

## *Special Report*

---

# Efforts to Strengthen Export Controls and Combat Illicit Trafficking and Brain Drain

---

SCOTT PARRISH & TAMARA ROBINSON<sup>1</sup>

*Scott Parrish is a Senior Research Associate with the Newly Independent States (NIS) Nonproliferation Project at the Center for Nonproliferation Studies (CNS). Tamara Robinson is also a Senior Research Associate with the NIS Nonproliferation Project.*

### THE PROBLEM

**T**he possible illicit transfer of weapons-of-mass-destruction (WMD) components and know-how across NIS borders is one of the most pressing proliferation threats coming from the territory of the former Soviet Union. In the circumstances created by collapsing economies, weak government institutions, and still nascent export control systems, the considerable technological and human resources located in the NIS are vulnerable to diversion to states or sub-national actors of proliferation concern. Cases involving the illicit export of WMD technologies and/or the leakage of WMD-related know-how from the NIS persist, despite ongoing cooperative efforts to combat them.

In December 1998, the Russian Federal Security Service announced that it had stopped an attempt by a group of employees from one of the nuclear facilities in Chelyabinsk Oblast to divert 18.5 kilograms of “radioactive materials that might have been used in the production of nuclear weapons.”<sup>2</sup> Ministry of Atomic Energy (Minatom) officials confirmed this attempted theft in November 1999, saying the conspirators “could have done serious damage to the Russian state.”<sup>3</sup>

Questionable exports and illicit trafficking in nuclear-related, dual-use materials are less well-known, but significant proliferation threats. In 1995, according to Kazakhstani press reports, the Ulba Metallurgy Plant shipped 26.5 metric tons of beryllium to a Swedish trading company before the Kazakhstan Atomic Energy Agency intervened to halt the deal, which called for the export of 180 metric tons of beryllium total.<sup>4</sup> In May 1999, Russian authorities blocked a Vladivostok trading company from illegally shipping 6.7 metric tons of zirconium to China.<sup>5</sup>

Brain drain of WMD specialists also remains a major proliferation threat. Here the threat was originally conceived as one involving possible emigration of such specialists to countries of proliferation concern. However, in recent years, brain drain has increasingly involved not emigration, but the training of foreign specialists in WMD and delivery system technologies at NIS institutions. In July 1998, the Russian government closed down a training program for Iranian students at the Baltic State Technical University in St. Petersburg on the grounds of national security.<sup>6</sup> A number of other cases suggest that the threat of what we will call “brain drain through training” remains high.

## OUTLINE OF US ASSISTANCE PROGRAMS

Since the passage of the original Nunn-Lugar legislation in 1991, the United States has designed and implemented a variety of programs to reduce the risk of WMD proliferation from the NIS by assisting the countries of that region to strengthen their export control systems, block attempts at illicit trafficking in WMD technologies, and combat the possible brain drain of WMD specialists. A number of these programs were initiated by the Department of Defense (DOD), with funding from the Nunn-Lugar Cooperative Threat Reduction program, but were later placed under the administration of other US agencies, sometimes at the insistence of Congress. Others have always been administered by agencies other than DOD, but receive some funding from the Nunn-Lugar program or were conceived as complements to DOD nonproliferation assistance programs. As a result, unlike other US nonproliferation assistance programs in areas such as missile/warhead dismantlement, submarine dismantlement, or material protection, control and accounting (MPC&A), which are usually managed by one or two US agencies, programs in this area are conducted by at least a half-dozen agencies. These agencies include the DOD, the Department of State, the Department of Commerce, the Department of Energy, the Federal Bureau of Investigation, and the US Customs Service.

The following section briefly describes the relevant US assistance programs, the agencies that administer them, and their goals. The programs are divided into three general areas:

- export control assistance;
- programs to strengthen border controls and block illicit trafficking; and
- programs to combat the brain drain of WMD specialists and assist the conversion of the NIS defense industry.

Within each section, US programs are listed by the primary agency that administers them.

### Export Control Assistance Programs

Under a number of programs, the United States has provided export control assistance to many of the NIS.<sup>7</sup> This assistance has aimed at helping the NIS establish the legal and institutional framework for an effective export control system and has assisted in the training of export control personnel. As Russia inherited the largest WMD infrastructure from the former Soviet Union,

it has been the focus of much of this assistance, even though it also inherited some elements of an export control system. The United States has also offered significant assistance to Ukraine, Kazakhstan, Belarus, and Georgia, which had to create export control systems from scratch after becoming independent in 1991. Currently, formal export control cooperation agreements have been concluded with Ukraine and Kazakhstan, but not with Russia. The extensive WMD infrastructure in Russia presents a greater proliferation threat than many of the other NIS, but political sensitivities and disagreements have hampered US-Russian collaboration in this area.

In fiscal year (FY) 1996, the State Department assumed funding responsibility for export control cooperation with the NIS, which it retains today. Export control assistance is administered by several other US executive branch agencies, however, including the Department of Commerce and the Department of Energy. The “balkanization” of US export control assistance to the NIS mirrors the complex inter-agency process by which US export controls are administered. In many cases, these US agencies work together to accomplish common objectives in the NIS, although competition, inter-agency turf battles, overlap, and confusion sometimes emerge.

#### *Department of State*

The State Department funds and coordinates US export control assistance through the Nonproliferation, Anti-Terrorism, Demining and Related Programs (NADR) and the Nonproliferation and Disarmament Fund (NDF). NADR receives its money through a budget line item and is, therefore, subject to provisions of existing legislation (such as US sanctions on particular states).<sup>8</sup> Its funds go towards planned, long-term projects, such as export control regime-building. Specifically, this work involves export control consultations with NIS officials, and training programs such as those designed to assist in the establishment of internal compliance programs at NIS firms that trade in sensitive technologies. NADR also provides money to the NDF, which focuses on funding projects to meet emerging needs that established mechanisms do not address. Section 504 of the 1992 Freedom Support Act established the NDF, whose activities involve preventing, deterring, and detecting WMD, WMD component, and delivery system proliferation.<sup>9</sup> Many of these activities involve export control cooperation, such as bilateral and multilateral training

seminars. NDF is not subject to the provisions of existing legislation, such as sanctions, which gives the State Department greater flexibility in administering the program.

Under the current funding procedures, many export control assistance programs that are administered by agencies other than the State Department are funded by NDF. These agencies must submit their proposed programs for a multi-stage review by the State Department before they can receive funding. For example, most of the export control assistance programs administered by the Department of Commerce (see below for details), are supported by NDF funding.

