Abstract.

During the past three years there have been at least five cases where weapon-usable fissile material, in amounts ranging from a few hundred grams to a few kilograms, has been stolen from nuclear facilities and subsequently recovered by government authorities. At least four, and perhaps all five, of these cases involve thefts from institutes in Russia, a weapon state not subject to international safeguards. Cooperative efforts between the United States and Russia to improve fissile material physical protection, control and accounting (MPC&A) during this period have achieved only very limited improvements and at only a few of the many facilities that store or utilize weapon-usable fissile materials. Relative to the task at hand, these cooperative efforts are under-funded, too limited in scope and are moving too slowly. To achieve meaningful progress the nuclear weapons laboratories in the United States and Russia should initiate a cooperative program designed to research, develop, and demonstrate a **safeguards regime covering all nuclear weapons and weapon-usable fissile materials in the weapon states**. Initially this would be a U.S.-Russian bilateral effort. If we are to achieve deep reductions in the global nuclear arsenals, such a safeguards regime for the weapon states is needed.

I. Diversions of Weapon-Usable Materials from Russian Facilities.

We estimate that about 28,000 intact nuclear weapons remain in the FSU, and that about 1000 tons of weapon-usable highly-enriched uranium (HEU), 170 tons of separated plutonium in weapons or available for weapons, and 30 tons of separated civil plutonium are stored in Russia. Most, if not all, of these inventories are stored under inadequate conditions of physical security and of material control and accounting.

Russian President Boris Yeltsin has said that 40 percent of individual private businessmen and 60 percent of all Russian companies have been corrupted by organized crime. Corruption is rife in the Russian Army; approximately 3,000 officers have been disciplined for engaging in questionable business practices, and 46 generals and other officers face trial on criminal charges, according to a recent Department of Energy report.[1] In 1992, some 40,000 charges of corruption were brought against members of the Russian armed forces. In the same year, the Russian defense ministry reported 4,000 cases of conventional weapons missing from military depots and nearly 6,500 cases in 1993.[2]

Since passage of the Nunn-Lugar Act of 1991, five serious cases of diversion of weapon-usable fissile material have occurred--three involving 1.5 to 3 kilograms (kg) of HEU, and the

---

[1] U.S. Department of Energy, Office of Intelligence and National Security, Office of Threat Assessment, "The Russian Mafia," 15 November 1993.

[2] "The High Price of Freeing Markets," *The Economist*, 19 February 1994, as cited by Jonathan Dean in "The Final Stage of Arms Control," Union of Concerned Scientist, 21 May 1994.

other two involved over 100 grams of HEU or plutonium (Table 1). Most, if not all, of the materials were stolen from Russian nuclear facilities, and in two cases the materials were intercepted outside of Russia. We are told that the U.S. has been informed that a larger amount of weapon-usable material was stolen, and that a substantial fraction remains unaccounted for, but we do not know the details, and are not in a position to judge the validity of this case.

Setting aside the one classified case, several conclusions can be drawn from the five most serious cases that have been revealed:

1) kilogram quantities of weapon-usable fissile materials are being stolen from institutes in Russia;

2) some fraction of these materials are not being intercepted before leaving the Russian borders; and

3) organized crime elements were involved in one known case to date (Vilnius), although it is not clear they knew they were shipping fissile material.

4) All known cases involved diversions from civil, space, and naval reactor research and fuel manufacturing facilities. No known diversions have occurred that involved nuclear weapons or weapon components.

5) We don't know what we don't know. Given the lack of adequate inventory controls, there may well have been successful diversions that have not been detected.

II. U.S.-Russian Cooperative Efforts to Improve MPC&A in Russia.

The U.S. effort to assist Russia in improving MPC&A currently has the following components:

* The U.S. Department of Defense's (USDOD's) Cooperative Threat Reduction program responsible for administering funding provided under the Soviet Threat Reduction Act of 1991 (also known as the "Nunn-Lugar Act"), and subsequent congressional appropriations. In the U.S. this program is referred to as the "Nunn-Lugar," or "Government-to-Government" effort.

