the international community to remove legal obstacles that hamper monitoring, auditing, transparency, and access and cause concerns regarding project taxation and liability. The United States has developed extensive oversight in these areas and is pushing for new agreements to further address procedural limitations to assistance projects, such as efforts to ratify a new CTR agreement within the Russian Duma. Other donors have been unable to gain such ground in this area and have thus been less willing to increase funding for what they deem high-risk and low-gain projects.

These problems can only be surmounted by a far more amenable legal framework in Russia that provides greater security for international assistance projects in nuclear submarine dismantlement and reflects the new scope of assistance the international community will be providing to Russia in line with the new G-8 commitments. A number of steps can be undertaken to create such a framework and a toolbox of approaches is available:

- Europe should seek its own separate umbrella arrangement, similar to that being sought by the United States in Russia for CTR activities, providing an encompassing framework to implement assistance activities.

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99. James Clay Moltz, "Russia: Naval Fuel Cycle Foreign Assistance," NTI, <http://www.nti.org/db/nisprofs/russia/naval/forasst/forasovr.htm> (accessed July 20, 2002).

- Russia and Western countries should renew efforts to sign targeted agreements in the naval nuclear area, such as reinvigorating efforts to reach agreement on the Multilateral Nuclear Environmental Program in the Russian Federation (MNEPR), to provide for nuclear cleanup activities in northwest Russia.
- Bilateral agreements and intergovernmental organizations should be used in the interim to extend implementation security for threat reduction projects in Russia while these broader measures are resolved.

However, for a real increase in international assistance through these mechanisms to become a reality, Russia will have to move quickly to provide a more open, flexible, and consistent approach in receiving international aid. Only then can a comprehensive plan of action be created to install an effective nuclear submarine dismantlement cycle in Russia.

■ Provide a comprehensive plan of action to create an effective "cradle-to-grave" naval nuclear fuel cycle.

The establishment of a comprehensive international plan of action to address and prioritize assistance in cooperation with Russia is essential. Such transparency of objectives will reinvigorate assistance, while avoiding potential overlaps, redundancy, and misallocation of scarce resources on projects later found to be either unnecessary or unworkable. Agreement on a plan of action would build trust and cooperation, but it has been hard to institute due to competing and contradictory national interests, often motivated by lucrative contracts, differing priorities, funding constraints, and varying technical expertise. These problems should be addressed using a series of criteria that emphasize several broad norms in direction setting, implementation, and sustainability such as:

- The outlining of key goals including the establishment of an effective nuclear fuel cycle to decommission nuclear submarines in an efficient manner; the reduction and prevention of environmental hazards and contamination resulting from this fleet and their dismantlement; and insurance against any proliferation risks stemming from this fleet and their associated infrastructure and materials before, during, and after dismantlement.
- Ensuring spent fuel in storage and radioactive waste is disposed of before submarine dismantlement is begun in earnest; safe and secure transportation and storage of radioactive materials is provided for; the capacity for management and reprocessing of additional spent-fuel and radioactive waste is adequate; the destruction, dismantlement, and salvaging of the nonradioactive remains of the dismantlement process is pursued in an effective way and in line with international arms agreements; and effective environmental remediation is undertaken to ensure the rehabilitation of these sites after dismantlement activities.

- A greater focus on Russian contractors where possible to ensure production sustainability and increase Russian stakes in promoting and expanding projects.
- An increased effort by Russia to provide funding for activities in this area as it moves toward an increased partnership with the international community in addressing these common threats.

■ Build on the Kananaskis pledges in the field of nuclear submarine dismantlement in Russia through achieving near-term and high-visibility project success.

Several ongoing projects should be targeted to provide success and impetus to expanded international assistance in nuclear submarine dismantlement. With increased financing, Russia could begin almost immediately to dismantle its retired, general-purpose nuclear submarines at Nerpa shipyard, using the infrastructure and expertise left in place by the U.S. program to dismantle Russia's ballistic missile submarines. Other high-visibility projects could include rapidly addressing spent-fuel storage problems at Andreeva Bay or accelerating multilateral efforts to address problems surrounding the *Lepse* spent-fuel storage ship. Whichever projects are highlighted, however, strong leadership will be required. Nations that have held a previous commitment to these activities will once again have to come to the fore. Norway, though not a G-8 country or a member of the European Union, will be a key player. In the Pacific, Japan will inevitably have to take on much of the burden. These lead nations will have to be backed by other key players such as the United States, United Kingdom, and EU, who in turn will have to be joined by other nations who have a legitimate environmental and security stake in submarine dismantlement.

The Need for a Transparent Warhead Dismantlement Regime in Russia

■ Pursue activities that build transparency into stockpiles of nuclear weapons and fissile materials and move closer to the installment of a transparent warhead dismantlement regime.

Russia, along with other nuclear powers, should encourage greater transparency, monitoring, and verification of nuclear weapons and materials. Despite setbacks in achieving a weapons dismantlement chain of custody, the HEU Transparency Implementation Program and the Trilateral Monitoring Initiative have shown substantive movement towards NPT goals in nuclear weapons dismantlement transparency. These steps toward transparency and openness must now be part of broader efforts to establish a transparent warhead dismantlement regime.

This would include measures such as unilaterally declaring warheads remaining to be destroyed under the Presidential Nuclear Initiatives (PNIs) and declarations of total nuclear warhead stocks and total plutonium and HEU stocks by Russia. It would also include bilateral efforts to provide agreements on effective methods to ensure that warheads from dismantled weapons are secured and accounted for in a transparent and verifiable way at nuclear warhead storage sites. Further agreements could be reached on transparency measures to ensure that these warheads are accounted for as they change from warheads to unclassified shapes before storage and final destruction. Multilateral measures could include expanding funding for the IAEA, whose long-term role in providing a comprehensive global fissile material transparency role over such materials should be fully supported.

- Facilitate warhead transparency through the increased purchase of HEU from Russia.

By 2005, it is estimated that Western demand for nuclear fuel will outpace supply.[100] This shortfall should be met by the additional purchase of HEU but contingent on Russia making new inroads in providing greater warhead transparency. This could be achieved through a variety of approaches. One example would be, under the conditions of the HEU Purchase Agreement, to purchase an additional four tons of HEU each year, costing approximately $100 million.[101] The international community, dependent on Russian willingness to engage on transparency and verification issues, would meet these costs. Additionally, the United States could provide a limited prepayment for each year's delivery of blended HEU to free resources for warhead dismantlement in the context of reciprocal transparency. This would mirror previous cash advances for transparency of $100 million provided to MINATOM in 1995 for transparency activities.[102]

- Accelerate initiatives in transparent warhead dismantlement in Russia, reciprocally exploring the transparent destruction of nuclear warheads.

Over the last two years, the DOE has prepared U.S. facilities for transparent nuclear warhead reductions and assisted the development of reciprocal activities in Russia. In 2003, the lab-to-lab program will also be demonstrating three Russian transparency technologies in warhead dismantlement. Many of the technologies being devised through lab-to-lab initiatives to provide a transparent warhead dismantlement regime are now developed to their theoretical extent and need to be practically tested. Government-to-government agreements are now needed to accelerate these final stages of testing. In the next few years, lab-to-lab initiatives should be moved into full-scale dismantlement activities between Russia and the United States. Following on from the SORT treaty, the time is now ripe for negotiations to renew efforts in this area, provided Russia receives the necessary incentives and reciprocal assurances to allow for such measures. This would be the next step to final transparent warhead dismantlement in Russia.

- Construct a production line to initiate transparent warhead dismantlement activities in Russia.

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100. Thomas L. Neff, "Decision Time for the HEU Deal: U.S. Security vs. Private Interest," *Arms Control Today*, (June 2001), p. 14.

101. Oleg Bukharin et al., *Helping Russia Downsize Its Nuclear Weapons Complex: A Focus on the Closed Nuclear Cities*, report of an international conference held at Princeton University, March 14–15, 2000 (Princeton: Program on Nuclear Policy Alternatives, Center of International Studies and Center for Energy and Environmental Studies, Princeton University, June 2000), p. 31.

102. Ibid.

As a final step, in conjunction with the downsizing of the Russian nuclear weapons complex, the modernization of a Russian warhead dismantlement facility to efficiently, transparently, and reciprocally dismantle warheads would reduce asymmetric concerns, operational impacts, and funding requirements in establishing a dismantlement regime. International funding for the development of this facility would allow for the final development and demonstration of lab-to-lab technologies to aid transparency.

To facilitate this long-term goal, funding could be provided for lab-to-lab transparency initiatives. This would increase engagement with Russia on additional practical studies of such a dismantlement facility, based on the conversion of one of the two warhead production sites designated to be closed under Russian nuclear downsizing plans announced by MINATOM. Establishing full-scale transparent dismantlement activities at such a facility would help ensure greater stability and security against proliferation. By bringing greater openness to nuclear weapons dismantlement, it also will encourage further nuclear weapons reductions.

C H A P T E R 6

Export Control Assistance to Russia and Other FSU States

Igor Khripunov
Center for International Trade and Security
University of Georgia

Any discussion of export control assistance to Russia and the other former states of the Soviet Union (FSU) must begin with a definition of the nonproliferation export control system in the context of those states' unique environment, where availability of sophisticated weapons and military technologies is combined with austere budgets, rampant corruption, and low salaries.

