NUCLEAR SUCCESSOR STATES OF THE SOVIET UNION

STATUS REPORT
ON NUCLEAR
WEAPONS,
FISSILE
MATERIAL, AND
EXPORT CONTROLS

A COOPERATIVE PROJECT OF

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Preface

As former Senator Sam Nunn and others have noted, the global security environment of the Cold War featured both a high threat of strategic nuclear conflict and high stability as a consequence of the strong desire of the two superpowers to avert nuclear conflict. The post–Cold War security environment, in contrast, features a low threat of strategic nuclear conflict that unfortunately is accompanied by low stability. Contributing to this instability are a number of new proliferation threats associated with the dissolution of the Soviet Union. They stem from the historically unique circumstances in which a military superpower collapsed, leaving its enormous military assets dispersed among 15 successor states. Of particular proliferation concern was the security of nuclear weapons, weapons-usable nuclear material, and weapons expertise in the states of Belarus, Kazakhstan, Russia, and Ukraine.

This fifth edition of *Nuclear Successor States of the Soviet Union*, first published by William C. Potter and Leonard S. Spector in 1994, reflects the significant progress that has been made in the past few years toward securing these weapons and fissile materials. In November 1996, the last Soviet nuclear warheads outside of Russian territory were withdrawn from Belarus, effectively ensuring the declared non-nuclear status of Belarus, Kazakhstan, and Ukraine. In Russia, destruction of nuclear weapons systems to meet the levels of the Strategic Arms Reduction Treaty (START) is proceeding with the help of U.S. disarmament assistance under the aegis of the Cooperative Threat Reduction program. The Gore-Chernomyrdin Commission, chaired by U.S. Vice-President Albert Gore and Russian Prime Minister Viktor Chernomyrdin, made progress on agreements to build a storage facility for dismantled nuclear warheads, and the cessation of plutonium production. Despite these positive trends, other issues, such as the enlargement of NATO, have complicated efforts to convince the Russian parliament to ratify the START II treaty, which would reduce by half the number of warheads by 2007.

In terms of the former Soviet nuclear complex, great strides have been taken to strengthen nuclear material accounting practices, physical protection, and export controls within Belarus, Kazakhstan, Russia, and Ukraine. (It should be noted that relatively small quantities of weapons-usable material also exist in Georgia, Latvia, and Uzbekistan, although these states are not included in this report.) Physical security is being upgraded at dozens of nuclear facilities, some of which house hundreds of kilograms of highly-enriched uranium and plutonium, and Belarus, Kazakhstan, and Ukraine all have safeguards agreements in place with the International Atomic Energy Agency. In addition, significant steps have been taken to improve export controls in these countries. Ukraine, for example, has become a member of the Nuclear Suppliers Group, and Kazakhstan and Belarus have both passed comprehensive export control laws.

As in earlier editions, Part I of this report presents the status of each of the four nuclear successor states regarding adherence to international non-proliferation norms, relevant nuclear arms control treaties, and other legal obligations, while also reviewing the nuclear infrastructures, nuclear materials, and capabilities of each of these states and the progress made in removing and dismantling nuclear weapons. Part II describes the export control systems that are being established to regulate nuclear exports and prevent unauthorized transfers, and also provides information on some concrete cases of illegal diversion and export of weapons-grade nuclear material. The chronology of press reports detailing illegal exports has not been repeated in this issue, but is available though the Monterey Institute’s NIS Nuclear Databases. (For more information about these databases, please contact John Lepingwell at jlepingwell@miis.edu.)

New features of this *Status Report* include:

- identification and description of many new sites with weapons-usable fissile material;
- detailed descriptions of proliferation-significant incidents of nuclear smuggling;
- additional coverage of disarmament assistance programs in Belarus, Kazakhstan, Russia, and Ukraine.