* A program of cooperation among U.S. and Russian nuclear laboratories, initiated last April and administered by the U.S. Department of Energy (USDOE). It is called the Laboratory-to-Laboratory Nuclear Materials Protection, Control, and Accounting Program, but more often simply referred to as the DOE administered "Lab-to-Lab" program.

* U.S. Nuclear Regulatory Commission (USNRC) cooperation with Gosatomnadzor (GAN) on development of a safeguards infrastructure for Russia.

* International Science and Technology Center (ISTC) administered MPC&A activities funded under Nunn-Lugar, including "Project 40," a GAN led project with Ministry of Atomic Energy (Minatom) cooperation to develop safeguards for plutonium processing at Tomsk-7; available funding - $0.815 M from Nunn-Lugar and $.025 M from DOE).

The first two programs, the Gov-to-Gov and Lab-to-Lab efforts, have received the greatest attention and funding. The annual funding levels for the Gov-to-Gov and Lab-to-Lab MPC&A efforts at existing facilities in Russia are shown in Table 2.

A. The USDOD administered Cooperative Threat Reduction (Nunn-Lugar) Program.

The Soviet Threat Reduction Act (Nunn-Lugar) had as its fundamental purpose assistance to (1) **destroy nuclear**, chemical and other **weapons** and (2) transport, store, disable, and **safeguard** weapons in connection with **their destruction**, and (3) **establish verifiable safeguards** against the proliferation of such weapons. Following passage of the Nunn-Lugar, the U.S. Congress has authorized $1.27 billion to carry out these tasks (See Table 3).

The USDOD lost $218 M of the original $400 M authorized in FY 1992, due to failure by USDOD to obligate the funds in a timely manner.

Following passage of the Nunn-Lugar, USDOD has allocated $211 M for Russian nuclear weapon transport, dismantlement, and fissile material security (Table 4).

Status and observations regarding selected Nunn-Lugar accounts:

1. Warhead Transport and Emergency Response ($40 M):

Kevlar blankets to protect warheads in transport from small arms fire were successfully delivered under budget (for $3.3 M) by June 1993, but this was after the tactical warheads had been transported back to Russia from dispersed deployment sites. Likewise, the first U.S.-made rail car modification kits were not shipped until April 1994. By August 1994, 80 percent of the emergency response equipment and training task had been completed. It is interesting to note that DOD allocated more funding to this task than it originally set aside for improving MPC&A at existing facilities. Also, DOD was willing to spend $15 M to show Russia how to respond to the next nuclear accident, but nothing to assist in the cleanup of the nuclear accidents that had already occurred.

2. Fissile Material Storage ($91 M):

DOD has purchased from U.S. contractors, and is storing in the United States awaiting shipment to Russia, almost $20 M in heavy equipment (bulldozers and road graders) under this program. There is no shortage of such equipment in Russia. The site for the first new fissile material storage facility at Chelyabinsk-65 has already been cleared.

3. Improving MPC&A at Existing Facilities ($30 M):

The U.S. initially offered to provide $10 M in assistance to demonstrate state-of-the-art MC&A at two facilities. Russia responded by offering the LEU line at the Elektrostal fuel fabrication plant. The U.S. declined, requesting access to the HEU line at Elektrostal. Russia said this line was used to manufacture naval fuel, and consequently, the U.S. could not be given access to this line (the Russians are not permitted access to U.S. naval fuel facilities). To date $1 M had been spent with no results. Subsequently the U.S. offered to spend $20 M to upgrade the MC&A at the facility that would be used to blend the 500 tonnes of HEU down into LEU prior to shipment to the U.S. Minatom constructed its own MC&A at the blending facility and claimed that U.S. assistance was not needed.