The wider interpretation of export controls would involve a range of possible tools designed to block numerous channels of proliferation regardless of origin, including illegal transfers, stealing, diversion, and smuggling. The narrower interpretation, which is the focus of this paper, would address the basic and generally recognized components of export controls, leaving other factors contributing to the nonproliferation problem and their solution outside its scope. This differentiation is important for better evaluating the weak and strong points of Russia's export control institutions, though some authors tend to ignore this dividing line and, as a result, add some confusion.

U.S. Concerns

Numerous U.S. government reports and statements by administration officials, especially from late 2001 to early 2002, indicate that despite Russia's vigorous claims to the contrary, it has failed to prevent significant leaks of sensitive goods and technologies. The January 2002 National Intelligence Estimate, "Foreign Missile Developments and the Ballistic Missile Threat through 2015," asserted that the proliferation of ballistic missile–related technologies, materials, and expertise—especially by Russian, Chinese, and North Korean entities—enabled emerging missile states to accelerate missile development, acquire new capabilities, and potentially develop more capable and longer-range future systems.[1]

These conclusions were echoed by an intelligence report to Congress on the acquisition of technology relating to weapons of mass destruction and advanced conventional munitions, released in January 2002. Among other things, the report criticized Russia's nuclear cooperation with Iran. It stressed that Russian assistance enhances Iran's ability to support a nuclear weapons development effort, even though the ostensible purpose of most of this assistance is for civilian applications.[2] Finally, speaking before the Senate Select Intelligence Committee on February 6, 2002, George Tenet, director of central intelligence, said that Russian entities continue to provide other countries with technology and expertise applicable to chemical weapons, biological weapons, nuclear, and ballistic and cruise missile projects. He referred to Russia as the first choice of proliferant states seeking the most advanced technology and training.[3]

In the absence of specific and publicly available evidence to substantiate the above charges, U.S. criticism of Russia is interpreted somewhat differently by some independent observers and the media. They do recognize inadequacies in Russia's export controls but see a less-compelling picture of its overall negative performance and impact on other countries' programs of weapons of mass destruction. A case in point is Michael Dobbs's January 13–14, 2002, series in the *Washington Post*, which characterized the U.S. process of intelligence gathering and assessment as largely politicized. It involved, according to the author, a concerted, mostly domestic policy–driven campaign by the Republican-dominated Congress (supported by Israel, which feared that it could soon become a target of Iranian missiles) to focus attention on the serious leakages of missile technology from Russia. Dobbs suggested that by demonizing Russia, congressional Republicans wanted, above all, to build public support for a national missile defense system.[4] The role of Israel, as explained by Seymour Hersh in the *New Yorker,* was to convince the Bush administration that Russia's transfers to Iran must be placed at the top of its foreign policy agenda. Only by renewing their warnings about the Iranian bomb threat and Russia's involvement could Israelis hope to get some attention from the Bush administration in the tense and unpredictable environment of the post–September 11 global antiterrorism campaign.[5]

What may be even more significant is the timing of the U.S. reports and overt pressure on Russia to take action. Against the background of unusually soft treatment by U.S. diplomats toward other valuable members of the antiterrorism coalition, this harsh criticism of Russia's inability to prevent, in Washington's view, dangerous transfers, as well as the Russian government's connivance in this phe-

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1. National Intelligence Estimate, "Foreign Missile Developments and the Ballistic Missile Threat through 2015," January 2002, at <http://www.cia.gov>.
2. "Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions (1 January through 30 June 2001)," January 2002, at <http://www.cia.gov>.
3. Prepared Statement of George J. Tenet, director of central intelligence before the Senate Select Intelligence Committee, Washington, D.C., February 6, 2002, at <http://www.lexis-nexis.com/congcomp/>.
4. Michael Dobbs, "How Politics Helped Redefine Threat," *Washington Post*, January 14, 2002.
5. Seymour Hersh, "The Iran Game," *New Yorker*, December 3, 2001.

nomenon, must have had a solid rationale. One possible explanation is that the two areas of proliferation and terrorism, loosely separated in the past, are being merged, following the September 11 attack, into one single security concept at the top of the current U.S. priorities list. As a result, Russia's earlier commitment and solidarity to combat terrorism is taking a back seat to the renewed U.S. requirement for making vigorous efforts to curb proliferation in deeds rather than in words.

Speaking before one of the Senate subcommittees, John Wolf, assistant secretary of state for nonproliferation, explained the new meaning of nonproliferation to the Bush administration: "Nonproliferation is not just one of many issues in U.S. policy, but rather . . . it is a cardinal issue, one on which we have to 'get it right.' It is fused in many ways to our effort to root out terrorism and to stop the flow of dangerous materials to countries that support terrorism and/or threaten key U.S. interests."[6]

Russia's reaction to the new wave of accusations in early 2002 was predictable. Moscow declared them "categorically unacceptable" and said it would be seeking an official clarification from the Bush administration. The statement from the Ministry of Foreign Affairs stressed that "for the first time in our recent relations, an official American document is making an effort to cast doubt on our desire, will and ability to avert leaks of sensitive equipment and technologies abroad."[7] The subsequent U.S.-Russia meeting in Moscow on February 21 and 22, slated to discuss the resumption of the bilateral export control dialogue either in the framework of the previously established working groups or in a different format, ended inconclusively. The Russian delegation evaded any specific discussions and the final statement alluded only to a shared view on the creation of a flexible and nonformal mechanism for future cooperation.[8]

The Moscow summit in May 2002 demonstrated that further positive evolution of bilateral relations would heavily depend, for the United States, on Russia's nonproliferation behavior. In their Joint Declaration on New U.S.-Russia Relationship both presidents called on all countries to strengthen and strictly enforce export controls, interdict illegal transfers, prosecute violators, and tighten border controls to prevent and protect against proliferation of weapons of mass destruction. However, specific bilateral talks at the summit about Russia's nuclear cooperation with Iran failed to produce concrete results.

Russia's Political Commitment

It is safe to assume that any country's export control system is a reflection of the status of its economy, its domestic and international politics, and its development

6. Statement of John Wolf, assistant secretary of state for nonproliferation, before the Senate Government Affairs Subcommittee on International Security, Proliferation, and Federal Services, June 6, 2002.

7. Agence France-Presse, "Moscow Fiercely Attacked CIA Report on Contracts with Iran," February 7, 2002.

8. RBC News, "Russian and U.S. Export Control Experts Agreed on Perspectives of Cooperation," February 22, 2002; telephone interview of a Russian official, February 26, 2002.

priorities. Hence, an export control system has two distinct and closely interwoven components: political and legal-organizational. Given Russia's continued search for an identity and global orientation, the political content is likely to act as a much more dominant factor than in most other politically stable countries and to have a pervasive impact on the way the entire system operates. Without a political commitment, even a legally and organizationally sophisticated export control system cannot perform adequately. Political leaders have a multitude of ways to manipulate export control law to permit questionable sales.

As Russia became a regional power with diminished global interests, it was only natural that it wanted to avoid a collision course with neighboring countries, many of which were important client states of the Soviet Union and with which Russia continues to maintain special relations. Increasingly, Russia perceived its future role as "a bridge between two or even three continents," rather than committed to a specific group of major countries. There was undoubtedly a consensus among the political elite that it was not in Russia's interest to have another strong nuclear and military power emerge close to its borders or elsewhere.

This elite view was consistent with the popular perception of proliferation risks. In 2000, 75 percent of all respondents to a public opinion poll believed that the world would become less stable if more countries acquire nuclear weapons, and 78 percent were opposed to any transfer of nuclear technologies and weapons from Russia to other countries.[9] However, it remained unclear as to what sacrifices and commitments Russia was really prepared to make in the prevailing circumstances in order to prevent this eventuality. An oft-repeated phrase in Russia's policy documents and official pronouncements of the 1990s was that it did not regard any state as its military adversary. It might have also been fair to say that Russia had no real friends.

With the arrival of President Putin and his team, there were ambiguous signs of increased emphasis on nonproliferation problems and the déjà vu approach of benevolent neglect. For instance, the National Security Concept (January 2000) clearly identified proliferation of weapons of mass destruction as a threat to Russia's national security, but it placed this concern rather low in terms of importance after "the eastward expansion of NATO" and the "deployment close to the Russian territory of foreign military bases and major military units."[10]

This was consistent with the prevailing perceptions of Russia's foreign policy elite. In an April 2001 poll, respondents placed "illegal proliferation of nuclear weapons" at the bottom of the list of threats to Russia's national security (12 percent). Top places were occupied by expansion of Islamic fundamentalism (61 percent); Russia's low competitiveness in world markets (59 percent); the growing gap between Russia's scientific and technical potential and those of other industrialized countries (55 percent); and NATO expansion and admission of former Soviet republics (53 percent), and others.[11]

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9. "Rossiyane o Yadernom Oruzhii I Yadernykh Ugrozakh" (Russians about nuclear weapons and nuclear threats), *PIR Center Report* (Moscow: PIR Center for Policy Studies in Russia, 2000).

10. "Russia's National Security Concept," at <http://www.scrf.gov.ru/documents/documents.htm>.

The Foreign Policy Concept (May 2000) reaffirmed Russia's commitment to combat proliferation and even suggested new ways of preventing the spread of missiles and missile technologies that were allegedly designed to strengthen the Missile Control Technology Regime (MTCR). The practical values of this new approach still need to be demonstrated. In February 2001, President Putin held a special meeting of his Security Council to focus exclusively on nonproliferation and export controls. He admitted that the Russian export control system has loopholes and urged the government to toughen relevant regulations in order to prevent the leakage of military technology and weapons of mass destruction out of the country.