This report has been prepared jointly by the Monterey Institute of International Studies and the Carnegie Endowment for International Peace as a resource to assist in monitoring the rapidly evolving events related to nuclear weapons and weapons-usable materials in the former Soviet Union. The report is published periodically in English and in Russian, and is distributed free of charge to officials and analysts in both the United States and the Newly Independent States. The report will be translated into Russian by the Carnegie Moscow Center.

We wish to thank the individuals whose contributions have made this report possible, including managing editors Emily Ewell of the Monterey Institute and Toby Dalton and Greg Webb of the Carnegie Endowment. These three individuals shared primary responsibility for gathering, assembling, and preparing for print the information in this report. In addition, Jason Pate of the Monterey Institute and Leonor Tomero of the Carnegie Endowment provided invaluable assistance on the compilation of Tables II-B and I-F, respectively.

Outside reviewers, whose comments have enhanced this volume but who may not necessarily agree with all of its contents, include:

Gary Bertsch	Center for International Trade and Security, University of Georgia
Oleg Bukharin	Center for Energy and Environment, Princeton University
Craig Cerniello	Arms Control Association, Washington, D.C.
Dastan Eleukenov	Ministry of Foreign Affairs, Kazakhstan
Jason Ellis	Center for Science and International Affairs, Harvard University
Elina Kirichenko	Institute of World Economy and International Relations (IMEMO), Moscow
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Jack Mendelsohn	Arms Control Association, Washington, D.C.
Vladimir Orlov	Center for Policy Studies in Russia (PIR Center), Moscow
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All of the information in this report has been derived from open sources. While every attempt was made to achieve accuracy and comprehensiveness, the rapidly changing and sometimes classified nature of much of this information creates the possibility that the report contains some inaccuracies or incomplete entries. The managing editors have made the final judgments as to the contents of this report and bear full responsibility for it.

We hope that you will find this fifth edition of *Nuclear Successor States of the Soviet Union* a useful resource, and we encourage you to send your comments to either the Monterey Institute of International Studies or the Carnegie Endowment for International Peace.

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--- February 1998 ---

Part I:

Nuclear Status

Table I-A Non-Proliferation Profiles

	BELARUS	KAZAKHSTAN	RUSSIA	UKRAINE
Party to the Non-Proliferation Treaty (NPT)	Yes (Non-Nuclear-Weapon State)	Yes (Non-Nuclear-Weapon State)	Yes (Nuclear-Weapon State)	Yes (Non-Nuclear-Weapon State)
IAEA Safeguards Agreement Covering All Nuclear Activities on Territory	Yes[1]	Yes[2]	"Voluntary offer" agreement[3]	Yes[4]
Member of Nuclear Suppliers Group (NSG)	No	No	Yes	Yes[5]
Member of NPT Nuclear Exporters (Zangger) Committee	No	No	Yes	No
Member of Missile Technology Control Regime (MTCR)	No	No	Yes[6]	No; Adhering to regime standards[7]
Party to START I	Yes	Yes	Yes	Yes
Party to the Lisbon Protocol	Yes	Yes	Yes	Yes
Party to the Partial Test Ban Treaty (PTBT)	Yes[8]	No	Yes	Yes[9]
Party to the Comprehensive Test Ban Treaty	Yes[10]	Yes[11]	Yes[12]	Yes[13]
Nuclear Weapons on Territory	No[14]	No[15]	Yes	No[16]
Weapons-Grade Nuclear Material on Territory	Yes	Yes	Yes	Yes
Nuclear Power Reactors on Territory	No	Yes	Yes	Yes
Nuclear Research Reactors on Territory	Yes	Yes	Yes	Yes
Nuclear Weapons Design Facilities on Territory	No	No	Yes	No
Uranium Enrichment Facilities on Territory	No	No	Yes	No
Spent Fuel Reprocessing Facilities on Territory	No	No	Yes	No
Nuclear Research Center on Territory	Yes	Yes	Yes	Yes
Nuclear Test Site on Territory	No	No[17]	Yes	No

NOTES

1. Entered into force on August 2, 1995. See Table II-A.

2. Entered into force on August 11, 1995. See Table II-A.

3. As a nuclear-weapon state party to the NPT, Russia is not required to accept IAEA safeguards. A voluntary agreement, under which a limited number of Russian nuclear facilities are subject to safeguards (e.g., a fuel fabrication facility at Elektrostal), entered into force on June 10, 1985.