After failure to make progress by demonstrating state-of-the art MC&A at two facilities, the U.S. asked Russia to identify the MPC&A improvement that were most needed. The U.S. would allocate an additional $20 M in assistance to provide "quick fixes." Russia did not respond to the U.S. request to identify the quick fix sites. Funding for all three projects ($30 M less $1 M already spent) has been reprogrammed for a new Gov-to-Gov initiative approved by the Russians to upgrade MPC&A at six major risk sites (Mayak, Obninsk, Elektrostal [breeder line], Dimitrovgrad, Novosibirsk and Podolsk) The U.S.-Russian agreement to upgrade MPC&A at four high risk facilities was reached only one month ago (January 20, 1995).

B. USDOE Administered Lab-to-Lab Effort.

In response to these difficulties, and Congressional direction in the Conference Report on the FY95 Defense Authorization Act to move ahead on improving fissile material control in Russia, the Under Secretary of Energy initiated the Lab-to-Lab MPC&A program. Under this DOE administered program, U.S. national laboratories are currently working with the two Russian weapon labs, Arzamas-16 and Chelyabinsk-70, the Kurchatov and Eleron Institutes in Moscow, and the Institute of Physics and Power Engineering (IPE) in Obninsk, along with three other Russian institutes that provide a small amount of technical support.

Starting from scratch in mid-April 1994, the Lab-to-Lab cooperative effort was already installing MPC&A improvements at the Kurchatov Institute by November-December. An Arzamas-16 proposal should permit the cooperative program to expand soon to other facilities.

The USDOD-administered program to upgrade the four to six high risk sites likely will soon to be transferred from USDOD to USDOE so that the two programs can be integrated.

C. Observations.

To date, there has not been any significant improvement in MPC&A in Russia under the USDOD administered Nunn-Lugar program. In contrast to the USDOD-administered Nunn-Lugar effort, the USDOE Lab-to-Lab effort has already begun to show results. Why is the Lab-to-Lab effort working, at least on a limited scale, whereas the USDOD administered Nunn-Lugar effort failed? We believe the following are among the primary reasons:

a) The USDOD initially did not support the Nunn-Lugar effort and actually obstructed its implementation.

b) The USDOD pursued an overly restrictive interpretation of the Nunn-Lugar Act, requiring that virtually all funding go to U.S. contractors, leading Minatom officials to ridicule the program. The U.S. national labs have greater flexibility to spend money in Russia and are less encumbered by procurement bureaucracy.

c) USDOD's Office of International Security Policy, which administers the Nunn-Lugar effort, never took an active interest in fissile material control issues; other DOD programs, e.g., dismantlement of delivery systems, the Ukraine problem, reduction of alert weapons, took precedence. USDOD officials excuse the lack of progress on fissile material control by casting blame on senior Minatom officials. Managers at USDOE and the labs have a strong interest in fissile material control, and attach greater importance to insuring the success of their effort and have made it a higher priority.

d) The Clinton National Security Council (NSC), characterized by bifurcated nonproliferation/arms control responsibilities, and a lack of management skills, failed to recognize the seriousness of the nuclear diversion threat, and ignored proposals for a coordinated, government-wide response; the Lab-to-Lab effort has not been stifled by the interagency decision-making process managed by the NSC.

e) There is a camaraderie among scientists at the Russian and U.S. labs that are working together on the program.

III. Proposed New Direction.

Despite showing remarkable progress in the last few months, the USDOE administered Lab-to-Lab effort will not succeed unless there are significant changes made in the scope of its mission and the level of funding.

The current objective of the USDOE administered Lab-to-Lab MPC&A effort is "to make rapid improvements in the protection, control, and accounting of nuclear materials, especially weapon-usable materials (separated plutonium and highly enriched uranium), by working directly and cooperatively with Russian laboratories and institutes. Implementation at operating nuclear facilities in Russia, many of which are highly sensitive and inaccessible to foreigners, will be carried out by the Russian laboratories, with technical cooperation from U.S. laboratories."[3] Without a more clearly defined goal, the program will be limited on the U.S. side by intense efforts by the Congress to reduce the Federal budget, including aid to Russia. On the Russian side the program will be limited by existing security requirements and policy that restrict U.S. access to sensitive facilities.