This process notwithstanding, Russia not only continued, but also expanded, nuclear cooperation with countries of concern such as Iran and India. What may be even more disturbing is that top Russian officials tend to provide their own rather confusing definition of proliferation to fit into Russia's foreign policy priorities and propaganda. For example, in a published interview, Oleg Chernov, deputy secretary of Russia's Security Council, characterized "U.S. ambition to deploy a national missile defense system" and the "process of NATO expansion" as leading to proliferation of weapons of mass destruction in the same way as weapons programs in countries of concern.[12]

Following the September 11 terrorist attacks and Putin's decision to join the U.S.-led coalition, he and other top Russian officials made frequent proclamations about the threat to Russia from weapons proliferation and the need to stop it. In reality, however, these emphatic political commitments have failed to trickle down to the mid-level Russian bureaucrats who actually control the situation. Random interviews with selected U.S. officials in January 2002 indicated that in the post–September 11 period most if not all of them continue to regard Russia's record as "proliferation delinquent."

A good example of the continued benevolent neglect is the 2001 annual report of Russia's Federal Security Service (FSS), the agency that was designated by President Putin in February 2001 to enforce export control regulations. The 11-page review highlights FSS achievements throughout 2001 in arresting foreign agents, preventing state secrets from falling into the wrong hands, disrupting numerous drug trafficking schemes, investigating corruption cases, etc., but does not even mention its mission to combat proliferation.[13] It is hardly an isolated case. Despite the Russian Customs Committee's clearly defined scope of work in export control, its 2000 annual report barely refers to this mission. It briefly talks about the installation of radiation detectors at some of its posts, but the overarching concern is mostly about illegal importation into Russia of nuclear waste and contaminated scrap.[14]

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11. "Vneshnepoliticheskii Kurs Stal Bolee Sootvetstvovat Natsionalnym Interesam Strany" (Foreign policy has become more consistent with the country's national interests), *Nezavisimaya Gazeta*, June 7, 2001.

12. Interview with Oleg Chernov, deputy secretary of the security council, *Yadernyi Kontrol*, no. 1 (January–February 2001).

13. FSS Public Relations Office, "About the Results of the FSS Activity in 2001," circulated by the Ministry of Foreign Affairs on January 22, 2002, at <http://www.ln.mid.ru/website>.

Most Russian officials privately admit that nonproliferation concerns do not occupy great prominence in the foreign policy of the post–September 11 period because there are other more pressing domestic and international problems that Russia must tackle. The breakup of the Soviet Union in the early 1990s brought about a dramatic shrinkage of Russia's global security interests. Having lost its superpower status, Russia appears to be focused instead on global export promotion as the only way to survive economically. Its security threats apparently take a back seat to economic imperatives. Thus, it is not surprising that Russia has not directed adequate resources toward combating proliferation or developing its export controls and probably will not without incentives and pressure from the West.

Russia's Organizational Setup

Legal Basis

Over the last 10 years, Russia worked arduously to develop and put in place a legal basis for export control. Some delays resulted from a backlog of other companion bills that were not formally associated with export controls, but were still required to regulate the economic environment in which export controls were supposed to operate. (For factors affecting the development of Russia's nonproliferation export control, see table 6.1.)

The 1999 Export Control Law created a new foundation for export control policy and decisionmaking, replacing the previous system in which export control regulations drew their authority from presidential decrees and government resolutions. By June 2002, all implementing acts of the new Export Control Law were passed. The latest one, adopted in May 2002, covered amendments and addenda to the Criminal Code toughening the appropriate punishment of export control violations. Also, a new code of administrative violations entered into force on July 1, 2002, providing for penalties to entities and persons engaged in the export of dual-use goods and technologies in circumvention of existing regulations and rules.[15]

Russia's export control agency (known as the Federal Service for Currency and Export Control) has been abolished as an independent entity and its staff merged with the Ministry for Economic Development and Trade (MEDT). In the past, MEDT's role in export controls was to issue licenses only. Now, all export control functions are vested in MEDT, including some interagency consultations and action on submitted applications. This organizational streamlining was originally designed to make the system more responsive and less cumbersome, but it is also likely to reduce what could have been inherent checks and balances in the decision-making process.

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14. "On the Outcome of the Work of the Russian Customs Committee in 2000 and Tasks in 2001," Resolution of the Collegium of the Customs Committee, February 20, 2001, at <http://www2.kodeks.net>.

15. Information in this and the following sections is based, unless otherwise noted, on interviews with Russian officials conducted from 2000 to 2002.

Table 6.1. Factors Affecting the Development of Nonproliferation Export Controls in Russia since 1992

Positive Factors	Negative Factors
Desire to be recognized as a civilized, democratic state and to create a favorable trade and investment climate	Tradition of economic and technological cooperation with problem countries
Joint ventures and profitable contracts with Western partners	Bureaucratic politics placing export promotion over export control as a result of economic hardships
Participation in international nonproliferation regimes	Diminished government authority and control of individual entities and regions
U.S. export control assistance, encouragement, pressure, and sanctions	Shortage of funding for export control personnel and policy implementation
Inherited governmental institutions and personnel with export control experience	Overmilitarized economy and industrial pressures for military exports
High-level political support and declaratory policy in the form of hearings, decrees, resolutions, etc.	Slow pace of defense conversion and residual stockpiles
Russian security concerns resulting from the possible spread of WMD	Growth of organized crime and corruption
Soviet tradition of nonproliferation with regard to weapons of mass destruction (WMD)	Porous borders and lack of customs control and enforcement
	Russian nationalism critical of submission to Western interests and perception of export control as a burden imposed by the United States
	Little export control coordination and cooperation with neighboring NIS countries
	Poor record keeping and accounting for weapons, technology, and materials

There is a clear jurisdictional division between MEDT and the Ministry of Defense (MOD). The latter is totally responsible for licensing exports of arms and duel-use defense items. In case of doubt, its Commission for Military and Technical Cooperation determines whether a specific export article should fall under MOD or MEDT purview. Rosoboronexport, a weapons trading unitary enterprise established in November 2000, operates under MOD jurisdiction. In addition, there are several defense enterprises authorized to act independently in international markets, but their share of the overall weapons export is negligible.

Nonmilitary export licenses issued by MEDT are also reviewed by other Russian government agencies. The Ministry of Atomic Energy (MINATOM), the Russian Aerospace Agency (Rosaviakosmos or RASA) and other sensitive export-related agencies maintain a group of experts (gosudarstvennaya exspertiza) who review export licenses, taking into account the end user, the technology, and the items to be exported.

According to Article 21 of the Export Control Law,

> official expert assessments will be conducted by federal agencies of the executive branch of government and will consist of an analysis of the documents and information pertaining to the foreign economic transaction in order to determine their correspondence to international commitments of the Russian Federation, state interests, and environmental safety requirements.

According to the law, the procedures for this interagency review are to be defined by the Russian government, but most Russian officials admit that reviews often occur in an ad hoc fashion. The interagency procedures for licensing nuclear exports are the only ones that have been clearly articulated thus far.

In addition to agencies like MINATOM, RASA, and the Ministry of Industry, Science, and Technology, which have export control departments and procedures, some larger exporters have internal-compliance programs and in-house experts to consider the advisability of exports and foreign economic ventures. There are plans under way to require internal-compliance programs for all dual-use and defense exporters. It is expected that a division of the Ministry of Economic Development and Trade will eventually conduct audits of company compliance practices, although no such undertaking is likely until the end of 2002.

In making decisions about issuing licenses, government authorities, in theory, are to take into account several factors, including reliability of the end user (investigating any possible involvement in WMD or other illegal activity); legitimate end use; the political, economic and security interests of Russia; and compliance with international obligations. In actuality, these factors are not always given due consideration, and some observers are quick to note that economic imperatives often trump the medium- and long-term security risks of proposed exports.

There is no doubt that Russian authorities have established a legal basis and procedures for licensing WMD-related articles and other sensitive defense items, but there are some shortcomings with the existing licensing mechanism. First, there have been frequent changes in licensing procedures and agencies, creating confusion for exporters. Only the most seasoned exporters have been able to keep up.

Second, export control regulations are sometimes difficult to interpret, and assistance from government authorities in understanding regulations is not readily available (without payment). Export control lists are complex and sometimes overlap. The catchall provision in the Export Control Law is not well understood by industry or even by some in government. Especially problematic is the inability of exporters and sometimes even government officials to classify technologies (i.e., determine whether an item is controlled or not). Oftentimes the only place to obtain assistance is in Moscow at the Ministry of Economic Development and Trade. Exporters sometimes mistakenly classify an export because of an inability to interpret control lists or because of a basic lack of knowledge about control lists. There have been cases to the contrary. Following the February 2001 Security Council meeting and Putin's commitment to a better export control performance, overly zealous officials arbitrarily placed some items on the proscribed lists just to be on the safe side. But on balance, this expertise vacuum is a major cause of export control violations.

Third, the licensing process is burdensome for exporters outside of Moscow (and to a lesser extent, for those within Moscow), who often must physically carry license applications and other documents around Moscow in an effort to obtain signatures and gain approval in a timely manner. The bureaucratic hurdles that exporters must clear undermine the efficiency of the system and may encourage exporters to bypass it altogether for the sake of expediting shipments. There are currently no nationwide electronic licensing procedures.

Fourth, lobbying and corruption threaten the integrity of the system. Because licensing involves multiple agencies and intergovernmental coordination is poor, the process is lengthy and laborious, creating a sizable incentive for exporters to appeal to influential bureaucrats for help in expediting shipments.