4. Entered into force on December 17, 1997. See Table II-A.

5. Ukraine was formally admitted into the Nuclear Suppliers Group (NSG) on April 20, 1996, at the NSG plenary meeting in Buenos Aires. Ukraine previously had attended NSG meetings as an observer.

6. After earlier agreeing to abide by the MTCR guidelines, Russia was formally admitted into the regime and participated in its first MTCR plenary meeting on October 10-12, 1995.

7. Although Ukraine is not a member of the MTCR, it agreed in a May 13, 1994, Memorandum of Understanding with the United States to conduct its missile and space related exports according to the criteria and standards of the regime. See Table II-A.

8. Belarus signed the Partial Test Ban Treaty in 1963, not as an independent country, but as the Byelorusian Soviet Socialist Republic. Both the Byelorusian and Ukrainian Soviet Socialist Republics had their own seats (and therefore votes) at the United Nations, although in fact the U.S.S.R. always determined the way in which these "countries" voted.

9. Ukraine signed the Partial Test Ban Treaty in 1963, not as an independent country, but as the Ukrainian Soviet Socialist Republic. Both the Byelorusian and Ukrainian Soviet Socialist Republics had their own seats (and therefore votes) at the United Nations, although in fact the U.S.S.R. always determined the way in which these "countries" voted.

10. Belarus signed the CTBT on September 24, 1996.

11. Kazakhstan signed the CTBT on September 30, 1996.

12. Russia signed the CTBT on September 24, 1996.

13. Ukraine signed the CTBT on September 27, 1996.

14. Belarus transferred the last of its SS-25s and their associated warheads to Russia on November 27, 1996. See Table 1-C.

15. By April 24, 1995, all nuclear warheads were withdrawn from Kazakhstan to Russia. The last SS-18 silos were destroyed in the second half of 1996. A nuclear explosive device buried at the former Soviet nuclear test site at Semipalatinsk was destroyed with conventional explosives on May 31, 1995. See Table 1-C.

16. By June 1, 1996, all nuclear warheads were withdrawn from Ukraine to Russia. SS-19 and SS-24 launchers and silos are still in the process of being destroyed. See Table I-C.

17. The former Soviet Semipalatinsk nuclear test site, located in northeastern Kazakhstan near the city of Semipalatinsk, was permanently closed in 1991. In October 1995, Kazakhstan announced a plan to seal the tunnels used for testing at the Degelen mountain and Balapan areas of the test site. Using funds from the U.S. Cooperative Threat Reduction program, Kazakhstan will close and seal 186 test tunnels by Fiscal Year (FY) 1999. See "U.S.-Kazakhstan Agreement to Seal Up World's Largest Nuclear Test Tunnel Complex," DOD News Release October 3, 1995; "Deal Signed to Seal Former Soviet Nuclear Test Site," Reuters, October 3, 1995; Emily Ewell, Center for Nonproliferation Studies, "Trip Report: International Conference on Nonproliferation Problems," Kazakhstan, September 1997.