To be effective and to gain access to sensitive nuclear weapon facilities, the cooperative MPC&A program must be viewed by Russia as completely reciprocal both in its mission and its implementation. This deficiency in the cooperative MPC&A effort could be overcome by revising the mission of the Lab-to-Lab program to include **joint research, development, and demonstration, on a bilateral basis, of a monitoring and safeguards regime designed to cover *all nuclear weapons and weapon-usable fissile materials* in the weapon states.** Only then will the parties be forced to work around problems related to classified information and materials and to begin addressing methods for adequately safeguarding the most sensitive facilities and materials in both countries. This RD&D effort could be done without making a political commitment to adopt the bilateral, or multilateral, safeguards program once demonstrated. Do the RD&D first; then have the political debate over whether the program should take on treaty status.

This expanded mission should have complete reciprocity. U.S. and Russian specialists would have equal access to each other's facilities. By covering *all weapon-usable fissile materials and nuclear weapons*, special interests, e.g., Minatom, and the U.S. Navy, cannot exclude coverage on the basis that their materials or facilities are too sensitive.

At their September 1994 summit meeting in Washington, D.C. Presidents Clinton and Yeltsin agreed to exchange data on aggregate stockpiles of nuclear warheads, on stocks of fissile materials and on their safety and security, and to exchange such information on a regular basis. The expanded Lab-to-Lab mission could become an important element of any future program to verify the data exchange once it is implemented.

If Russia and the United States ultimately are to succeed in their joint effort to prevent further proliferation of nuclear weapons, other countries must be persuaded that the existing global stocks of *nuclear weapons* and *weapon-usable fissile materials* are:

(a) steadily being withdrawn from weapons use and placed under effective safeguards that would provide timely warning of any reversion or diversion to weapons use; and

---

[3] "Integrated Action Plan for the US-Russian Laboratory-to-Laboratory Program on Nuclear Materials Protection, Control, and Accounting," Revision 1, Prepared by the Multi-Laboratory Steering Group, September 30, 1994.

(b) stored or utilized for peaceful purposes under conditions that minimize the risk of theft or seizure by unauthorized parties.

Only when such criteria are met on a global scale will it be possible to argue convincingly with other countries that the nuclear threat has been contained, and therefore that nuclear weapons are no longer needed to deter foreign nuclear threats.

Thus, if we are to achieve deep reductions in the global nuclear weapon arsenals, a safeguards regime covering the weapon states is essential. We should initiate the RD&D for such a regime now. To convince other weapon states to reduce their own arsenals significantly, they must be convinced that weapons retired under current and future arms agreements have been dismantled and all weapon-usable materials are accounted for. If we fail to implement today a comprehensive verification regime over the nuclear stockpile reduction process and fissile material inventories in the U.S. and Russia, this failure may constrain in the future how far we can go in reducing global arsenals and ending further proliferation of nuclear weapons.

Likewise, the threat of proliferation is a major obstacle to realizing the long-term future potential of nuclear power production. Without further verified deep arms reductions by the nuclear weapon powers, major improvements in the current system of international nuclear cooperation and safeguards will not be forthcoming. Without such improvements, government and public acceptance for advanced nuclear fuel cycles, possibly involving weapon-usable fissile materials, cannot be obtained. Therefore, intensified international cooperation and more effective safeguards arrangements are essential to achieving both deep arms reduction and full utilization of the nuclear power option.

Thus, given the substantial nuclear proliferation risks today, building toward a comprehensive non-discriminatory safeguards regime that covers the weapon states should be a high priority in its own right. Had this program been initiated a year ago, even on a bilateral basis, we would have improved our chances of achieving an indefinite extension of the Non-Proliferation Treaty (NPT).

The recent weapon-usable material thefts occurred in a weapon-state (Russia), not from facilities now under IAEA safeguards. But the IAEA probably is not the appropriate institution for administering safeguards over sensitive weapons facilities and materials in declared nuclear weapon states. Moreover, because Russian civil and military nuclear fuel cycle facilities are so highly integrated, Minatom does not want IAEA oversight at its nuclear facilities at this time. Thus, it makes more sense for RD&D on safeguards applicable to the weapon states to begin initially on a bilateral basis by the United States and Russia. And as noted above, this would also provide a vehicle for moving more quickly to improve MPC&A in Russia.