The following list provides a sample of the types of export control and trafficking detection activities NDF has funded, a number of which were implemented by agencies other than the State Department:<sup>10</sup>

- Nonproliferation Briefing and Training workshop, co-hosted by the Turkish government, to train representatives from Armenia, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan;
- Export Control and Enforcement Training Forum in Washington, DC, for representatives from Armenia, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan;
- Export Control System Assessments and Export Control Border Assessments for Armenia, Georgia, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan;
- training programs focusing on legal and regulatory export control issues in Washington, DC, for representatives from Armenia, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan;
- Department of Commerce Symposium in Washington, DC, for foreign export control officials from Belarus, Kazakhstan, Russia, and Ukraine;
- several multilateral export control training programs in Washington, DC, for representatives from the Baltic States and Moldova;
- provision of x-ray vans and training in their use to the Baltic States;
- US Customs Export Control Enforcement Assessment and Training for representatives from the Baltic States;

- Regulations Development Exchange and Technical Forum in Washington, DC, for Kazakhstani export control officials;
- Industry Outreach Program for Russian exporters developed by the non-governmental Center for Export Controls; and
- training for Russian compliance officers and exporters.

#### *Department of Commerce*

The Department of Commerce (DOC) has only limited direct funding for its work on export controls with the NIS and is one of the agencies that must apply for funding from the State Department through NDF and NADR. In FY 1999, for example, DOC received \$4.4 million in funding from these sources for its NIS export control assistance programs.<sup>11</sup> In addition, DOC obtains funding from the US Customs Service and the DOD/US Federal Bureau of Investigation (FBI) program (described below).

The Bureau of Export Administration's (BXA) Nonproliferation and Export Control Program (NEC) implements the programs and reports directly to the undersecretary or deputy undersecretary of commerce for export administration. In general, NEC's work has focused on organizing technical exchanges in five functional areas (legal foundations and regulatory development, licensing procedures and practices, preventive enforcement mechanisms, industry-government relations, and administration and system automation). In accordance with the Government Performance Results Act (GPRA) of 1993, the NEC has devised a strategic plan, which includes a mission statement and 38 performance measures that help NEC assess a country's export control system.<sup>12</sup> NEC works with 23 countries (including Russia, other NIS,<sup>13</sup> the Baltic States, and Central European countries) and tailors its program to fit the needs of each country. For example, NEC might hold only one technical exchange that addresses all of the functional areas at once for a smaller country, whereas it might hold more exchanges for countries with larger WMD infrastructures.<sup>14</sup>

Because of its domestic role in supporting internal export control compliance programs at US firms, DOC export control assistance programs in Russia have focused on providing the same support there. In January 1998, following the introduction of a "catch all" clause

in Russia's export control regulations, NEC efforts in this area intensified. They are now focused on strengthening Russian efforts to develop internal compliance programs at firms that trade in sensitive and dual-use technology. NEC is currently contracting with a Russian non-governmental organization (NGO), the Center for Export Control (CEC), to conduct training seminars for and provide specialized software to internal compliance programs at such firms across Russia. As of fall 1999, CEC has held seminars in several Russian cities attended by representatives of over 400 firms, and plans to conduct additional seminars in 2000 at the rate of one to two per month.<sup>15</sup> Under a contract with an Ukrainian NGO, a similar pilot program is underway at three selected firms in Ukraine, with plans to expand it to additional companies during 2000.<sup>16</sup>

#### *Department of Energy*

Given its statutory mandate, the Department of Energy's (DOE's) export control assistance programs concentrate on the nuclear sector. DOE export control assistance is funded partly by its own funds, and partly by funds from NADR. Most assistance has targeted Russia, Ukraine, and Kazakhstan, but DOE is working on strengthening its ties with other NIS and has worked with Belarus in the past. Launched in 1995, DOE export control efforts have been implemented on three levels: government-to-government, laboratory-to-laboratory, and, more recently, multilateral projects. DOE export control assistance programs have focused on developing technical expertise in the NIS, in order to establish a cadre of experts that can play a role similar to that of the national laboratories in the United States. Similar to DOC, DOE aims to provide assistance in five functional areas: (1) helping develop licensing procedures; (2) establishing and enhancing the legal and regulatory framework; (3) engaging and using technical expertise and information; (4) promoting multilateral standards of conduct; and (5) increasing awareness among industry and government officials.<sup>17</sup> In Russia, for example, DOE has funded training seminars by the CEC for internal compliance personnel from nuclear facilities, just as DOC has funded similar seminars for firms dealing in dual-use equipment.<sup>18</sup> DOE has also funded the English-language training of Russian, Ukrainian, and Kazakhstani export control officials in the United States in order to improve their ability to interact with US and international colleagues.<sup>19</sup>

#### **Programs to Strengthen Border Controls and Block Illicit Trafficking**

Other assistance programs aim to strengthen NIS border controls by training personnel and providing equipment to detect illicit trafficking. These programs seek to upgrade the final element of national export control systems in the NIS—the enforcement of export controls at international borders. Some of these programs aim specifically at improving the ability of border guards and customs personnel to detect certain types of contraband, such as smuggled nuclear materials, while others seek to improve overall awareness of export control issues by NIS law enforcement officials.

#### *Department of Energy*

Since 1998, DOE has moved to supplement its MPC&A program with assistance aimed at blocking illicit trafficking in nuclear materials. The program, called the Second Line of Defense (SLD), seeks to improve Russian capabilities to prevent leakage of nuclear materials and technology.<sup>20</sup> In FY 1998, DOE and the Russian State Customs Committee signed a protocol on cooperation in this area. The SLD program, funded modestly at a level less than \$1 million per year (FY 2000 funds come from NDR, but in FY 2001, plans call for funds to be included in the DOE budget), has concentrated on training Russian State Customs Committee officials and on procuring Russian detection equipment for Customs Committee sites and border crossings.<sup>21</sup> The Russian State Customs Committee had already developed portable radiation detectors and portal monitors, but needed financing to purchase and install them. An internal strategy team determined the priorities of the SLD program. This team concluded that detection technology should be installed primarily on the southern borders of Russia, where nuclear smugglers might try to transport material on its way to states of proliferation concern in the Middle East and South Asia. In its first two years, program activities included installation of detectors and portal monitors at Moscow's Sheremetevo-1 airport, which handles flights to many of the NIS, and at the port of Astrakhan on the Caspian Sea. The program hopes to upgrade border crossings at six areas in Russia during FY 2000, principally along the border with Kazakhstan, in the Caspian Sea area, and in the Far East.<sup>22</sup> The program currently does not cover the non-Russian NIS.