Table I-B Declared Nuclear Status

BELARUS	
NUCLEAR STATUS	On July 22, 1993, Belarus became a non-nuclear-weapon state party to the Nuclear Non-Proliferation Treaty (NPT), having recognized Russia's jurisdiction over the remaining nuclear weapons on its territory. Belarus completed the transfer of all nuclear weapons from its territory to Russia on November 27, 1996.[1]
START I / START II STATUS	The Republic of Belarus signed the START I treaty on July 31, 1991, and the Lisbon Protocol on May 23, 1992; Belarus ratified the treaty on February 4, 1993.[2] The treaty entered into force on December 5, 1994. (START II, as a bilateral U.S.-Russian treaty, does not call for the participation of Belarus.)
IAEA INSPECTION STATUS	On April 14, 1995, Belarus signed a draft safeguards agreement with the IAEA providing for IAEA inspection of all Belarusian nuclear activities.[3] This agreement entered into force on August 2, 1995.[4]
KAZAKHSTAN	
NUCLEAR STATUS	On February 14, 1994, Kazakhstan became a non-nuclear-weapon state party to the NPT. Kazakhstan transferred all nuclear warheads remaining on its soil to Russia by April 24, 1995, and destroyed the remaining SS-18 silos by the second half of 1996.[5]
START I / START II STATUS	Kazakhstan signed the START I treaty on July 31, 1991, and the Lisbon Protocol on May 23, 1992; Kazakhstan ratified START I on July 2, 1992; the treaty entered into force on December 5, 1994. (START II, as a bilateral U.S.-Russian treaty, does not call for the participation of Kazakhstan.)
IAEA INSPECTION STATUS	Kazakhstan signed a safeguards agreement with the IAEA on July 26, 1994, providing for IAEA inspection of all Kazakhstani nuclear activities. This agreement entered into force on August 11, 1995.[6]
RUSSIA	
NUCLEAR STATUS	*De jure* nuclear-weapon state; recognized as nuclear-weapon state party to the NPT.[7] It is currently dismantling about 2,000 warheads annually.[8] It is also deactivating and dismantling strategic systems according to the terms of the START I treaty.
START I / START II / START III STATUS	Russia signed the START I treaty on July 31, 1991, and the Russian parliament approved the treaty on November 4, 1992, with the condition that Russia would not exchange instruments of ratification until Belarus, Kazakhstan, and Ukraine acceded to the NPT as non-nuclear-weapon states. Upon Ukraine's accession as a non-nuclear-weapon state on December 5, 1994, Russia joined Belarus, Kazakhstan, Ukraine, and the United States in exchanging instruments of ratification for the START I treaty, bringing it into force on that date.[9] President Yeltsin submitted the START II treaty to the Duma for ratification on June 22, 1995, but prospects for treaty ratification remain uncertain due to domestic and international developments.[10] The U.S. Senate, by a vote of 87-4, provided its advice and consent to ratification of START II on January 26, 1996. At the March 1997 Helsinki Summit, Presidents Clinton and Yeltsin agreed to extend by five years, to December 31, 2007, the deadline for eliminating strategic nuclear delivery vehicles under START II.[11] This amendment requires consent by both the Duma and Congress. The Presidents also agreed that once START II enters into force, formal discussions on a START III treaty would begin, which would further reduce warheads to 2,000 - 2,500 each, and might include measures on warhead inventory transparency and stockpiles of tactical nuclear weapons.[12]
IAEA INSPECTION STATUS	Russia is permitting IAEA inspections of selected civilian nuclear facilities pursuant to a “voluntary offer” to allow such monitoring, codified in a 1985 agreement between the Soviet Union and the IAEA.