Table 1. Diversions of Significant Quantities of Weapon-Usable Fissile Material from Institutes in Russia.

Oct. 1992:	an employee of the Luch Production Association, which manufactures nuclear space reactors, in Podolsk was apprehended at the Podolsk train station with 1.5 kilograms of HEU in his suitcase.
May 1993:	27 crates containing 4 tonnes (t) of beryllium (Be) metal and a small quantity of HEU were discovered in a bank vault in Vilnius, Lithuania. The DOE claims there were 2 kg of U-235 mechanically implanted in the beryllium. The Lithuanian Nuclear Power Authority (VATESI) claims there were 3860 kg of pure Be and 140 kg of a Be alloy containing 150 g of uranium enriched to 50 percent. The CIA account is consistent with that of claim of VATESI, and differs from DOE's. Apparently, the beryllium was intercepted as it was being shipped from the Minatom Institute of Physics and Power Engineering (IPE) in Obninsk, by a company called AMI (two mobsters) in Zarechny, Sverdlovsk region (Yekaterinburg), to an organized crime group in Lithuania.
Feb. 9, 1994:	3 kg (90% U-235) HEU stolen from the Elektrostal plant near Moscow. A St. Petersburg butcher was apprehended in an attempt to sell it.
Aug. 10, 1994:	German authorities intercepted 0.5 kg of material in a suitcase at the Munich airport after arrival by plane from Moscow. Of this, 0.3-0.35 kg were Pu-239 (87.5% Pu-239). The Pu was a peculiar mixture of oxide powders similar to mixed-oxide (MOX) fuel. The suspected couriers, two Spaniards and a Columbian were arrested. Also in 1994 (on May 10, June 13, and August 14) German authorities intercepted smaller samples of plutonium and HEU.
Dec. 14, 1994;	2.7 kg of HEU (87.7% U-235) in the form of uranium dioxide were seized by Czech authorities in Prague. Three men were arrested: two men with Soviet passports, said to be a Ukranian and a Belarussian, and one Czech, described as a nuclear physicist.

Table 2. Annual U.S. Funding Levels for the Government-to-Government and Lab-to-Lab MPC&A Efforts for Existing Facilities in Russia.

	Gov-to-Gov	Lab-to-Lab	Total
FY-1994	$ 1 M	$ 2 M	$ 3 M
FY-1995	$29 M	$15 M	$44 M
FY-1996 (proposed)	$30 M	$40 M	$70 M
Total	$60 M	$57 M	

Table 3. Annual Nunn-Lugar Funding Levels.

FY 1992	$ 182 M
FY 1993	288 M
FY 1994	400 M
FY 1995	400 M
Total	$1,270 M

Table 4. Allocation of Nunn-Lugar Funds for Fissile Material and Nuclear Warhead Security in the FSU.

A. Warhead Transport and Emergency Response:

1)	$ 5 M	for delivery of 2,500 Kevlar armored blankets;
2)	$ 20 M	to improve the security of rail cars for nuclear weapons transport;
3)	$ 15 M	for emergency response equipment and training
Subtotal	$ 40 M	

B. Fissile Material Storage:

1)	$ 16 M	for the design, and
	$ 75 M	for the construction, of one or two fissile material storage facilities in Russia;
2)	$ 50 M	worth of fissile material storage containers;
Subtotal	$141 M	

C. Improvement in MPC&A at Existing Facilities

Russia:

1)	$ 10 M	to assist Russia in improving MPC&A (originally for improvements at Elektrostal);
2)	$ 10 M	for MC&A associated with blending HEU to LEU for sale to the U.S.; and
3)	$ 10 M	for MPC&A quick fixes at selected facilities
Subtotal	$ 30 M	
	$ 5 M	available to assist Kazakhstan with MPC&A
	12.5 M	available to assist Ukraine with MPC&A
Total:	$228.5 M	($211 M to Russia)