Another concern stems from military-technical cooperation with other Newly Independent States (NIS) that are exempt from licensing. Not all NIS states have compatible export controls, and many of the NIS have only rudimentary controls systems. The NIS could easily become middlemen for illicit exports of defense articles to undesirable end users. Belarus has already become a channel for illegal Russian defense exports. In February 2002, Deputy Assistant Secretary of State Steve Pifer traveled to Belarus to express U.S. concern about that country's involvement in selling arms to countries with histories of supporting terrorism or fomenting regional conflicts. There are grounds to believe that Pifer's complaint involved, among other things, a case of transshipment of Russian weapons.[16]

International Nonproliferation Regimes

Russia is a member of all the multilateral export control arrangements, except for the Australia Group.[17] Russia inherited the Soviet Union's status as a member of the Nuclear Suppliers Group (NSG), and its representatives have been active within the arrangement since Russia's independence. In 1993, following the settlement of a conflict with the United States over a contract to transfer missile technology to India, Russia signed a memorandum of understanding that stated its intention to comply with the Missile Technology Control Regime (MTCR) guidelines. Finally, in 1995, Russia was accepted as a full member of the MTCR.

Although Russia is a member or adherent of all the nonproliferation export control regimes, some believe that Russian exports of nuclear and missile technology to Iran, India, and other states contradict Russia's international commitments. Russia's pledge to curtail arms transfers to Iran paved the way for its admission into the Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-

16. U.S. Department of State Daily Briefing, Office of the Spokesman, February 27, 2002.

17. Although Russia is not a member of the Australia Group, Russia's control lists closely correspond to the group's lists of controlled items.

Use Goods and Technologies—but Russia withdrew from this pledge in November 2000. Russia has also openly modified domestic nuclear export regulations in order to rationalize proposed nuclear trade with India that violates its Nuclear Suppliers Group commitments. Most observers regard Russian arguments as disingenuous, claiming that the Indian deal was sealed in 1988 and therefore not subject to the 1992 NSG provision requiring full-scope safeguards.

Although Russia's nuclear cooperation with Iran does not formally violate any of Russia's international obligations, some argue that it violates the "spirit of the treaty." Russian officials point to Article IV of the Non-Proliferation Treaty (NPT) in support of their decision to pursue nuclear cooperation with Iran and contend that this article "obligates" Russia and other nuclear states to share technology with nonnuclear weapons states, such as Iran, whose facilities are safeguarded by the International Atomic Energy Agency (IAEA).

Finally, some question Russia's ability and willingness to comply with its MTCR commitments and to combat missile proliferation.

Russian participation in the regimes highlights the sizable problems plaguing the regimes' multilateral efforts to control proliferation. Russia's security outlook differs significantly from that of other members, especially the United States, which is especially concerned about Iran. Because the regimes are informal arrangements that do not explicitly target any state, Russia is able to rationalize almost any export to any state. Russia is not alone in this endeavor of justifying some deals or programs that may not be consistent with regimes: the United States restructured its deliveries to Israel under the Arrow interceptor program and kept the program intact. In any event, the combination of informal regimes coupled with a Russian state of economic disarray, and being at odds with the United States over security issues, results in a major stumbling block to international nonproliferation efforts.

Russia should be encouraged to continue to strengthen its national export control system and to demonstrate its professed commitment to nonproliferation by showing greater responsibility and cooperation in strengthening multilateral controls rather than using the existing weaknesses of the regimes to rationalize sensitive transfers. A high-level political dialogue is also needed in the G-8 framework to complement mostly U.S. programs under whose auspices export control infrastructure has been built in, and technical expertise provided to, Russia.[18]

Bureaucratic Process

Russia's bureaucratic structure has undergone numerous changes and continues to remain in flux. In the area of export control, bureaucratic restructuring has been a major obstacle to the implementation of coherent policy, as agencies are renamed, reconfigured, or dismantled. Personnel turnover has also inhibited the implementation of sound policies. Several decrees and resolutions have set forth the roles of Russian agencies in regulating technology and arms trade, but oftentimes different resolutions are issued before agencies have even assumed their new roles.

18. Center for International Trade and Security, "Strengthening Multilateral Export Controls: A Nonproliferation Priority," University of Georgia, September 2002.

The bureaucratic process is broadly defined by Article 8 of the Export Control Law. In theory, the Russian president is responsible for articulating Russia's nonproliferation and security policy. In the area of export control, the president defines the direction of state export control policy, approves and signs control lists, and issues decrees. The government implements state policy in export controls, helps to define the policy toward international regimes, defines the procedures for implementing export controls, and negotiates treaties and other international agreements. Although the Russian Duma passed the Export Control Law, it has given very little attention to export control policy since its passage. Currently, there is a renewed interest in these issues, especially in the Federation Council, the upper chamber of the Russian parliament.

After the interagency coordinating body (Export Control Commission) specified by the Export Control Law was virtually disbanded in the second half of 2001, most of its functions were transferred to the Interagency Working Group on Nonproliferation and Export Control under Russia's Security Council. By law, the Security Council is chaired by the president and advises him on important security matters regarding domestic and foreign policies. The end result of this transfer was rather ambiguous because, on the one hand, the presidential staff can deal more effectively with interagency conflicts, but on the other, the group lacked technical support and often limited itself to superficial policy considerations.

The Export Control Commission was reconstituted in June 2002 by a presidential decree, as a result of which interagency coordination on political and technical levels had a chance to be reinvestigated. Alexei Kudrin, deputy prime minister and minister of finance, was appointed as chairman. On the one hand, this high-level interagency commission has to be coordinated and managed by at least a deputy prime minister. On the other, it was an unprecedented move to put in charge of an export control body the finance minister whose departmental interest may run counter to the spirit of export control limitations.

Catchall Clause

On January 22, 1998, the Russian government issued a so-called catchall resolution. This measure was taken primarily in response to U.S. insistence that Russia do more to prevent missile technology transfers to Iran and Iraq. The catchall provision, also included in the Russian Export Control Law (Article 20), requires Russian exporters to forgo potential contacts with foreign parties "if they have valid reason to believe that the goods, information, work, services, and results of intellectual activity will be used by a foreign state or foreign party for the development of weapons of mass destruction and their delivery systems." Russian authorities understand the catchall provision to mean that exporters must "be alert" to ensure that their foreign partners will not use acquired information or technology for military purposes. In addition, Russian export control officials say that they will intervene if they learn of "unreliable" foreign entities attempting to acquire weapons-related (dual-use) technologies or information.

Interpreting the catchall provision presents major hurdles for Russian exporters. Many complain that the Russian government is rarely forthcoming with information about sensitive end users. Often the only information available to exporters comes from U.S. sources, and there is little evidence that exporters use these sources regularly.

Part of the problem stems from the fact that Russia rejects the practice of blacklisting states, yet it closely scrutinizes all exports to states that appear on the U.S. blacklist. For example, control agencies scrutinize exports to Iran while many Russian officials encourage closer commercial relations with Iran, thereby sending mixed messages to exporters. Second, exporters find it difficult to determine what constitutes "goods, information, and services, which could be used for production of WMD." Third, the government has no real way of investigating suspected end users. Ideally, information on end users would be available as a result of information sharing, not only at the domestic but also at the international level.

Unfortunately, such transparency and cooperation among Russian agencies and among regime members has proven hard to achieve thus far. Enforcing the catchall provision is likely to prove as difficult in Russia as it has in other countries, including the United States, because it requires the government to prove that exporters knew or should have known that the end user was involved in weapons or other suspect activities.

Penalties

One of the most tenacious weaknesses in Russia's export control system has been the inability to identify and punish violators. The Export Control Law provides a more solid legal basis for imposing penalties, but the question remains as to whether the law will be enforced to the fullest extent possible and penalties imposed.

Enforcement is easier under the Export Control Law because it is more explicit about what constitutes a violation and what penalties pertain than any other legal acts. Previously, in the absence of the Export Control Law, some courts refused to act on the basis of presidential decrees and government resolutions. Article 31 of the law states, "The representatives of organizations and citizens guilty of violations of laws of the Russian Federation in the sphere of export control will be subject to criminal, administrative, and civil legal penalties in accordance with laws of the Russian Federation." Fines range from the value of the export (for first-time violators who fail to acquire a license or falsify documents) to the loss of export privileges for up to three years (for repeat offenders or for violations that result in "the infliction of considerable injury on the political and economic interests of the Russian Federation"). The law does not, however, specify what kind of violation would inflict "considerable injury."

In addition to being subject to the provisions of the Export Control Law, those who violate export controls are also subject to penalties under the 1996 Criminal Code Article 189, "Illegal Exports of Technologies, Scientific and Technical Information and Services Used in Developing Weapons of Mass Destruction, Armaments and Military Hardware," and Article 188, "Smuggling." After the amendments to these articles came into force in May 2002, these two articles became a more effective enforcement tool.

Unfortunately, the Criminal Code suffers from the same ambiguities and poorly defined concepts that make the Export Control Law difficult to enforce. The lack of well-defined provisions leaves several glaring loopholes and regularly complicates any efforts to prosecute violators of export control regulations. Thus, despite numerous investigations, there have been no criminal sentences imposed and few fines levied. Moreover, the fines that have been imposed are relatively small due to the fact that they are based on wages, which in Russia are minimal.