UKRAINE	
NUCLEAR STATUS	On December 5, 1994, Ukraine became a non-nuclear-weapon state party to the NPT. Earlier, on November 16, 1994, the Ukrainian parliament approved (301-8) Ukraine's accession to the NPT, contingent upon first receiving negative security guarantees from the five nuclear-weapon states. Assurances from the United Kingdom, the United States, and Russia were provided in a memorandum at the Conference on Security and Cooperation in Europe (CSCE) on December 5, 1994. France and China also provided security assurances to Ukraine in separate documents.[13] On January 14, 1994, the presidents of Ukraine, Russia, and the United States signed a Trilateral Statement obligating Ukraine to eliminate all nuclear weapons on its territory within seven years after the START I treaty entered into force.[14] Pursuant to this agreement, all nuclear weapons on Ukrainian soil were transferred to Russia by June 1, 1996.[15] Remaining SS-19 missiles will be destroyed by the end of 1998, and destruction of SS-24 missiles with U.S. assistance is scheduled to begin in early 1998. (See Table I-C for details.)
START I / START II STATUS	Ukraine signed the START I treaty on July 31, 1991, and the Lisbon Protocol on May 23, 1992; the Ukrainian parliament unconditionally approved START I for ratification on February 3, 1994. The treaty was brought into force on December 5, 1994, when Ukraine's accession to the NPT fulfilled the final Russian precondition to START I ratification. (START II, as a bilateral U.S.-Russian treaty, does not call for the participation of Ukraine.)
IAEA INSPECTION STATUS	Ukraine acceded to the NPT as a non-nuclear weapon state on December 5, 1994, and on September 21, 1995 Ukraine signed a comprehensive safeguards agreement with the IAEA pursuant to its obligations under Article III of the NPT. This agreement was ratified by the Verkhovna Rada (Ukrainian Parliament) on December 17, 1997.[16] Prior to its accession to the NPT, Ukraine had signed a temporary safeguards agreement with the IAEA. This temporary *in sui generis* agreement, covering all nuclear material in all peaceful nuclear activities in Ukraine, was signed by Ukrainian and IAEA officials on September 28, 1994, and entered into force on January 13, 1995.[17] This agreement was in force until December 17, 1997, when it was superseded by the new safeguards agreement (above).

NOTES

1. "Belarus Completes the Withdrawal of the Remaining Russian Missiles," Press Release, Embassy of the Republic of Belarus to the United States of America, November 27, 1996; in "Belarus: Nuclear Weapons," NIS Nuclear Profiles Database, Center for Nonproliferation Studies, Monterey Institute of International Studies.

2. START I, signed in Moscow by the United States and the Soviet Union on July 31, 1991, was the result of nine years of negotiations between the two superpowers. It was the first arms control treaty to enter into force that mandated reductions of deployed strategic weapons as opposed to limitations on future deployments. Under the accord (as modified by the Lisbon Protocol to include Belarus, Kazakhstan, Russia, and Ukraine in lieu of the Soviet Union), the two sides will reduce their strategic nuclear forces to equal aggregate limits of 6,000 accountable warheads deployed on 1,600 strategic nuclear delivery vehicles. Sublimits for warheads include the restriction that no more than 4,900 warheads may be deployed on ICBMs and SLBMs, and of this subtotal, no more than 1,100 warheads may be deployed on mobile ICBMs and no more than 1,540 warheads on heavy ICBMs. See "START I Entry into Force and Security Assurances," ACDA Factsheet, December 5, 1994; "START I: Lisbon Protocol and the Nuclear Non-Proliferation Treaty," ACDA Fact Sheet, March 17, 1994; "START: Analysis, Summary, Text," *Arms Control Today* (November 1991), pp. 17-26.

3. International Atomic Energy Agency, Information Circular No. 495 (INFCIRC/495), *Agreement of 14 April 1995 Between the Republic of Belarus and the IAEA for the Application of Safeguards in Connection With the Treaty on the Non-Proliferation of Nuclear Weapons*, January 1996.

4. *Ibid.*

5. A Russian Strategic Rocket Forces official announced that all nuclear warheads had been transferred from Kazakhstan to Russia by April 24, 1995. An agreement on nuclear weapons in Kazakhstan reportedly had been signed at the March 28, 1994, summit between Russian President Boris Yeltsin and Kazakhstani President Nursultan Nazarbayev, under which all warheads were to be transferred to Russia within fourteen months and all silos and missiles in Kazakhstan were to be dismantled within a three-year timeframe. See Doug Clarke, "Kazakhstan Free of Nuclear Weapons," *OMRI Daily Digest*, April 26, 1995; Doug Clarke, "Kazakhstan Confirms It Is Nuclear Free," *OMRI Daily Digest*, May 25, 1995, p. 3; *Radio Free Europe/Radio Liberty Daily Report*, May 4, 1994.

