U.S. Assistance to Improve Physical Security and Accounting of Fissile Materials in Russia

by

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I. Introduction.

This paper is intended to provide an assessment of the progress the Administration has made in cooperative efforts to improve fissile material protection, control and accounting (MPC&A) in Russia, which inherited more than 90 percent of the Soviet Union's weapon-usable fissile material.[1] Other panelists will address progress in cooperative efforts with other republics of the former Soviet Union (FSU). For discussion purposed we divide the U.S. MPC&A assistance effort into the following components:

* The Department of Defense's (DOD's) Cooperative Threat Reduction program responsible for administering funding provided under the Soviet Threat Reduction Act of 1991 (P.L. 102-228, also known as the "Nunn-Lugar Act"), and subsequent congressional appropriations. This program is referred to as the "Nunn-Lugar," or "Government-to-Government" effort.

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

* Nuclear Regulatory Commission (NRC) 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.

The first two programs, the Gov-to-Gov and Lab-to-Lab efforts, have received the greatest attention and funding and are the focus of our assessment.

From the Administration's prospective cooperative efforts to improve MPC&A in Russia have moved slowly due to the difficulties in negotiating with Minatom officials, but that in recent months good progress has been made, and the two countries are poised to

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[1] This paper represents minor revisions of a report co-authored with Christopher E. Paine and presented on January 27, 1995 to the Panel on U.S.–Russian Cooperation to Control and Account for Fissile Material of the President's Commission for Advice on Science and Technology.

make significant progress in the future. While there is some merit in this prospective, our assessment is that:

a) the DOD administered Nunn-Lugar effort, now three years old, has failed to date to improve MPC&A in Russia;

b) the current program can be characterized as too late, too little, and too slow;

c) a large share of the blame rests squarely with the Administration; there are serious managerial deficiencies within DOD and the National Security Council (NSC) with regard to administering this effort;

d) the new DOE administered Lab-to-Lab program is making good progress; management of the residual Nunn-Lugar MPC&A efforts should be shifted from DOD to DOE; and

e) the Executive Branch has failed to construct an effective cooperative MPC&A effort; the current program mission must be revised; and MPC&A efforts should be given higher priority and accelerated if the program is to have a significant and timely impact on ongoing nuclear smuggling activities in Russia.

To assess the seriousness of the problem, and thus its rightful priority within the spectrum of potential threats to U.S. security interests. It is useful to examine the publicly known cases involving diversion of weapon-usable materials.

II. 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.[2] In 1992, some 40,000 charges of corruption were brought against members of

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

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.[3]

Reports of illegal activities in Russia associated with nuclear materials--offers to sell and successful and unsuccessful attempts to steal nuclear materials--appear in the Russian and European press at a rate of several per week. Low-enriched uranium fuel has been stolen.

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 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.

If one assumes that the significance of a given risk to national security is a function of its lethality and likelihood of occurrence, then the prospect of tens or hundreds of thousands of Americans dying in a nuclear terrorist attack should rank very high on the list of

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[3] "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.

threats. In fact, an attack of the requisite *potential* lethality -- last year's bombing of the World Trade Center -- has *already* occurred. All it lacked was the requisite explosive power. Even the fissile yield of a crude nuclear device made with a few kilograms of plutonium would have been enough to bring down the building, killing 40,000 or more people.

So there would appear to be a very high priority -- at least as high if not exceeding that attached to theater ballistic missile defense -- to preventing terrorist organizations and hostile states from gaining access to weapon-usable fissile materials. So why is the Pentagon $3 billion annually on missile defense, but only $45 million on fissile material security and control.

From this perspective, the overriding policy implications of the known cases of diversion are:

The greatest risk to the U.S. national security today is the ongoing diversion of nuclear weapon-usable material from Russia.

The Administration's MPC&A effort in Russia is not commensurate with this assessment of the threat.

Before reviewing the DOD administered Nunn-Lugar and the DOE administered Lab-to-Lab MPC&A efforts, we turn to one of the success stories, Project Sapphire.

II. Project Sapphire.

Last year the United States, in cooperation with the Kazakh Republic, moved 600 kg of HEU (at various enrichments) from Kazakhstan to the Y-12 plant at Oak Ridge for safe keeping. While a marked success, we note that there are an estimated 1,200 tonnes of separated weapon-usable fissile material in the FSU, mostly in Russia. Thus:

Project Sapphire remedied only 0.05 percent of the problem.

The Project Sapphire materials were naval fuel which the Kazakh Republic had no interest in retaining, and for which Kazakhstan was richly rewarded by the United States. This case has little relevance toward securing the other weapon-usable materials--the other 99.95 percent of the problem--most of it in Russia.

III. The DOD administered Cooperative Threat Reduction (Nunn-Lugar) Program to Date Has Failed to Produce Results on MPC&A.

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 2).

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

Following passage of the Nunn-Lugar, exclusive of Operation Sapphire, DOD has allocated just over $200 M for Russian nuclear weapon transport, dismantlement, and fissile material security (Table 3).