*Department of Defense*

DOD also manages two assistance programs that aim to stem the leakage of WMD and delivery system materials, equipment, and technology: the DOD/FBI Counterproliferation Program and the DOD/US Customs Service Counterproliferation Program. Initiated in 1995, the DOD/FBI efforts have focused on improving the qualifications of law enforcement personnel; helping develop laws, regulations, and enforcement mechanisms upon the request of participating countries; building solid long-term bureaucratic frameworks for addressing proliferation problems; and bolstering the political commitment to do so.<sup>23</sup> Implementation of these objectives has involved policy consultations, program development, training of law enforcement personnel, and procurement of equipment. To date, the DOD/FBI program has provided training to representatives from Kazakhstan, Uzbekistan, Kyrgyzstan, Georgia, Moldova, and Turkmenistan.<sup>24</sup>

Before the current DOD/Customs program began operation in 1997, the US Customs Service had already conducted some training programs using funding from the State Department's NDF. This initial effort, called Project Amber, involved basic training for representatives from the Baltic States and Central Europe. The DOD/Customs program has continued similar training, especially of operational personnel who work at border crossings, and has also provided some border control equipment, including radiation detectors. The objectives of the program are similar to those of the DOD/FBI program, except that it targets border enforcement and customs personnel. Equipment provided during this phase ranges from gloves to radiation detection pagers. Countries involved in this phase have included Kazakhstan, Georgia, and Uzbekistan.

Another major training activity of the DOD/Customs program is a cooperative training event called INTERDICT/RADACAD. This event takes place at Battelle Pacific Northwest National Laboratory, in cooperation with DOE. There, participants undergo a hands-on training course using the Hazardous Materials Management and Emergency Response (HAMMER) Training Center, where they engage in simulated scenarios. NIS participating countries have included Kazakhstan, Kyrgyzstan, Uzbekistan, Russia, Azerbaijan, and Georgia.<sup>25</sup> In addition, the DOD/Customs program sponsors a limited number of special advisors, who go on detail to participating countries for up to five months. To date

these advisors have been posted only to Central European countries and the International Atomic Energy Agency.

**Programs to Combat Brain Drain**

The United States also supports several programs that attempt to prevent the leakage of WMD-related knowledge and technology, a phenomenon known as "brain drain," to countries of proliferation concern or terrorist organizations. In the first few years after the collapse of the Soviet Union, there was considerable fear in the West that former Soviet weapons scientists, including designers of nuclear weapons and ballistic missiles, might seek employment in countries such as Iran, Iraq, or North Korea, owing to poor economic conditions in the NIS. More recently, concerns have focused on another variant of this problem: the possible training of weapons scientists and engineers from countries of proliferation concern in the NIS. US programs aimed at stopping brain drain offer NIS scientists and engineers alternative employment in peaceful research and cooperative activities. Below are descriptions of some of the larger efforts, which are principally managed by the Department of State and the DOE.

*Department of State*

The State Department manages US participation in two international organizations established specifically to combat the threat of brain drain from the former Soviet Union: the International Science and Technology Center (ISTC), formally established in 1993, and the Science and Technology Center of Ukraine (STCU), created in 1995.<sup>26</sup> These centers, chartered by international agreements and funded by the European Union, Japan, Canada, and several other countries in addition to the United States, provide financial support to qualified former weapons scientists who submit proposals to research grant competitions. Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan, and Russia are the NIS members of the ISTC, while Georgia, Ukraine, and Uzbekistan are members of the STCU. Scientists from all of these countries have received grants from the centers. Proposals are evaluated by the Governing Board of each center—which represents all its members—and approved depending on a combination of scientific, political, and nonproliferation considerations. As of the 20th meeting of its Governing Board in October 1999, the ISTC has funded 835 projects worth \$231 million, providing em-

ployment to some 24,000 NIS scientists and engineers.<sup>27</sup> As of the ninth meeting of the STCU Governing Board in December 1999, the STCU has approved over 240 projects with a value of \$32.1 million. These STCU projects have engaged over 5,000 NIS scientists and engineers.<sup>28</sup>

The science centers initially focused more on supporting basic and applied research and technology development, but are increasingly oriented toward finding commercial applications for former weapons technology. The US portion of funding for these centers comes from NADR.<sup>29</sup> Since 1997, both centers have actively sought to engage Western firms in selected projects through their Partner Programs. These projects aim to reduce dependence on government funding, increase project sustainability, and promote integration of NIS researchers into the international research and development community. As of December 1999, for example, the ISTC has approved 71 partner projects worth a total of \$16.6 million.<sup>30</sup>

In FY 1996, the State Department also began funding the Civilian Research and Development Foundation (CRDF), which was created in 1995 by the National Science Foundation with CTR money from DOD and a grant from the Soros Foundation. Unlike the multilateral science centers, CRDF is a US program that provides grants for US-NIS cooperative activities. Its annual budget is much smaller than that of the science centers, with FY 1998 funding, for example, only \$1.8 million (\$1.6 million from the State Department and \$200,000 from the National Institutes of Health). CRDF has provided funding for collaborative work between US scientists and scientists in Armenia, Russia, Ukraine, and Uzbekistan.<sup>31</sup> CRDF grants are often made to individual scientists, rather than to project teams, as is the case with ISTC and STCU grants.

#### *Department of Energy*

DOE has two programs aimed at stemming brain drain: the Initiatives for Proliferation Prevention (IPP) and the Nuclear Cities Initiative (NCI). The primary goal of IPP is nearly identical to that of the ISTC and STCU. It offers NIS weapons scientists and engineers the opportunity to work with US counterparts on the development of commercially viable, non-military projects. Because of their heavily developed weapons infrastructure, funding has gone towards projects in Belarus, Kazakhstan, Russia, and Ukraine only, with 85 percent of the projects

in Russia.<sup>32</sup> As of the end of FY 1999, IPP had approved 511 projects. As of January 2000, 200 of these projects are active. Overall, IPP projects have engaged about 6,200 NIS scientists, engineers, and other staff at over 170 NIS institutes. Seventy percent of the projects have been in the nuclear sector, and 30 percent in the chemical and biological sectors.<sup>33</sup> Since 1994, IPP has received about \$159 million in funding, and it received \$22.5 million for FY 2000 out of a requested \$30 million.<sup>34</sup> In principle, each project funded by the program should proceed through three stages, culminating in the location of a US commercial partner and the eventual withdrawal of US government funding. Few IPP projects have reached this final stage, however.<sup>35</sup>