6. "Situation on 31 December 1996 with respect to the Conclusion of Safeguards Agreements between the Agency and Non-Nuclear-Weapons States in Connection with NPT," International Atomic Energy Agency homepage, http://www.iaea.org.

7. See "Message From Russian President Boris Yeltsin to Hans Blix, Director General of the International Atomic Energy Agency, January 17, 1992," *ITAR-TASS*, January 17, 1992, in *FBIS-SOV*, January 21, 1992, p. 38. In "The Written Statement by the Russian Side At the Signing of the Protocol To the START Treaty on 23 May 1992 in Lisbon," Russian Foreign Minister Andrei Kozyrev noted "that Russia as the successor state of the USSR is a Party to the Non-Proliferation Treaty and acts as a depository state of this Treaty." See "Documents," *Arms Control Today*, June 1992, p. 36; "`Nonnuclear' States Join," Moscow, *ITAR-TASS*, May 24, 1992, in *FBIS-SOV-91-101*, May 26, 1992, p. 2. Russia was also recognized as the largest and most powerful Soviet successor state, when it took the place of the Soviet Union as a permanent member of the UN Security Council on December 24, 1991.

8. Interview with DOD Special Coordinator for Cooperative Threat Reduction Laura Holgate, February 27, 1996. These figures include the dismantlement of both strategic and tactical nuclear weapons.

9. Russia is currently deactivating nuclear weapon systems and destroying launchers, subject to verification by the United States, as provided by the START I Treaty. (Additional details concerning the status of Russian strategic nuclear weapons are provided in Table I-C.) Shortly after the START I Treaty was brought into force, the implementation of the inspections process began.

10. See Table I-D for further discussion of START II ratification.

11. Although the deadline for elimination was extended, the presidents agreed to deactivate all the systems scheduled for destruction under START II by the end of 2003.

12. For further discussion on the Helsinki agreements and the parameters for the START III treaty, see Table I-D. Additionally, in September 1994, Clinton and Yeltsin agreed that once START II enters into force they would deactivate all systems scheduled for elimination under the treaty, thereby removing the threat of those systems in one or two years, rather than the seven or more allowed by the treaty at that time. See "Joint Statement on Strategic Stability and Nuclear Security by the Presidents of the United States and Russia," the White House, September 28, 1994; "Clinton, Yeltsin Discuss Arms Control at UN and in Washington," *Arms Control Today*, November 1994.

13. See "Text of Resolution Detailing NPT Reservations," *Kiev Radio Ukraine World Service in Ukraine* in *FM-FBIS-London-U.K.*, November 16, 1994; "Ukraine Joins Treaty Curbing Nuclear Arms," *Washington Post*, November 17, 1994; "Ukraine Accedes to NPT Treaty," *United Press International*, December 5, 1994; "Remarks by President Clinton at Signing of Denuclearization Agreement," Federal News Service, December 5, 1994; "France Signs NPT Security Guarantee Document," Moscow, *Interfax*, December 5, 1994, in *FBIS-SOV-94-234*, December 6, 1994; Statement of the Chinese Government on Security Assurance to Ukraine, December 4, 1994.

14. The Trilateral Statement called for a phased deactivation and transfer process. In the first phase, which was completed by mid-November 1994, at least 200 warheads from Ukraine's SS-19s and SS-24s were transferred to Russia and all SS-24s on Ukrainian territory were deactivated. Although seven years was the original timetable for the transfer of all the warheads, a protocol signed by Ukraine's Acting Prime Minister Yefim Zvyagilsky and Russian Prime Minister Viktor Chernomyrdin on May 16, 1994, obligated Ukraine to transfer its warheads within three years of the signing of the Trilateral Statement. See "Ukraine Pledges to Double Speed of Disarmament," *Reuters*, May 19, 1994. As noted in Table I-C, withdrawals have been completed, and destruction of ballistic missile systems is underway.