Administrative penalties for export control violations also exist but are seldom imposed. Article 7 of the Export Control Law grants authorities the power to impose administrative punishments for export control violations. Under the previous regulatory framework, these penalties applied only to individuals. Now, with the new Export Control Law, entities are also subject to such penalties. In particular, the Ministry of Economic Development and Trade can suspend export-import operations and annul licenses and other rights for illicit foreign economic activity. The Ministry of Atomic Energy can also deny export rights to its enterprises. However, most agencies are hesitant to impose sanctions on entities that they oversee, as most entities are state owned, raising the problem of self-indictment.

Customs Authority and Border Guards

Preventing sensitive technology leaks from a state with 40,000 miles of borders is an enormous challenge, even under the best of circumstances. Given Russia's economic decline and corruption, the task is all the more daunting. Russia's State Customs Service faces a number of problems including a shortage of qualified specialists, a shortage of equipment (special equipment for customs checkpoints, computers and databases, and customs laboratories), a lack of independent expertise, an open border with Kazakhstan (a 5,000-mile section), and a lack of common customs rules for members of the Customs Union.

Russian customs remains poorly equipped to interdict illicit trade in nuclear materials and other controlled technologies. Inadequate training means that customs officers are unable to identify items of a strategic or dual-use nature that have been mislabeled (e.g., missile components labeled as electronic components.) Customs officers' limited understanding of nonproliferation export controls has also created some bottlenecks within the export control system. In some cases, exporters complain that customs officers are overzealous and hold up items if they have characteristics or a name that resembles that of a controlled item.

Custom's role in Russia's export control is threefold:

- preventing unlicensed exports of dual-use materials, equipment, and technologies, according to the list of items subject to export licensing;
- issuing delivery confirmation certificates for items imported into Russian territory that are listed as controlled by the exporting country and for which an import certificate has been issued by the Ministry of Economic Development and Trade;
- preventing unsanctioned reexports of dual-use materials, equipment, and technologies.

Russia's Customs Service is likely to be faced with a new set of challenges in the years to come. At the informal summit of the parties to the Commonwealth of

Independent States (CIS) in March 2002, the participating countries decided to accelerate work on developing a free trade zone and closer economic integration. President Putin volunteered to draft new guidelines to be discussed and approved at the next summit. One major implication is that their national customs services will have to improve their compatibility.[19]

Customs is, in many ways, one of the weakest links in Russia's export control, both because of the lack of training and equipment and because of rampant corruption. It is common for exporters and importers to pay bribes to customs officials in an effort to move items without paying duties or to expedite service. Some exporters complain of deliberate delays by customs authorities calculated to elicit bribes in exchange for efficient service. The lack of informed regional customs posts with knowledge of dual-use technologies can also lead to unauthorized exports or, even more likely, unnecessary delays for exporters of items that are not controlled. Addressing problems of corruption and professionalism within customs (as elsewhere) is no simple undertaking. Until customs officers' salaries increase and Russia's economy stabilizes, many of these problems are likely to persist.

Verification

The Russian government has procedures and designated agencies to verify that exported and imported articles are being used for peaceful purposes at the intended locations. Designated agencies issue import verification certificates and end-user certificates (the Ministry of Economic Development and Trade) and delivery-confirmation certificates (Customs Authority). However, the state lacks the funding to carry out post-license checks aimed at determining whether an export is being used at the intended location for the declared purpose.

Pre-license checks to assess the risks of a particular transaction are not conducted on a regular basis. The burden of gathering information on and making judgments about the reliability of foreign clients falls to Russian exporters themselves. If there are concerns about an importer, the Russian exporter can theoretically obtain additional information from the Federal Security Service, the Ministry of Economic Development and Trade, the Foreign Intelligence Service, and the Ministry of Foreign Affairs. These agencies ostensibly maintain lists against which they screen end users and are equipped to investigate foreign companies if there are questions about the activities of an end user. If information provided by the exporter or by relevant government agencies suggests that the importer is not reliable or has links to a weapons program of concern, the exporter will be directed to end negotiations and will not be provided with an export license. In the wake of the September 11 events, Russia participated in the U.S.-initiated campaign to identify entities associated with terrorist groups and prevent money transfers or deliveries of goods to them.

Rather than engage in comprehensive pre-license and post-license checks, which would require resources that are unavailable, the Russian government tends to rely upon end-use guarantees from importing companies and governments.

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19. "Rossiya Razrabotaet proekt reformy SNG" (Russia will draft CIS reforms), *Nezavisimaya Gazeta*, March 4, 2002.

Depending on the category of goods and whether or not the importing country is a member of multilateral international export control agreements, the following documents may be requested from the importer:

- an import certificate, or its analog, registered by the authorized state agency of the country of end use according to the provisions of the national legislation, or an official statement of end use if the country does not issue import certificates;
- a delivery-confirmation certificate, or any other document issued by the customs authority of the end-user country, confirming that the item entered its territory;
- a letter from the end user promising that the imported items are to be used exclusively for the declared purposes and that the end user will not reexport or transfer the items to anyone without prior written permission of the exporter. This document is required in the event that the end user and importer are two different entities (i.e., in cases in which the importer is serving as an intermediary in the transaction).

If the Russian government learns that a foreign importer has violated its export control guarantees, protocol dictates that the Ministry of Foreign Affairs, in coordination with the Ministry of Economic Development and Trade, send an official memorandum to the government authorities of the end-user country citing the alleged violation. This importer is then placed on the Ministry of Economic Development and Trade's list of unreliable foreign companies banned from importing dual-use and other controlled items from Russia.

Despite written regulations describing procedures for carrying out end-user and end-use checks, Russian agencies are understaffed, underfunded and ill equipped to actually implement such checks. In some cases the Russian government had to turn to its nationals working in importing countries like China, for example, to perform end-use checks in the framework of the bilateral agreement on the peaceful use of nuclear energy. It is questionable, however, whether these persons can act independently and pass independent judgments. Thus, Russia gets reduced marks for its ability to monitor end use and end users. Nevertheless, Russia has attempted to offset its relatively weak verification system with greater documentation requirements (e.g., end-use guarantees) for importers.

Other FSU States

Overnight, the other NIS became dangerously vulnerable transit states and sources of sensitive products and technologies inherited from the Soviet Union. Yet developing a nonproliferation mentality to underpin export control development and implementation in these countries has proven even more challenging than in Russia. The leaders of these countries emerged with mostly local and at best regional outlooks, ranking costly and time-consuming efforts to establish export control systems at the bottom of national priority lists.

These countries' perceptions of national interests rarely merged with the imperatives of global nonproliferation concerns. A more compelling incentive for them to set up and operate national systems would be the likelihood of getting rewards and generous assistance, in addition to demonstrating high-profile international solidarity. This is particularly true of most FSU states of the southern tier. At the same time, given their porous borders with Russia and the evolving multilateral trade arrangements within the NIS, the effectiveness of Russia's export controls would largely depend on the extent to which the West may be willing to provide export control assistance to these neighboring republics.

Belarus

Immediately after acquiring independence and proclaiming its nonnuclear status, Belarus was targeted by the Cooperative Threat Reduction (CTR) leadership as a potential export control showcase. The government of Belarus demonstrated at that time a genuine commitment to nonproliferation export control and cooperation with the West. In the first half of the 1990s, the evolution of its export control was transparent, predictable, and rapid. Belarus was the first FSU state that adopted an export control law. Being more integrated economically with Russia, Belarus attempted, however, to emulate most elements of the Russian system. Belarus joined the NSG in 2000 and is considering membership in the Wassenaar Arrangement and the MTCR.

Its current president, Alexander Lukashenko, who reversed democratic reforms and reintroduced Soviet-style authoritarian leadership, is the main driving force behind the yet-to-be-finalized initiative regarding the Russian-Belarus Union and the Customs Union currently consisting of Belarus, Russia, Kazakhstan, Kyrgyzstan, and Tajikistan.

Under the first, more ambitious project, the two countries were supposed to have compatible export control systems and move toward license-free bilateral trade much like two integral and equal parts of a single state. There are grounds to believe that for a variety of reasons—including the economic cost of this union to Russia—President Putin is backing off.

Under Lukashenko, the export control system became less transparent and more manipulated by government agencies, especially in dual-use and conventional weapons transfers. It was reported that in some questionable international transactions, Russia chose to siphon its arms via Belarus.

Ukraine

Ukraine is the second-largest former Soviet republic whose missile production, arms manufacturing industry, and nuclear sector are closely intertwined with the Russian economy. The Uzhmash plant in Dnepropetrovsk has produced, among other things, heavy SS-18 ICBMs that are still the mainstay of Russia's strategic nuclear force. A series of bilateral agreements were concluded after the disintegration of the Soviet Union, whereby Ukrainian engineers and technicians retained their clearance status to provide maintenance and service for these weapons systems in Russia. During President Putin's visit to Ukraine in 2001, a series of agreements on scientific and technical cooperation were signed, including one on closer coordination of both countries' missile design and manufacturing sectors.

Both countries still maintain coproduction schemes for arms manufacturing, as a result of which hundreds, if not thousands, of dual-use items and components cross the border license free in both directions. Russia is still a major supplier of fresh nuclear fuel for Ukrainian nuclear power plants, which were designed and built by institutions and companies located in Russia, and until very recently collected its spent nuclear fuel for storage/reprocessing on its territory. Given a high degree of bilateral integration in these strategic areas, any major weakness in Ukraine's export control system could become an important loophole for unscrupulous Russian exporters.