In the fall of 1998, DOE started the NCI, a program targeted at Russia's formerly closed nuclear cities. The program aims to create 30,000 to 50,000 jobs in the 10 closed cities of the Russian nuclear complex within five to seven years, at a cost of \$550 million. NCI is concentrating initially on pilot programs in the closed cities of Arzamas-16 (Sarov), Chelyabinsk-70 (Snezhinsk), and Krasnoyarsk-26 (Zheleznogorsk).<sup>36</sup> It seeks to create employment for displaced weapons workers from these cities in civilian jobs, facilitating the downsizing and conversion of the Russian nuclear weapons complex. NCI plans to cultivate a civilian private sector culture by promoting product diversification, the development of entrepreneurial skills, and the creation of conditions conducive to attracting foreign investment. The program only took its first steps during 1999, but it has already had to scale back its goals, owing to congressional skepticism about their feasibility. DOE requested \$30 million for the program in FY 2000. Congress allocated only \$7.5 million, and also imposed several restrictions on the program, including limiting its operations to three nuclear cities—Snezhinsk, Sarov, and Zheleznogorsk—and two serial assembly plants. DOE has accordingly decided to focus NCI on these three pilot cities for the year 2000.<sup>37</sup>

#### **ASSESSMENT OF PROGRAMS**

Assessing the effectiveness of these US assistance programs presents a number of difficulties. Although there is broad agreement that weak export control systems, uncontrolled borders, and under-employed former weapons scientists increase the risk of WMD proliferation from the NIS, it is difficult to gauge the magnitude of these threats. Along these same lines, while it is clear

that the US programs outlined above have mitigated these risks to some extent, it is hard to quantify the extent to which they have done so. At the same time, it is also clear that the proliferation risks that these programs address persist, if at a lower level than before, and are unlikely to be completely eliminated in the near future. Taking these considerations into account, the sections below represent a preliminary attempt to evaluate the effectiveness of these programs. For each area—export control assistance, border control assistance, and assistance to combat brain drain—program accomplishments and remaining challenges are discussed. The final section of the paper contains policy recommendations for future action across all of the three functional areas.

### Export Control Assistance Programs

US export control assistance programs have significant accomplishments to their credit. They have helped lay the legal and institutional basis for nuclear, missile, and dual-use export controls in Russia, Ukraine, and Kazakhstan, and to a lesser extent in Georgia and Belarus. In several cases, US assistance directly influenced the actual text of export control legislation and regulations in the NIS. For example, in part as a result of interaction with US officials, Russia introduced the principle of “catch-all” export controls in January 1998, and this principle was also included in the new Russian export control law that took effect in July 1999.<sup>38</sup> US assistance has also played a major role in promoting the establishment of internal compliance programs at nuclear and defense-related firms in Russia and Ukraine. The new Russian export control law requires that such programs be established at Russian firms that regularly trade in sensitive military and dual-use technologies. In both Russia and Ukraine, US-funded industry outreach programs are increasing awareness of export controls at these firms.<sup>39</sup> Georgia and Kazakhstan have also passed export control legislation, and Ukraine has draft legislation under consideration. Considering the weaknesses of export controls in the NIS right after the collapse of the Soviet Union, these accomplishments are not inconsiderable, and were purchased at a relatively modest price.

Despite these successes, many challenges remain. While the legislative and regulatory standards for export controls have been established in many of the NIS, the enforcement of these provisions remains sporadic. In Russia, for example, no one was prosecuted as a re-

sult of the 1995 case involving the export of strategic missile gyroscopes to Iraq.<sup>40</sup> Ukrainian export control officials also admit that although they have detected some violations of their export control regulations, no one has been prosecuted for them.<sup>41</sup> Allegations about the transfer of ballistic missile technology to Iran continue to be leveled at several Russian firms, which have been sanctioned by the United States, but not prosecuted by the Russian government.<sup>42</sup> US assistance programs should not take the blame for this situation, however, which is largely the result of domestic political conditions in the NIS. US assistance has had a real role in laying the foundations of export control systems in the NIS, and has thus reduced the threat of illicit export of WMD technologies from the region. Without better enforcement, however, the effectiveness of this assistance will be reduced.

One important aspect of this problem is the relative lack of export control educational and reference materials in the NIS. There is currently no export control curriculum in use at major NIS technical universities. As a result, graduates of these institutions, as well as many faculty members, have an insufficient awareness of the role of export controls in national security policy. NIS firms dealing in WMD-related technologies often do not have a solid understanding of their country’s export control system, and obtaining relevant information and reference material can be difficult. NIS NGOs, with US financial assistance, are making efforts to fill these gaps, but their efforts are as yet insufficient. Officials at CEC, for example, report that they cannot satisfy the demand for the export control reference materials that they produce.<sup>43</sup>

It should also be noted that even the legal and institutional infrastructure for an effective export control system has not yet been established in many of the NIS, especially in the “southern tier.” Although these countries do not have significant nuclear or WMD capabilities, they are nonetheless possible routes of transit for illicit WMD shipments.

As long as the economic situation remains grim in many of the NIS, progress will be difficult. Many NIS firms with WMD-related technology continue to receive offers from countries of proliferation concern. For example, Kazakhstani officials have told CNS that Iranian agents approached the Ulba Metallurgy Plant to purchase nuclear technology. Also, in 1994 and 1995, Iraqi agents negotiated with a number of NIS firms, including the

Yuzhmash Production Association in Ukraine and the Mars Rotor Plant and Energomash in Russia,<sup>44</sup> for missile technology. Attempts to implement firm-level internal export control compliance programs may not deliver solid results under these conditions.

US export control assistance programs themselves also have some shortcomings. While it makes sense administratively for funding to be centralized with the State Department, this centralization generates some problems in implementation. The Department of Commerce has had great success with its educational and outreach programs in the NIS, but it must apply to the State Department for financing of these programs, and the cumbersome approval process has delayed some assistance programs and hampers long-term planning. Some officials have also suggested that the experience of the DOE export control assistance programs in Russia is in some cases being mechanically applied to the other NIS, even when the conditions in the other NIS make the Russian experience of dubious relevance.<sup>45</sup> Another shortcoming is the lack of a clear long-term sustainability program. The Department of Commerce does have a strategic plan for its NIS export control assistance program, but an inter-agency strategic plan for overall export control assistance to the NIS has not yet been accepted.<sup>46</sup> US State Department officials insist that coordination issues are not a serious problem, but the absence of a strategic vision defining the long-term objectives of US export control assistance to the NIS remains a real concern. The continuing lack of a top-level nonproliferation "czar" to coordinate US nonproliferation policy, despite the provisions of the 1996 Nunn-Lugar-Domenici legislation calling for the establishment of such a position, may be contributing to this problem.