Status and observations regarding selected Nunn-Lugar accounts:

A. 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.

B. Fissile Material Storage:

DOD has purchased from U.S. contractors, and is storing in the United States awaiting shipment to Russia, $8 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.

C. 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 four major risk sites (Mayak, Obninsk, Elektrostal [breeder line], and Dimitrovgrad). Two other sites, Novosibirsk and Podolsk, have been tabled by the U.S. but not agreed to by the Russians. The U.S.-Russian agreement to upgrade MPC&A at four high risk facilities was reached only last month. **To date, there has not been any significant improvement in MPC&A in Russia under the DOD administered Nunn-Lugar program, primarily, for the following reasons:**

a) the DOD initially did not support the Nunn-Lugar effort and actually obstructed its implementation;

b) the DOD 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;

c) DOD'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; DOD officials excuse the lack of progress on fissile material control by casting blame on senior Minatom officials;

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.

e) the Executive Branch is still searching for a way to structure a program of MPC&A assistance that is acceptable to both the U.S. and Russian interests.

IV. U.S. DOE 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[4], 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.

In contrast to the DOD-administered Nunn-Lugar effort, the DOE Lab-to-Lab effort has already begun to show results. 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 annual funding levels for the Gov-to-Gov and Lab-to-Lab MPC&A efforts at existing facilities in Russia are shown in Table 4. The DOD-administered program to upgrade the four to six high risk sites likely will soon to be transferred from DOD to DOE so that the two programs can be integrated.

Why is the Lab-to-Lab effort working when the DOD administered Nunn-Lugar effort failed? We believe the following are among the primary reasons:

a) managers at DOE and the labs attach greater importance to insuring the success of their effort and have made it a higher priority; DOE and the labs take the program more seriously, want it to work, and are striving to insure its success;

b) compared to the DOD administered Nunn-Lugar effort, the national labs have greater flexibility to spend money in Russia and are less encumbered by procurement bureaucracy;

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[4] In April 19, 1994 testimony before the Military Application of Nuclear Material Panel of the House Armed Services Committee, NRDC cited the failure of the Nunn-Lugar effort with regard to improving physical security and MC&A in Russia, and the need for a joint lab-to-lab R&D effort related to the verification of the nuclear warhead dismantlement process. We recommended, among other proposals, that DOE (as opposed to DOD) be given primary responsibility for policy development and implementation of safeguards over warhead dismantlement and fissile material control--areas of responsibility that traditionally have been the purview of DOE and Minatom. We also recommended that Congress provide DOE with $100 M to conduct a much expanded and accelerated effort to implement its international fissile material control responsibilities.

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

d) the Lab-to-Lab effort has not been stifled by the interagency decision-making process managed by the NSC; and

e) Minatom Minister Mikhailov received his Ph.D from, and worked at, Arzamas-16. Wearing two hats, Mikhailov is also the Scientific Director of Arzamas-16. He has a strong personal and institutional interest in promoting Lab-to-Lab cooperation.

V. Proposed New Direction.

Despite showing remarkable progress in the last few months, the DOE 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 DOE 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."[5]

To appreciate a major shortcoming of this mission, it is useful to recall that shortly after the passage of Nunn-Lugar, Minatom Minister Mikhailov was attacked by Russian hard-liners for giving the Americans access to Russia's defense secrets. They were referring to conditions contained in the Act and in the subsequent U.S.-Russian framework agreement, which states that the United States "shall have the right to examine the use of any material, training, or other services" that it might provide under the Nunn-Lugar assistance program. In December 1992, Minister Mikhailov publicly defended himself by noting that the Nunn-Lugar provisions provided no real access to, or information on, Russia's nuclear weapon activities.[6] Ever since, Mikhailov has had to make sure the cooperative effort carried no national security disadvantage to Russia. **Consequently, to be effective and to gain access to sensitive Russian nuclear weapon**

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[5] "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.

[6] Christopher E. Paine and Thomas B. Cochran, "Strengthening International Controls on the Military Applications of Nuclear Technology," in *Controlling the Atom in the 21st Century*, edited by David P. O'Very, Christopher E. Paine, and Dan W. Reicher, (Boulder: Westview Press, 1994), p. 45.

facilities, the cooperative MPC&A program must be viewed by Russia as completely reciprocal both in its mission and its implementation. Moreover, as presently defined, the mission has no ultimate goal, and no quantitative means of measuring progress or success. This will result in the program becoming budget-limited. The available budget will define what can be accomplished, instead of the objective defining the budget.