Similarly to Russia, Ukraine kept restructuring its export control system and management throughout the 1990s. The latest round of reshuffling came in 1999. As a result, the newly established interagency Commission on Export Control Policy and Military-Technical Cooperation was tasked with considering and deciding on critical exports (weapons of mass destruction–related items and technologies) to any country and military export to critical countries (those against which the UN Security Council and/or the Organization on Security and Cooperation in Europe (OSCE) have imposed sanctions or other limitations; those which pose or may pose a threat to Ukraine's national security; and those which support terrorism). The commission was not to interfere in the licensing functions beyond the critical cases, while the other export control body, the State Service on Export Control, continued to act as a main licensing authority. Ukraine's export control still operates on the basis of presidential decrees and government resolutions. The draft law on export control is still under consideration at the Ukrainian parliament.

Also like Russia, Ukraine has to overcome a number of obstacles to make its export control system more effective and responsive to its international obligations. Among these problems and difficulties are continuous budgetary underfunding, rampant crime and corruption, interagency rivalries, lack of export control culture, overmilitarized economy, and surplus defense production.

An important feature of Ukraine's international status (this equally applies to Belarus and Kazakhstan) is that it turned down the nuclear option to become, in December 1994, a nonnuclear weapon state, party to the NPT. After signing an agreement on full-scope safeguards with the IAEA, Ukraine joined the NSG. In 1996, Ukraine became one of the 33 original members of the Wassenaar Arrangement.

The most painful and time-consuming negotiations were those between the United States and Ukraine regarding Ukraine's membership in the MTCR. The major obstacle facing U.S. and Ukrainian negotiations was Kiev's insistence that it be allowed to join the MTCR without giving up its 130-some SCUD missiles and the future option to develop and deploy missiles with ranges between 300 and 500 kilometers. Washington was opposed to Ukraine maintaining these capabilities. A compromise leading to Ukraine's membership in the MTCR was reached only in 1998, but the sides agreed not to make public its substance. Unofficial reports, however, indicate that under this compromise formula Ukraine would keep its SCUD missiles until their service life but not manufacture and deploy new ones.[20]

Kazakhstan

Kazakhstan was the only nuclear state in Soviet Central Asia. Despite dramatic reductions in the nuclear sector, most of its nuclear personnel and infrastructure remained. It exports dual-use goods and technologies, as well as uranium and strategic materials. It also possesses a large amount of conventional arms left over from former Soviet military bases. The strategic location of Kazakhstan makes it an ideal transshipment country for smuggling and drug trafficking to and from other Central Asian countries.

Kazakhstan has the most developed export control system of any country in the region. Pending completion of all formalities, it participated in the 2002 NSG meeting as a full-fledged member. Despite this progress, Kazakhstan is still struggling to accomplish a functioning export control system compatible with its national requirements.

Several reasons can be identified for the slow improvement of its export control. Like all former Soviet republics, it needs more financial and technical resources, well-trained personnel, and appropriate infrastructure. Most ethnic Russians who operated the export control system after the breakup of the Soviet Union left the country later in the wake of ethnic unrest. Some indigenous export controllers resigned and joined private companies when the Kazakh capital was moved from Almaty to Astana (economically, climatically, and otherwise Astana was at least originally a much less-enjoyable place to live). Low salaries in combination with rapidly introduced Western goods and amenities have led to rampant corruption. The authoritarian political setup and Asian clan relationship significantly hamper any efforts both to build up and modernize national export control and make it transparent and accountable. Throughout the 1990s, Kazakhstan has been involved in several scandalous export control violations, which put into question the ability of its leadership to adhere to international export control principles.

Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan

The remaining Central Asian states—Uzbekistan, Kyrgyzstan, Tajikistan and Turkmenistan—have the weakest export control systems among the NIS. In terms of their scientific and industrial capacity they are hardly an important source of sensitive or dual-use items and technologies, but being located between proliferant countries in the south—in particular Iraq and Iran—and more industrially developed FSU states, they provide a convenient route for illegal transfers. Their porous and poorly controlled borders with Kazakhstan facilitate smuggling. Numerous cases of illegal shipment have been reported in the media.

None of these four Central Asian states is a member of any of the international export control regimes or has realistic plans to join them. Throughout the 1990s, they made some very modest progress in developing their national systems virtually from scratch. The United States was the main source of financial support, encouragement, and training. Kyrgyzstan has the best-established export control mechanism among the four states. It has developed a legal basis, interagency pro-

20. Interview with Victor Zaborsky of the Center for International Trade and Security, University of Georgia, June 5, 2002.

cess, and some other formal trappings of a national system. Much is yet to be accomplished in the enforcement area through better-organized training for customs and border officials.

Tajikistan is an important transit state with inefficient and practically nonexistent export control. Attempts by the government to exercise control over imports and exports have been seriously hindered by the civil war. Trafficking in drugs and conventional weapons is widespread.

Another country with a seriously underdeveloped export control system is Turkmenistan, though the almost complete lack of publicly available information makes it difficult to evaluate its status. Turkmenistan is at particular risk for becoming a transit country for illegal exports since it has a 992-km border with Iran. But on the whole, the authoritarian regime in Turkmenistan is sensitive to Western nonproliferation concerns and is likely to cooperate.

Uzbekistan has a more sophisticated export control system because it had built up a relatively modern industrial base during the Soviet period and still operates a number of high-tech facilities that produce potentially sensitive items and technologies. Uzbekistan has an extensive chemical industry based in the Fergana Valley. There is uranium mining and processing centered around the Navoi Mining and Metallurgy Complex, as well as one nuclear research reactor near Tashkent. There are also a number of sites where sensitive, weapons-related activities previously took place, including a genetics institute, which used to work on the development of biological agents to destroy enemy crops for the Soviet Ministry of Defense.

In April 2002, Uzbekistan hosted a U.S.-sponsored regional conference on export control and nonproliferation. The message from the leadership was that Uzbekistan is prepared to invest its own resources and use Western assistance in order to make its export control system compatible with international requirements.

Georgia, Armenia, Azerbaijan

The three countries in the Caucasus—Georgia, Armenia, and Azerbaijan—present an even more serious challenge. They have been and still are the scene of civil wars, separatist actions, local conflicts, and political instability. Hence, their efforts to develop functional export control have been a mixed success. What is more, the region has several "gray areas" where government authorities exercise little or no control and which can be easily used as transshipment points for smuggling operations. These gray areas include Abkhazia and Southern Ossetia in Georgia and Nagorno Karabakh (an Azeri territory occupied by Armenia in their latest military conflict).

U.S. Interaction with Former Soviet Republics

Unlike many other CTR projects launched after the signing of the June 1992 bilateral umbrella agreement, export control engagement has been driven by its own unique rules. Because of the complex interplay between the two export control components—political and legal-organizational—the U.S. dialogue with Russia in this area can hardly be characterized as assistance only.

This realization came when traditional assistance approaches, which had been effective in most other NIS countries, got stalled in Russia. Formal export control assistance agreements were concluded with Ukraine, Kazakhstan, and other countries, but not with Russia mostly because of its political sensitivity and secrecy requirements. In response to this reality, the United States went beyond the traditional CTR framework of assistance and developed a combination of ad hoc technical approaches with multidimensional political engagement. Export control engagement had to be organized differently than in other newly independent states because Russia inherited all Soviet stockpiles and infrastructure of weapons of mass destruction, retained most of the former USSR export control personnel, and as the successor state, took over the Soviet membership in most international regimes.

The political engagement went on throughout the 1990s, but it was formalized in 1998 with the establishment of joint expert groups dealing with nuclear, missile, and other proliferation issues, internal-compliance programs, conventional weapons transfers, customs, and enforcement. The Russian government welcomed this new channel of cooperation as a two-way dialogue and recognition of its equal partner status. Though technically oriented assistance issues were regularly discussed, Russian officials also had a chance to interact with U.S. counterparts and understand how U.S. export control mechanisms operate.

In part as a result of such interaction, Russia introduced the catchall principle in its 1999 export control legislation. The information exchange in these groups also played a major role in promoting the establishment of internal-compliance programs at nuclear and defense-related facilities. The joint export control groups were put on hold with the inauguration of the Bush administration, and in February 2002, both countries agreed to negotiate a more-flexible and less-formalized version of the earlier dialogue. However, little progress has been achieved so far.

In 1996, the Department of State (DOS) assumed funding responsibility through the Nonproliferation, Anti-Terrorism, Demining, and Related Programs (NADR) and the Nonproliferation and Disarmament Fund (NDF). The transfer of the responsibility for export control engagement with Russia from the Department of Defense (DOD) to other agencies reflected a trend toward dispersing CTR projects originally conceived and concentrated in the Pentagon. It mirrored, among other things, the complex interagency process by which U.S. export controls are administered. In many cases, U.S. agencies work together to accomplish common objectives in Russia, although competition, interagency turf battles, overlap, and confusion are common features of such cooperation.

At the same time, the Department of Commerce (DOC) was tasked with providing support in several technical-organizational areas including legal foundations and regulatory development, licensing procedures and practices, preventative enforcement mechanisms, industry-government relations, and administration and system automation. The DOC Bureau of Export Administration (BXA), which was renamed the Bureau of Industry and Security, has been collaborating with the Moscow-based Center on Export Controls, a nongovernmental organization with close ties to Russian government agencies, in holding workshops designed to improve industry-government relations in export control and Russian industry compliance with export control regulations. Since 1997, the emphasis has been put on holding seminars to promote international compliance mechanisms (ICM) and assist with product classification. By the end of 2001, the center had carried out nearly 40 regional export control workshops reaching over 550 enterprises.