### **Programs to Strengthen Border Controls and Block Illicit Trafficking**

These programs also have some solid accomplishments to their credit. US funding has helped to significantly upgrade the qualifications of and equipment available to NIS customs officials. The purchase and installation of radiation detection equipment through the DOD/Customs program and the Second Line of Defense Program have increased the probability that smuggled nuclear materials will be detected before they leave the NIS. These programs have accelerated the installation of radiation detection equipment along Russia's borders, for example. One Russian official estimated that with-

out US assistance it would take at least 10 years for all the major Russian border crossings to receive such equipment.<sup>47</sup> As this equipment has been installed, it has enabled Russian customs officials to detect a larger number of attempts to export nuclear and radioactive materials illegally. In 1998, for example, the Russian State Customs Committee detected "about 100" attempts to import or export radioactive isotopes or nuclear materials illegally.<sup>48</sup> In contrast, Russian experts have estimated that in 1995, Russian customs officials detected only about five such cases.<sup>49</sup> Preliminary estimates for 1999 indicate the rate of detection is still increasing, and Russian customs officials attribute this increase directly to the equipment at their disposal.<sup>50</sup>

The Russian State Customs Committee has also consolidated all customs checks of radioactive material being legally shipped out of the country at 18 posts. These posts have been equipped with detectors and other equipment, which make it easier for customs officials to verify the contents of legal shipments of radioactive material. In some previous cases of nuclear smuggling, one radioactive isotope was shipped out of the country under a license for another isotope, which raised concerns that weapons-useable nuclear materials might be smuggled out of Russia under the pretext of a legal shipment of radioactive isotopes. The increased capabilities provided by US assistance have helped reduce the probability that this method of smuggling nuclear materials could be used successfully.

There has also been some effective synergy between these border control programs and other US nonproliferation assistance programs. The ISTC, for example, helped fund the testing of some of the radiation monitoring devices supplied by US Customs. In addition, a current project underway with STCU funding at the Institute of Nuclear Physics in Tashkent, Uzbekistan, will design radiation monitors for use in Central Asia.<sup>51</sup>

Nevertheless, there have been some difficulties in these programs. Russian and US officials have had some disagreements about the placement of detectors for the Second Line of Defense Program. US officials want to place the detectors in the Russian Far East (to prevent possible illicit transfers to North Korea) and along the southern borders of Russia (to prevent possible illicit transfers to the Middle East and/or South Asia). Russian officials have wanted to place detectors along the border with China, to prevent illicit import of radioactive waste from China. However, officials of both countries



have said that these disputes are “normal” and are being resolved in a businesslike manner.<sup>52</sup> It also appears that the US-Russia agreement on sharing intelligence data regarding nuclear smuggling that was reached at the April 1996 Group of Eight nuclear security summit is not being fully implemented. Improved information sharing would enable these programs to become more effective.

Some of the most likely routes for illicit traffickers in WMD technology remain relatively unguarded. The Turkmenistan-Iran border is a good example, as is the Russian-Kazakhstani border and the Black Sea ports in Ukraine. The increasing integration of Belarus and Russia also opens up a potential smuggling route. The seizure in March 1998 by Azerbaijani officials of a consignment of maraging steel destined for Iran demonstrates the importance of many NIS countries as transit routes.<sup>53</sup>

Consequently, the overall effectiveness of these border control assistance programs remains difficult to assess. Since 1995, there have not been any confirmed cases of smuggling in the NIS involving weapons-grade nuclear materials such as highly enriched uranium or plutonium. It remains unclear whether this absence of confirmed cases means there is no smuggling of such materials taking place, or if more sophisticated nuclear traffickers are using smuggling routes and techniques that allow them to evade detection. While the publicity surrounding the installation of US-funded border control equipment may have a deterrent effect on potential nuclear smugglers, traffickers in WMD technology may simply be exploiting the still uncontrolled borders noted above to avoid detection. It must also be noted, however, that corruption remains a serious problem and potentially undermines the effectiveness of US assistance programs.

### **Programs to Combat Brain Drain**

US programs to combat possible brain drain of WMD specialists from the NIS appear to have been relatively effective. The lack of confirmed large-scale brain drain to countries of proliferation concern can be attributed at least in part to the science centers and IPP. The ISTC and the STCU, for example, have together employed close to 30,000 NIS weapons scientists and engineers in over 1,000 projects worth over \$260 million.<sup>54</sup> Officials at the ISTC admit that it is difficult to prove that the lack of obvious brain drain is attributable to the assistance provided by the science centers and other

similar programs. But they are also correct when they state that the existence of the ISTC has changed the atmosphere among former Soviet weapons scientists and given them a realistic means to convert their skills to civilian uses.<sup>55</sup> Although it cannot easily be quantified, this development should be considered a major success of US nonproliferation assistance policy.

In addition, the multilateral approach embodied in the ISTC and STCU has contributed to their accomplishments. As international organizations, the science centers have a special tax-free status, which has helped them develop a highly effective means of targeting their funds directly on former weapons scientists, with relatively low overhead. The centers have thus avoided many of the taxation issues and high overhead costs that have plagued other similar programs, such as IPP. The multilateral character of the science centers also means that the United States can “leverage” its contributions to the centers by encouraging additional funding from other members, such as the European Union and Japan. Another major accomplishment of the science centers has been their effective collaboration with other US nonproliferation assistance programs, as in the development of radiation detectors in Uzbekistan or collaboration with IPP on a beryllium toxicity project at the Ulba Metallurgical Plant in Kazakhstan. Another positive step by the centers is their efforts to attract private sector “partners” to participate in projects. The increasing number of such “partner projects” at both centers demonstrates that they are working toward long-term sustainability. Other assistance programs in this area do not appear to have made as much progress in this direction yet, although IPP is now also placing increasing emphasis on projects that produce commercially viable products.<sup>56</sup>

Despite these successes, difficulties remain. Although a large-scale emigration of former Soviet weapons scientists to countries of proliferation concern has not occurred, anecdotal evidence suggests that individual cases persist. The Russian Federal Security Service admitted in July 1998, for example, that two Russian defense firms specializing in air-defense missiles sent employees to work in Iran using falsified documents to circumvent travel restrictions. Chinese sources have reported that Ukrainian missile experts provided “on the spot” assistance to the North Korean Taepodong missile test launch in August 1998.<sup>57</sup> Russian sources have said that Ukrainian missile experts are assisting China to develop MIRV

technology.<sup>58</sup> While US assistance appears to have diminished the scale of this problem, it has not eliminated it. In this regard, it is worth noting that the ISTC and STCU are able to fund less than half of the project applications they receive. Of the 1,920 proposals registered by the ISTC since its founding, for example, only 835, or 44 percent, received funding. Even assuming that some of these projects were not of high quality, there is clearly scope for further cooperation in this area.