15. Ustina Markus, "Last Nuclear Weapons Removed From Ukraine," *OMRI Daily Digest*, June 6, 1996; in "Ukraine: Nuclear Weapons," NIS Nuclear Profiles Database, Center for Nonproliferation Studies, Monterey Institute of International Studies.

16. Center for Nonproliferation Studies, correspondence with Ukrainian official from Ministry of Environmental Protection and Nuclear Safety, January 1998.

17. Center for Nonproliferation Studies, correspondence with IAEA Division of External Relations, July 7, 1995.

Table I-C Nuclear Weapon Systems and Associated Warheads

Five sets of data are reflected in this chart:

September 1990: Data derived from the first Memorandum of Understanding (MOU), attached to the Strategic Arms Reduction Treaty (START).

December 1994: From a START MOU exchanged December 5, 1994, the date of the treaty's entry into force.

December 1996: From a START MOU exchanged December 5, 1996.

July 1997: From a START MOU exchanged July 5, 1997.

Current: "Current" numbers, except for SLBMs, refer to deployed, operational "strategic offensive weapon" systems only, that is, those systems capable of delivering a nuclear warhead on short notice. "Current" estimates, therefore, are usually lower than MOU figures because START I rules require counting weapon systems, even if they are not operational, until they are dismantled using START I procedures.[1] SLBMs are therefore counted under START I rules until the submarine missile tubes are dismantled according to treaty guidelines.

Definitions

The terms *deactivation* and *dismantlement* are distinct. A **deactivated** weapon has had its nuclear warhead removed, but still counts under START I. A **dismantled** weapon has had its warhead removed, and its silo or launcher eliminated pursuant to agreed procedures; it can therefore be removed from a state's START I inventory.

ICBM: Intercontinental ballistic missile; **SLBM**: Submarine-launched ballistic missile; **ALCM**: Air-launched cruise missile

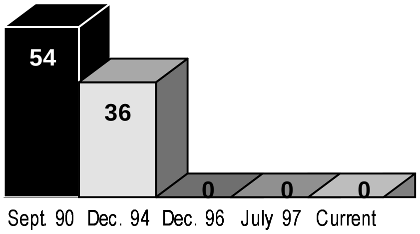
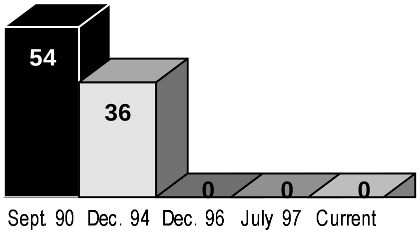
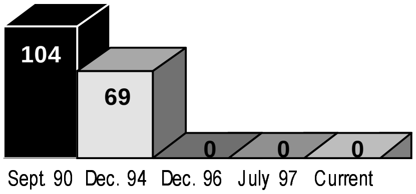
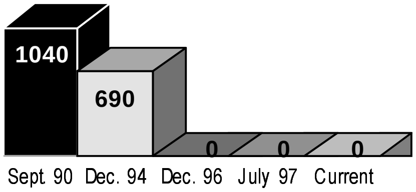
<table>
<tr><th colspan="4">BELARUS</th></tr>
<tr><th>TYPE</th><th>LAUNCHERS/ICBMs</th><th>WARHEADS</th><th>LOCATIONS</th></tr>
<tr><td rowspan="2">**SS-25 ICBMs**
Range:[2]
10,000 km
Payload:
600-1,200 kg
Warheads/ missile: 1</td><td> </td><td> </td><td>Lida: 0
Mozyr: 0</td></tr>
<tr><td colspan="3">**Comments**: Belarus transferred the last of its SS-25s and their associated nuclear warheads to Russia on November 27, 1996.[3] Although the original START MOU indicated that 54 road-mobile SS-25s were deployed at Lida and Mozyr, the number increased to 81 in the early 1990s.[4] Despite the dissolution of the Soviet Union, all SS-25s in Belarus remained under formal Russian jurisdiction and control.
The transfer of the weapons to Russia was delayed repeatedly. In early December 1995, Russia and Belarus reached an agreement to transfer the remaining 18 SS-25s to Russia by September 1, 1996, but in mid-January 1996, Belarusian President Alexander Lukashenko cautioned that Belarus might retain or redeploy nuclear weapons if NATO were to expand.[5] Ultimately, Lukashenko did not act on his threat and the warheads were transferred.</td></tr>
</table>