We believe these major deficiencies in the cooperative MPC&A effort could be overcome by revising the mission of the Lab-to-Lab program. The expanded mission should be cooperatively defined by a directive issued jointly by President's Clinton and Yeltsin, for example:

> **"We [Presidents Clinton and Yeltsin] have requested that our respective national laboratories jointly research, develop, and demonstrate, on a bilateral basis, a monitoring and safeguards regime that covers *all nuclear weapons and weapon-usable fissile materials* in the weapon states."**

Only then will the parties be forced to address 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. The following are a few observations concerning this proposed expanded mission:

a) This expanded mission should have complete reciprocity. U.S. and Russian specialists would have equal access to each other's facilities.

b) The directive should come from the two presidents in order to give needed political cover to Russian ministry and institute officials, and to obtain the cooperation of the U.S. Navy.

c) 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.

d) 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) As shown in Figures 1 and 2 most of the weapon-usable materials in the world are not covered by any international safeguards. The recent weapon-usable material thefts occurred in a weapon-state (Russia), not facilities now under IAEA safeguards.

e) RD&D on safeguards applicable to the weapon states should begin initially on a bilateral basis with Russia in order to move more quickly to improve MPC&A in Russia, and because the Russians do not want the IAEA at their weapon facilities at this time.

f) If we are to achieve deep reductions in the global nuclear weapon arsenals, a safeguards regime covering the weapon states is essential (Figure 3). 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.

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;	3 kg of HEU (87.5% U-235) were seized by Czech authorities in Prague.

Table 2. 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 3. Allocation of Nunn-Lugar Funds for Fissile Material and Nuclear Warhead Security.

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

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	
Total:	$211 M	

Table 4. 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	$ 2 M
FY-1995	$29 M	$15 M	$45 M
FY-1996 (proposed)	$30 M	$40 M	$70 M
Total	$60 M	$57 M	

The sources for the FY 1995 and FY 1996 funding are:

FY 1995:

Gov-to-Gov	$ 29 M	Prior year Nunn-Lugar funds: $10 M originally for Elektrostal (of which $1 M already spent); plus $20 M added ($10 M for blending plus $10 M for quick fixes).
Lab-to-Lab	$ 15 M	money shifted from DOD to DOE; or if this fails it will come from reprogrammed DOE funds; $7 M has already been advanced by DOE Office of Nonproliferation

FY 1996:

Gov-to-Gov	$ 30 M	Funding requirements have not been identified for activities beyond upgrades at the four sites in FY 1995; currently within the interagency process DOE is seeking $ 30 M to extend the Gov-to-Gov program
Lab-to-Lab	$ 40 M	Money from DOE sources (in DOE budget submission)
Additional	$ 25 M	Undifferentiated funding for Nonproliferation (including N. Korea)

FIGURE 1. CURRENT SAFEGUARDS

	WEAPON STATES		NON-WEAPON STATES
	DECLARED	UNDECLARED	
MILITARY:			
Warheads:			
Operational			
Reserve			
Retired			
Fissile Material:			
In Warheads			
Reserved for Warheads			
Declared Excess			
Facilities:			
Weapon Production			
Material Production			
Excess Material Storage			
NAVAL FUEL CYCLE:			
Facilities			
Fuel			
CIVIL NUCLEAR:			
Reactors		IAEA	IAEA
Fuel Cycle Facilities		IAEA	IAEA
HEU/Pu		IAEA	IAEA
LEU		IAEA	IAEA
Spent Fuel		IAEA	IAEA

FIGURE 2. FISSILE CUTOFF FOR WEAPONS AND EXCESS STOCKS UNDER IAEA SAFEGUARDS

	WEAPON STATES		NON-WEAPON STATES
	DECLARED	UNDECLARED	
MILITARY:			
Warheads:			
Operational			
Reserve			
Retired			
Fissile Material:			
In Warheads			
Reserved for Warheads			
Declared Excess	IAEA		
Facilities:			
Weapon Production			
Material Production	IAEA	IAEA	
Excess Material Storage	IAEA		
NAVAL FUEL CYCLE:			
Facilities			
Fuel			
CIVIL NUCLEAR:			
Reactors		IAEA	IAEA
Fuel Cycle Facilities	IAEA	IAEA	IAEA
HEU/Pu	IAEA	IAEA	IAEA
LEU		IAEA	IAEA
Spent Fuel		IAEA	IAEA

FIGURE 3. A COMPRESENSIVE SAFEGUARDS REGIME FOR THE 21ST CENTURY

	WEAPON STATES		NON-WEAPON STATES
	DECLARED	UNDECLARED	
MILITARY:			
Warheads:			
Operational	MONITORED		
Reserve	MONITORED		
Retired	MONITORED		
Fissile Material:			
In Warheads	MONITORED		
Reserved for Warheads	MONITORED		
Declared Excess	IAEA	IAEA	
Facilities:			
Weapon Production	MONITORED		
Material Production	IAEA	IAEA	
Excess Material Storage	IAEA		
NAVAL FUEL CYCLE:			
Facilities	MONITORED	MONITORED	MONITORED
Fuel	MONITORED	MONITORED	MONITORED
CIVIL NUCLEAR:			
Reactors	IAEA	IAEA	IAEA
Fuel Cycle Facilities	IAEA	IAEA	IAEA
HEU/Pu	IAEA	IAEA	IAEA
LEU	IAEA	IAEA	IAEA
Spent Fuel	IAEA	IAEA	IAEA