A significant proliferation threat is also posed by the training of personnel from countries of proliferation concern at NIS facilities, including institutions of higher education. After repeated protests by the United States that Iranian students were receiving training in missile technology at Baltic State Technical University, the Russian Federal Security Service shut down a training program at the university for Iranian students in July 1998, citing national security considerations.<sup>59</sup> CNS contacts in September 1999 with faculty at the Bauman Moscow State Technical University, which has also been accused by Western sources of training Iranian missile specialists, revealed a weak grasp of nonproliferation issues. This finding suggests that the risk of brain drain through training remains high.<sup>60</sup> Current US assistance programs are not well-suited to combat this threat since, as previous studies have shown, a scientist who is employed by a US assistance program may also be involved in other programs, including weapons programs.<sup>61</sup> These programs also do not appear to have targeted institutions of higher technical education, which have become one of the leading sources of WMD-related technology leakage from the NIS.

Examination of the main programs in this area—ISTC, STCU, IPP, CRDF, and NCI—suggests a large degree of overlap. The exact rationale for maintaining several programs with highly similar objectives is not entirely clear, although US officials argue that the different programs give US policymakers a flexible and varied set of policy instruments with which to address the brain drain issue.<sup>62</sup> While there is some truth to this argument, and cooperation among US officials implementing these programs appears good, overall strategic vision seems lacking. One result of this overlap may be an over-emphasis on the nuclear sector, as opposed to the missile, chemical, and biological sectors. At the same time that DOE is working to get the NCI off the ground, CRDF also has a closed cities program, under which projects operate through the ISTC. Moreover, nuclear weapons

laboratories in these closed cities are among the leading recipients of grants through the ISTC. Of course, it makes sense to devote significant resources to help prevent nuclear technology leakage from these sensitive facilities, but it might be more effective to better coordinate and consolidate this assistance. This point is reinforced by the cases cited above that suggest the rising threat of missile technology proliferation from the NIS. Consolidation on the nuclear side might free up funds to target this relatively neglected sector. As in the area of export control assistance, the continuing lack of a top-level nonproliferation “czar” to coordinate US nonproliferation policy may be contributing to these problems.

While US assistance programs are turning to private industry and intensifying efforts to convert defense production to civilian uses, only modest concrete results have been achieved in this area. IPP has been criticized for spending large amounts of money—much of which went to US national laboratories rather than Russia—yet failing to produce commercially viable projects.<sup>63</sup> This criticism may be unfair, as it is inherently difficult to convert military industry to civilian industry. Nevertheless, additional efforts in this area, as have already been undertaken by the ISTC and STCU, as well as IPP, are clearly necessary over the longer term. Indeed the ISTC and STCU may be best suited to attract private Western companies to participate in projects that employ former Soviet weapons scientists, because their tax-free status allows them to offer such companies a greater rate of return on their investments.

## POLICY RECOMMENDATIONS

On the basis of these findings, the following recommendations for future policy action, many of which cut across all three functional areas examined above, warrant consideration:

- **Promote the establishment of nonproliferation curricula at NIS technical universities that produce personnel for defense-related industry, especially the missile sector.** CNS discussions at some Russian technical universities suggest that there is also an urgent need to provide faculty and administrators there with additional nonproliferation training. NIS NGOs are probably best suited to carry out this task, with US financial assistance. Such an effort should particularly target some of the institutions that have been accused of violating export controls in the past, and could draw on the experience of the MPC&A graduate program

established at the Moscow Engineering Physics Institute with DOE assistance.

- **Increase the availability of export control educational and reference materials, which are sorely lacking in many of the NIS.** NIS NGOs would be well-suited to carry out this task, since it would dovetail with their other efforts to promote public understanding of the role of export controls and border controls in national and international security.

- **Consider the creation of a special initiative targeted at the missile sector under the umbrella of the science centers.** Such a program would compensate for the tendency to emphasize the nuclear sector.

- **Enhance long-term sustainability planning for continued, regularized interaction of US and NIS export and border control officials after laws are in place and current educational programs end.** As a 1995 study by CNS of CTR-related export control assistance pointed out, the most effective collaborative programs are those which establish regularized and reliable channels of communications between the US and NIS partners.<sup>64</sup> The Department of Commerce export control assistance programs that work with Ukrainian and Russian NGOs provide good examples. Along the same lines, the science centers should intensify their ongoing sustainability efforts.

- **Modestly expand resources to work more intensely on export controls and border controls with the “southern tier” of the NIS.** This effort should focus on regularized, small, working-level meetings, and can be justified by the importance of these countries as potential transit routes to regions of proliferation concern such as the Middle East and South Asia. Future assistance—training in particular—should target current gaps, such as the Turkmenistan-Iran border.

- **Consider modestly expanding the DOE Second Line of Defense program or initiating parallel programs to include selected sites in Ukraine and Kazakhstan, which are likely routes of transit out of Russia.**

- **Improve coordination of US export control assistance programs, perhaps by centralizing them in one of the agencies that implements them, such as the Department of Commerce or Energy.** In the area of assistance to combat brain drain, it may also make sense to integrate programs like IPP and NCI more closely with the science centers in order to take advantage of each program’s strengths (for example, IPP’s emphasis on industry and the science centers’ tax-exempt status). With regard to both export con-

trol and brain drain assistance, the establishment of a nonproliferation “czar,” as called for in the 1996 Nunn-Lugar-Domenici legislation, could help foster development of a strategic vision to guide the various agencies involved.