Because Russia has a large number of dual-use and defense exporters and the government has yet to improve its control of individual facilities, the willingness and motivation of Russian exporters to comply with export regulations are important prerequisites of proliferation prevention in Russia. This is the main reason these regional seminars and their overall effect warrant special attention.

The BXA training program is composed of two sets of export control workshops. Workshops to familiarize companies with export control procedures and assist them in establishing export control compliance procedures or internal-compliance programs are held first. Typically, they are followed one year later by two- to three-day workshops designed to train industry and institute representatives in commodity classification. One of the objectives of these workshops is to help industry representatives in determining whether or not items produced by their companies appear on Russia's national control lists. Providing them with these skills reduces the likelihood that Russian companies will mistakenly (or otherwise) transfer dual-use or other weapons-related items requiring an export license. At the product classification workshops, attendees learn how to make such product classifications through a series of hands-on exercises.[21]

Although the training offered at these workshops cannot address most of the economic conditions affecting proliferation, they are likely to result in individuals better versed in national export requirements and with greater motivation to comply with them. Also, the transparency in Russian export regulations resulting from BXA workshops will not only increase industry compliance but also gradually strengthen international confidence that Russia is working to meet its international obligations. Lastly, officials from Moscow who are invited to participate in these workshops get a better understanding of proliferation-relevant items being produced in particular military-industrial regions. Although most officials have some idea of what is being produced for export in regions throughout Russia, the fluid nature of Russia's military-industrial complex and the emergence of new entities engaged in foreign economic relations make the government's task of gathering accurate information fairly challenging.

The Department of Energy's (DOE) export control programs concentrate on the nuclear sector. Launched in 1995, DOE efforts have been implemented on three levels: government-to-government, laboratory-to-laboratory, and multilateral projects. There are cooperative projects with think tanks and individuals in Russia's closed cities focused on nuclear export control. DOE's objective is to develop technical expertise in order to establish a cadre of experts capable of playing a role similar to that of the national laboratories in the United States. Like the DOC, DOE attempts to engage Russia's export control community in improving licensing pro-

21. Interview with Anatoli Bulochnikov, director of the Center on Export Control, March 1, 2002.

cedures, enhancing the legal and regulatory framework, using technical expertise and information, promoting multilateral standards of conduct, and increasing awareness among industry and government officials.[22] DOE has hosted, in cooperation with the Center on Export Control, a series of workshops for nuclear facilities, including one in Sarov (Arzamas-16).

Other U.S. agencies like the Customs Service and the Department of Defense have implemented individual projects for enhancing Russia's export control. Recently, the Department of State sponsored an expanded interagency program known as the Export Control and Related Border Security Program (EXBS). This program has given Customs the opportunity to ensure long-term sustainability of improved border control procedures and infrastructure in several former Soviet republics including Russia.

More than 90 percent of export control assistance has come from the United States. Most EU documents that talk about assistance to FSU countries in the nonproliferation area fail to provide specifics about export control. One exception is the United Kingdom, which in the past supported several regional conferences and the publication of legal acts in Russia.

U.S. export control assistance to Ukraine is by far the largest and most-comprehensive program of any non-Russian program. It was provided under a separate bilateral agreement, which was part of the framework arrangement for overall CTR assistance to Ukraine. Its provisions included bilateral and multilateral policy and technical-level discussions on establishing and implementing a multipurpose export control system; classroom and on-site training for licensing, enforcement, and other related officials; experts to assist in the drafting of export control legislation and implementing regulations; and computerized systems and related training to improve tracking of controlled items and technologies. Most of these objectives were pursued through both governmental and nongovernmental channels.

In December 1998, both sides signed a protocol effectively concluding CTR export control assistance to Ukraine. However, in early 1999, the United States and Ukraine opened a new round of negotiations on extending export control assistance. Specifically, the Ukrainian side requested support for the following: political and technical information exchange on catchall issues; information exchange and counseling regarding specifics of multilateral export control regimes and technical characteristics of certain controlled items; training for licensing and enforcement officers; legal assistance in developing export control norms and regulations; improved detection capabilities at border checkpoints to deter illegal transfers of controlled goods and technologies. No new agreement has yet materialized, but chances for its speedy conclusion look promising.

Export control assistance to Belarus was initiated under the 1992 CTR bilateral agreement. It went ahead of all other similar bilateral programs in the FSU and was supposed to serve as a model. President Clinton was even planning at the early stage to announce the creation of a U.S.-funded nongovernmental export control center in Minsk, but this idea never materialized (mostly for internal bureaucratic reasons

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22. Scott Parrish and Tamara Robinson, "Efforts to Strengthen Export Controls and Combat Illicit Trafficking and Brain Drain," *Nonproliferation Export Review* (Spring 2000): 113.

in the United States). Assistance to Belarus involved, among other things, training, policy advice, equipment (mostly computers), and support for customs and border guards. In March 1997, the Department of State announced that the United States would suspend its CTR funding for Belarus because of Minsk's lack of respect for human rights. The funding cutoff affected most, if not all, export control projects. The imperative of political reaction to human rights violations and anti-U.S. rhetoric by the leadership is quite understandable, but as a result, the emerging export control community in Belarus was left isolated.

Given Kazakhstan's strategic importance in the region, it was always at the top of the list for security assistance. Out of $81.4 million budgeted by U.S. government agencies for assistance programs in Kazakhstan in fiscal year 2002, security programs receive is $35.7 million. The U.S. government provides training for government officials in charge of export control, special technical training, and training for border guards and customs officials. DOE also sponsors English-language training for export control officials. Kazakhstan's comprehensive export control law of 1996 was developed, in part, during a DOC-sponsored workshop in Washington, D.C. CTR funding sources provide equipment for computer-based export control systems, local area networks, coastal patrol boats, x-ray equipment, radiation-detection equipment, and patrol vehicles. The IAEA and some EU members—in particular, Germany, the UK, and the Netherlands—have also been involved in providing technical assistance and training to the Kazakh export control community.

As to U.S. support for export control in the former Soviet republics of Central Asia and the Caucasus, relatively low-profile security assistance throughout the 1990s gave way to a much more vigorous and diverse program in the wake of the September 11 terrorist attacks. Such support focuses on export control enhancement, customs and border guard improvement, military assistance, relevant institutions and infrastructure building, and so on. In addition to the CTR budget, money comes from the Freedom Support Act; Foreign Military Financing; Nonproliferation, Antiterrorism, Demining, and Related Assistance Fund; and others government sources. In FY 2002, security programs from all U.S. government agencies have totaled $9 million for Tajikistan, $12 million for Kyrgyzstan, $8.3 million for Turkmenistan, $59.8 million for Uzbekistan, $31.7 million for Georgia, and $13.6 million for Azerbaijan.

The modus operandi in the past has been to give assistance priority to filling in the most serious security gaps. Now, almost 10 years after the CTR export control engagement was initiated, there is a need to strategize on a longer-term basis. Better implementation and enforcement of export controls depend to a great extent, especially in Russia, on greater awareness and motivation of the key personnel. Hence, further engagement efforts must place more emphasis on training a younger generation for professional careers in Russia's export control.

One example of such an approach would be to support an export control course at Russia's several technical universities, which could then award internal-compliance officer certificates to graduates. As they found jobs at nuclear, missile, and other defense related or dual-use manufacturing facilities, they would be qualified to operate as internal-compliance officers, either on part- or full-time bases.

The time has come to conceptualize and support the establishment of a professional association for a Russian and/or FSU export control community that can become a focal point for information exchange and networking. What may be needed as the next step in adjusting assistance modalities to new realities is cultivating an export control culture not only among officials directly involved but also among those who are in a position to affect relevant decisions.

More specifically regarding Russia, there are at least four areas where proactive Western engagement would be useful: intangible transfers, catchall provision, internal-compliance programs, and enforcement. As far as the first two are concerned, relatively little practical progress has been made by the United States or other Western states in dealing with them. As a result, the best way to engage Russia would be to invite its officials to jointly explore possible approaches and solutions rather than recommend what can and should be done. Intangibles have been continually reviewed under the Wassenaar Arrangements, though with limited results. An option for intangibles would be a more open forum enabling both government officials and the academic community to discuss this issue. As Russia (like Ukraine and Kazakhstan) joins the IT revolution and continues to restructure its higher educational institutions, intangible transfers risk becoming a major export control loophole.

Weaknesses in the government-operated export control system make it imperative to continue and expand assistance in improving internal-compliance mechanisms and information sharing at the level of individual facilities. This has been done so far by conducting DOC-funded regional seminars in Russia and Ukraine. As the process of privatization of the defense industry is moving ahead in Russia, Ukraine, and Kazakhstan, internal-compliance officers increasingly find themselves "on the other side of the barricade." If in the past, as employees of state-owned facilities, they perceived their collective and professional interests as being virtually no different from those of the government, now the situation is likely to change dramatically. Their loyalty will be with their shareholders and facility leadership rather than the government only. They must feel more personally liable for their actions or lack thereof. Inevitably, they will develop a corporate spirit and some degree of alienation from the government.

This is yet another reason why regional export control seminars must be continued. The more enlightened internal-compliance officers are, the easier is the burden of the government-run export control system. These regional seminars must be held regularly, each building on the previous ones' accomplishments. According to the resent testimony of Matthew Borman, deputy assistant secretary of commerce, even after holding regional workshops in Russia, only 20 percent of those surveyed characterized their knowledge of Russia's export control requirements as good.[23] Much more needs to be done.

Enforcement assistance would involve customs and border guards, among others. The latest estimate is that only 45 percent of Russia's customs checkpoints have operable detectors and monitors. An accelerated delivery of these instruments and

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23. Testimony of Matthew Borman, deputy assistant secretary for export administration, Bureau of Industry and Security, Department of Commerce, before the Senate Governmental Affairs Subcommittee on International Security, Proliferation, and Federal Services, June 6, 2002.

support for customs analytical labs must be given higher priority. As noted above, customs officers must be involved in the overall efforts at nurturing what can be characterized as an export control culture. It would enhance their motivation, professional pride, and work performance.

Russian border guards have received negligible support so far for their role in intercepting smuggling. On the Russian-Kazakh border they work side-by-side with customs officers; their performance along key segments of the border could be improved with some financial and technical assistance. Also, Russian border guards are still deployed on the border between Tajikistan and Afghanistan and could benefit from similar support.

Continued assistance to the southern-tier countries should be geared toward preventing their use as transit territories and for combating international terrorism. The immediate priority here is with enforcement. At the April 2002 export control and nonproliferation conference in Tashkent, a group of border guard officials from Central Asia and the Caucasus presented "an assistance wish list" that provides useful guidance for the future:

- Interagency coordination: improvement of interagency coordination through development of individual relations between heads of border guard posts; establishing mechanisms for sharing information—like emergency hotlines; creation of a databank for individuals and commercial entities who violate export controls; international training seminars to enhance border security;
- Training: conduct additional field training for border guards incorporating the experience and technique of their western counterparts, particularly as it relates to drug smuggling and antiterrorism; publish training manuals and textbooks to summarize the experience of regional and Western border guard forces;
- Communications: development and implementation of a sophisticated regional communication system for use of border guards; acquisition of better equipment for detection of radioactive materials; acquisition and deployment of mobile radiation-detection systems to the farthest reaches of Central Asia.[24]

A more effective way to promote export controls may be to engage entities in Russia and other FSU countries in major international projects and mutually beneficial commercial contracts with the West. What transpired in Russia's missile and space sector in the 1990s is a good case in point. A precondition for Russia's participation in the International Space Station (ISS) was its agreement to join the Missile Technology Control Regime (MTCR) and develop a mature national export control system. The ISS program helped develop a mentality and infrastructure that allowed U.S. aerospace companies to step in and engage Russian partners in private, mutually beneficial commercial contracts. They routinely prioritized the implementation by Russian facilities of export control regulations and provided some

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24. Interview with Julia Khersonsky of the Center for International Trade and Security, University of Georgia, June 16, 2002.

practical guidance. Because this was done on a company-to-company basis through everyday interaction, real improvement in Russia's export control motivation increased much faster. The incentive of doing business with major U.S. companies is a much more effective way of providing accountability and encouraging export control adherence than either formal instructions from the Russian Aerospace Agency or U.S. diplomatic efforts and sanctions.

Russian aerospace companies are also cooperating with Boeing in the Sea Launch Project. They have teamed up with Pratt and Whitney for coproduction of the RD-180 rocket engine and are cooperating with Thiokol in the worldwide marketing of the converted SS-18 ICBM, known as the "Dnepr" space launch vehicle. What is emerging within the framework of U.S.-Russian aerospace relations can be characterized as a successful two-level model. The first level involves government-to-government interaction ranging from CTR and other security-related assistance in complying with START I or other arms control obligations to diplomatic pressure, and if necessary, sanctions against individual Russian enterprises. The second level involves mutually beneficial commercial partnerships and economic incentives, complementing and reinforcing intergovernmental interaction. As evidenced by recent developments in the aerospace industry, this two-level model is contributing to Russia's export control awareness and enhanced sustainability for U.S.-funded security-related assistance programs.

Given Russia's fluid political and economic situation, it is difficult to evaluate the general effectiveness of its national export control system and those particular components under the jurisdiction of the Russian Aerospace Agency. However, very few of Russia's major ISS contractors or companies engaged in U.S. partnerships have been publicly implicated in any serious export control violations or sanctioned by the United States for illegal transfers to countries on its proscribed list. It is safe to assume that the degree of export control maturity at individual facilities is directly proportional to their involvement in international programs (i.e., both the ISS and commercial contracts). The facilities that are recognized as maintaining the best export control systems—Khrunichev, NPA Energomash, Ts NIIMash, and some others—have extensive international cooperation projects. They are used as export control success stories to demonstrate to the U.S. Congress and administration the benefits of such cooperation. Those who proliferate invariably operate outside Western contracts.

Serious thought should be given to developing a similar two-level model for engaging Russia's nuclear sector. It would likewise combine assistance programs, diplomatic efforts, and sanctions, with enhanced incentives for U.S. private initiatives. The way U.S. companies have engaged their Russian counterparts in aerospace cooperation has increased U.S. leverage with both Russian government and industry. The lesson is clear.

As for the current status of U.S.-Russian nuclear interaction, engagement is still too weak to be meaningful. Although there is no doubt that market conditions differ in the aerospace and nuclear industries, building a strong commercial foundation should become an important agenda item for both economic and security reasons. One significant step in this direction involving a variety of high-tech sectors would be to introduce attractive incentives for major Western investors in the NIS to promote, as appropriate, export control awareness and mechanisms at their partners' facilities.

Conclusion

The cooperation of Russia and other FSU states in controlling proliferation trade is and will be vital because some of them possess enormous stockpiles of weapons, nuclear material, WMD dual-use technology, and related know-how, while others can act as transit routes. Over the last 10 years, some important steps have been taken to establish an effective export control system in this region. Its effectiveness, however, will largely depend on the leadership's political commitments and its desire to adhere to nonproliferation values and practices in deeds as well as words.

Export control's potential contribution to proliferation prevention is important, but should not be overestimated. It is just one of several supply-side tools in the hands of governments. This is especially true of Russia, where there is an equally compelling need to improve physical protection, accounting, and control; border guards; migration management, etc. Attributing continued proliferation from Russia and other countries exclusively to the loopholes and gaps in its export controls will not lead to durable solutions.

On the positive side, Russia's evolving export control system is now compatible with Western standards. First, Russia established export control agencies that are beginning to develop standard operating procedures for the review of licenses. Export control personnel at the agencies have gained valuable experience over the last 10 years that should enhance their ability to implement and enforce export controls. Second, Russia has also joined almost all of the export control regimes, an encouraging development even though the motivation is primarily economic rather than proliferation related and Russia's record inside the regimes is widely critcized as unconstructive.[25] Third, Russia has adopted an export control law and taken important steps to develop a stronger legislative basis for its control system. Finally, an increasing number of Russian exporters have become aware of export control regulations. Most major exporters now have knowledge of control lists and understand the licensing process. Many of these positive developments were achieved thanks to Western assistance and to the effort of a handful of dedicated Russian officials.

There is no question, however, that the export control system in the region requires additional enhancements, many of which will be difficult to undertake until economic conditions improve. The principal challenge remains implementation and enforcement of export control regulations. Russia and other FSU countries have yet to impose any penalties on companies suspected of violating export control regulations. Although many are reportedly "under investigation," none has been prosecuted or convicted. There is an urgent need for Russia to control "intangible" export as it accelerates its integration into the information age and pushes through the restructuring of the military-industrial complex. New and vig-

25. Center for International Trade and Security, "Strengthening Multilateral Export Controls."

orous efforts are needed for training internal-compliance officers from among university graduates.

There are grounds to hope that the new rapprochement with the West following the September 11 attacks will eventually have a positive effect on Russia and other countries' commitment to cooperate on nonproliferation export control on a mutually beneficial basis. In the long run, if the new mechanism of integrating Russia into NATO and the U.S.-Russian nuclear weapons reduction agreement signed at the Moscow summit of 2002 start to materialize, they are likely to provide additional momentum to this process and lead to more political commitments. In the meantime, Russia is expected to continue to make small advances in fine-tuning its regulatory framework, streamlining its licensing procedures, and enhancing its enforcement efforts. A new, better-coordinated assistance program by the West has a chance to speed up progress in Russia and enable other former Soviet republics to catch up.

About the Contributors

Victor Alessi is the president and CEO of the United States Industry Coalition and the U.S. board member of the International Science and Technology Center in Moscow. He is also a retired senior civil servant whose government career was in arms control and nonproliferation.

Derek Averre is a research fellow at the Centre for Russian and East European Studies, European Research Institute, of the University of Birmingham in England. His principal research interests lie in Russian security, arms control and nonproliferation policy, and European security issues.

Igor Khripunov joined the Center for International Trade and Security (CITS) at the University of Georgia in Athens after resigning from the Russian Foreign Service in October 1992. He is now the associate director of CITS and an adjunct professor at the university's School of Public and International Affairs.

Paul F. Walker is director of the Legacy Program of Global Green USA, the U.S. affiliate of Mikhail Gorbachev's Green Cross International. Previously, he was a professional staff member of the Armed Services Committee in the U.S. House of Representatives.

Jon B. Wolfsthal is deputy director of the Non-Proliferation Project at the Carnegie Endowment for International Peace in Washington, D.C. Previously, he served for five years at the U.S. Department of Energy, specializing in arms control and nonproliferation issues.

Ian A. Woodcroft is a researcher in the CSIS International Security Program, specializing in issues related to weapons of mass destruction in the former Soviet Union. He has also researched nuclear force modernization in the United States and scenarios for Korea's future. He holds a degree in politics from Portsmouth University, England.