- **Implement the US-Russia agreement on sharing intelligence data regarding nuclear smuggling that was reached at the April 1996 Group of Eight nuclear security summit.**

- **Encourage NIS governments to take more vigorous steps to enforce export and border control regulations and prosecute violations.**

## CONCLUSION

To date, US assistance programs have made significant progress in reducing the proliferation threat from the NIS by strengthening export controls, bolstering border controls, and taking steps to reduce brain drain. The legal basis for export controls has been laid in Russia, Ukraine, Kazakhstan, and some of the other NIS. Border controls have been strengthened, especially through the provision of equipment that has led to increased detection of illicit nuclear trafficking. And about 30,000 NIS scientists and engineers have been provided with alternative employment, which has reduced the chance that they will sell their skills and knowledge to potential proliferants. Although the long-term consolidation of these gains requires improvement in the economies of Russia and the other NIS, continued US assistance for the next several years is also crucial. Many challenges remain, some of which merit additional US assistance, while others must be addressed primarily by NIS governments. Export control enforcement, for example, continues to lag in Russia, Ukraine, and Kazakhstan, even though the necessary legal framework is largely in place. Long stretches of NIS borders are poorly monitored and vulnerable to smuggling of WMD components. WMD technology and know-how continue to leak from the NIS, despite the cooperative efforts of the science centers and other US assistance programs. Thanks to the hard collaborative work of US and NIS specialists, US assistance programs in these areas have accomplished much. Building upon this foundation and expanding it where appropriate should be priorities for NIS and US leaders in the 21st century.

<sup>1</sup> The authors would like to gratefully acknowledge the assistance of Elina Kirichenko, Vladimir Orlov, and Pavel Oleinikov, who contributed research papers to this study, as well as Anne Harrington, Viktor Mizin, and Todd Perry, who provided extensive comments on an earlier version of this paper. Any shortcomings, however, are the sole responsibility of the authors.

<sup>2</sup> Yevgeniy Tkachenko, "FSB Agents Prevent Theft of Nuclear Materials," ITAR-TASS, December 18, 1998.

<sup>3</sup> Dmitriy Litovkin, "Viktor Yerastov: Yadernyye zloumyshlenniki v Chelyabinskoy oblasti mogli nanesti serezhnyy vred gosudarstvu [Viktor Yerastov: Nuclear Thieves in Chelyabinsk Oblast Could Have Inflicted Serious Harm on the State]," *Yadernyy kontrol* No. 6 (November-December 1999), p. 40.

<sup>4</sup> Rudolf von Shlessinger, "Ulbinskiye milliony [Ulba's Millions]," *Novoye pokoleniye* (Almaty), February 26, 1999, p. 1.

<sup>5</sup> "Zirconium Smugglers Arrested," ITAR-TASS, May 20, 1999.

<sup>6</sup> Olga Semenova, "Security Service Cracks Down on Weapons Technology Exports," ITAR-TASS, July 13, 1999, in FBIS document FTS19980713001516 (July 13, 1998).

<sup>7</sup> For a discussion of the development of these US export control assistance programs, see Michael H. Newlin, "Export Controls and the CTR Program," in John M. Shields and William C. Potter, eds., *Dismantling the Cold War: US and NIS Perspectives on the Nunn-Lugar Cooperative Threat Reduction Program* (Cambridge, MA: MIT Press, 1997), pp. 291-308.

<sup>8</sup> US Department of State official, Washington, DC, telephone interview with author, April 1999.

<sup>9</sup> Nonproliferation and Disarmament Fund website, <<http://www.ndf.org/>>.

<sup>10</sup> Ibid.

<sup>11</sup> US Department of Commerce officials, Washington, DC, telephone interview with author, January 2000.

<sup>12</sup> US Department of Commerce officials, interview with author, Washington, DC, May 1999. See also US Department of Commerce, Bureau of Export Administration, *Strategic Plan: Nonproliferation and Export Control Cooperation (NEC) Program 1996-2000*, September 1996.

<sup>13</sup> In early 1999, NEC received permission to start working with Azerbaijan also, despite the fact that Section 907 of the Freedom Support Act, which prohibits all but humanitarian assistance to Azerbaijan because of its embargo on Armenia, remains in place.

<sup>14</sup> US Department of Commerce officials, interview with author, Washington, DC, May 1999.

<sup>15</sup> Center for Export Control personnel, interview with author, Moscow, Russia, September 1999.

<sup>16</sup> Scientific and Technical Center for the Import and Export of Special Technologies, Equipment, and Hardware personnel, interview with author, Kiev, Ukraine, September 1999.

<sup>17</sup> US Department of Energy officials, interview with author, Washington, DC, May 1999.

<sup>18</sup> Center for Export Control personnel, interview with author, Moscow, Russia, September 1999.

<sup>19</sup> For details of this training program, see the Center for Nonproliferation Studies website, <<http://cns.miis.edu/cns/projects/nisnp/training.htm#ELAN>>.

<sup>20</sup> For a Russian view of this program, see Aleksandr Gromov, "Sotrudnichestvo Gosudarstvennogo tamozhennogo komiteta RF i ministerstvo energetiki SshA po programme 'vtoraya liniya zashchity,'" in *Programma sovmevnogo umensheniya ugrozy: otsenka effektivnosti i perspektivy razvitiya*, PIR-Tsentri Nauchnye Zapiski (Research Notes), no. 13, January 2000, pp. 43-45.

<sup>21</sup> US Department of Energy official, interview with author, Washington, DC, May 1999.

<sup>22</sup> US national laboratory personnel, interviews with author, Monterey, CA, December 1998 and November 1999.

<sup>23</sup> Office of the Coordinator of US Assistance to the NIS, *US Government Assistance to and Cooperative Activities with the New Independent States of the Former Soviet Union FY 1998 Annual Report*, January 1999, pp. 165-166.

<sup>24</sup> Ibid. See also US Department of State, *Expanded Threat Reduction Initiative*, March 1999, pp. 17-18.

<sup>25</sup> US Customs Service personnel, interview with author, Washington, DC, May 1999. See also US Customs Service, *US Customs Service Export Control and Counterproliferation Training Programs*, May 1999.

<sup>26</sup> For a discussion of the founding and early history of both organizations, see Glenn E. Schweitzer, *Moscow DMZ: The Story of the International Effort to Convert Russian Weapons Science to Peaceful Purposes* (Armonk, NY: M.E. Sharpe, 1996); and Adam Moody, "The International Science Center Initiative," in Shields and Potter, eds., *Dismantling the Cold War*, pp. 251-290.

<sup>27</sup> "Statement of the 20<sup>th</sup> Governing Board of the International Science and Technology Center, Moscow, Russian Federation, 27 October 1999," <<http://www.istc.ru>>.

<sup>28</sup> "Joint Statement: STCU Governing Board Meeting, December 15, 1999;" and "STCU Project Employment Status as of 22 November 1999," <<http://www.stcu.kiev.ua>>.

<sup>29</sup> US State Department website, <[http://www.state.gov/www/budget/1999\\_budget\\_forops.html](http://www.state.gov/www/budget/1999_budget_forops.html)>.

<sup>30</sup> ISTC officials, Moscow, Russia, correspondence with the author, January 10, 2000.

<sup>31</sup> *US Government Assistance to and Cooperative Activities with the New Independent States*, pp. 174-175. See also the Civilian Research and Development Foundation website, <<http://www.crdf.org>>.

<sup>32</sup> In accordance with US policy, IPP has not funded any projects in Belarus since 1997, when the US government decertified Belarus, accusing it of violating international human rights standards.

<sup>33</sup> Peter Green, Deputy Director of the IPP program, US Department of Energy, interview with author, Washington, DC, January 2000.

<sup>34</sup> Ibid., and *Expanded Threat Reduction Initiative*, March 1999, pp. 22-23.

<sup>35</sup> US General Accounting Office, *Concerns with DOE's Efforts to Reduce the Risks Posed by Russia's Unemployed Weapons Scientists*, GAO/RECD-99-54, February 1999.

<sup>36</sup> Russian American Nuclear Security Advisory Committee, *The Nuclear Cities Initiative: Status and Issues*, January 1999, <<http://www.princeton.edu/~ransac/start.html>>.

<sup>37</sup> Walter Pincus, "Funds to Hire Russian Atom Scientists Cut," *Washington Post*, November 12, 1999, p. A8, <<http://www.washingtonpost.com/>>; *Nuclear Cities News* 1 (December 1999), <<http://www.Princeton.edu/~ransac/initiatives/city-news.html>>.

<sup>38</sup> *Rossiyskaya Gazeta* (online edition), July 29, 1999, pp. 4-5, in "Export Control Law Published," FBIS Document FTS19990802000019 (August 2, 1999).

<sup>39</sup> Center for Export Control personnel, interview with author, Moscow, Russia, September 1999; Scientific and Technical Center for the Import and Export of Special Technologies, Equipment, and Hardware personnel, interview with author, Kiev, Ukraine, September 1999.

<sup>40</sup> Vladimir Orlov and William Potter, "The Mystery of the Sunken Gyros," *Bulletin of the Atomic Scientists* 54 (November-December 1998), pp. 37-38.

<sup>41</sup> Ukrainian State Export Control Service officials, interviews with author, Monterey, California, July 1999 and Kiev, Ukraine, September 1999.

<sup>42</sup> On US sanctions against Russian firms accused of assisting Iranian WMD programs, see David Stout, "U.S. Imposes Sanctions on Tech Labs in Russia," *New York Times*, January 12, 1999, p. A7; for a discussion of the export control enforcement issue in Russia see Vladimir Orlov, "Export Controls in Russia: Policies and Practices," *The Nonproliferation Review* 6 (Fall 1999), pp. 139-151.

<sup>43</sup> Center for Export Control personnel, interview with author, Moscow, Russia, September 1999.

<sup>44</sup> Kazakhstani government officials, interview with author, Almaty, Kazakhstan, 1997; Orlov and Potter, "The Mystery of the Sunken Gyros," p. 36.

<sup>45</sup> DOE official, interview with author, (name and place withheld on request), September 1999.

<sup>46</sup> Department of Commerce official, Washington, DC, telephone interview with author, January 2000.

<sup>47</sup> Russian State Customs Committee officials, interview with author, Moscow, July 1999.

<sup>48</sup> "V proshlom godu tamozhenniki presekli okolo 100 popytok provoza delyashchikh i radioaktivnykh materialiov," Interfax, February 3, 1999. This report did not specify how many cases were attempted imports and how many were exports, nor did it specify how many cases involved nuclear materials as opposed to radioactive isotopes. Russian officials have said that of these 100 cases, about 40 percent were attempted exports from Russia, while 60 percent were attempted imports, Russian State Customs Committee officials, interviews with author, Monterey, CA, December 1999.

<sup>49</sup> PIR Center researcher, interview with author, Moscow, Russia, September 1999.

<sup>50</sup> Russian State Customs Committee officials, interviews with author, Monterey, CA, December 1999.

<sup>51</sup> STCU staff, interview with author, Kiev, Ukraine, September 1999.

<sup>52</sup> Russian State Customs Committee officials, interviews with author, Monterey, CA, December 1999; US Department of Energy officials, interviews with author, Monterey, CA, December 1999.

<sup>53</sup> Michael R. Gordon with Eric Schmitt, "Iran Nearly Got A Missile Alloy From Russians," *New York Times*, April 25, 1998, p. 1A.

<sup>54</sup> For more information see the International Science and Technology Center website, <<http://www.istc.ru>> and the Science and Technology Center of Ukraine website, <<http://www.stcu.kiev.ua/>>.

<sup>55</sup> ISTC official, interview with author, Moscow, Russia, September 1999.

<sup>56</sup> Peter Green, Deputy Director of the IPP program, US Department of Energy, correspondence with author, January 2000.

<sup>57</sup> Center for Nonproliferation Studies, Monterey Institute of International Studies and Institute for Contemporary International Problems, Moscow, *DPRK Report* (November-December 1998), <<http://cns.miis.edu/pubs/dprkrprt/98novdec.htm>>.

<sup>58</sup> Russian government officials, interview with author, Monterey, CA, November 1998.

<sup>59</sup> Semenova, "Security Service Cracks Down on Weapons Technology Exports."

<sup>60</sup> Bauman Moscow State Technical University faculty, interview with CNS researcher, Moscow, Russia, September 1999.

<sup>61</sup> US General Accounting Office, *Concerns with DOE's Efforts to Reduce the Risks Posed by Russia's Unemployed Weapons Scientists*.

<sup>62</sup> US Department of State official, interview with author, Monterey, CA, December 1999.

<sup>63</sup> US General Accounting Office, *Concerns with DOE's Efforts to Reduce the Risks Posed by Russia's Unemployed Weapons Scientists*.

<sup>64</sup> John M. Shields and William C. Potter, "Cooperative Assistance: Lessons Learned and Directions for the Future," in Shields and Potter, eds., *Dismantling the Cold War*, pp. 395-396.