Table 1-C Nuclear Weapon Systems and Associated Warheads

<table>
<tr><th colspan="4">KAZAKHSTAN</th></tr>
<tr><th>TYPE</th><th>LAUNCHERS/ICBMs</th><th>WARHEADS</th><th>LOCATIONS</th></tr>
<tr><td rowspan="2">SS-18 ICBMs
Range: 11,000 km
Payload: 7,600 kg
Warheads/ missile: 10</td><td>
</td><td>
</td><td>Derzhavinsk: 0
Zhangiz-Tobe: 0</td></tr>
<tr><td colspan="3">Comments: All nuclear warheads, a total of 1,410, were withdrawn from Kazakhstan to Russia by April, 24 1995.[6] The last SS-18 silos were destroyed in the second half of 1996, making Kazakhstan completely free of strategic offensive nuclear weapons, according to the START I counting rules, which count empty silos as deployed ICBMs.</td></tr>
<tr><td>Bear-H Bombers</td><td colspan="3">Comments: The 1990 MOU indicated that 27 Bear-H6 and 13 Bear-H16 bombers, capable of carrying a total of 370 ALCMs, were deployed in Kazakhstan, but all strategic bombers and associated ALCMs in Kazakhstan were subsequently moved to Russia.[7]</td></tr>
<tr><td>Strategic Warheads in Storage</td><td colspan="3">Comments: At the time of the dissolution of the Soviet Union, one undetonated nuclear device with a yield of approximately 0.4 kilotons was buried in Degelen Mountain at the Semipalatinsk nuclear test site; it was destroyed with conventional explosives on May 31, 1995.[8]</td></tr>
</table>

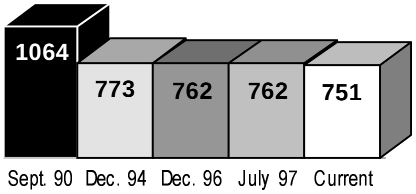
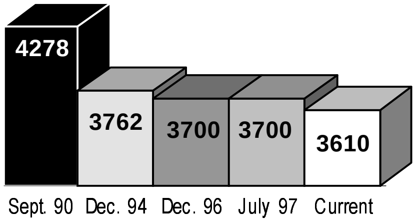
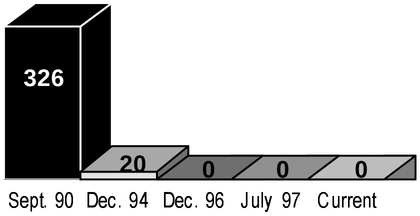
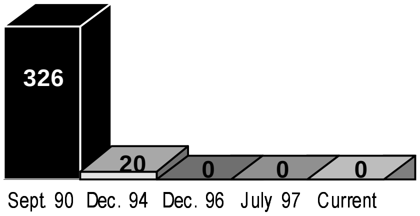
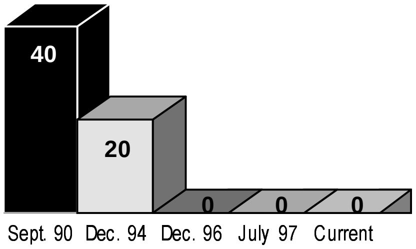
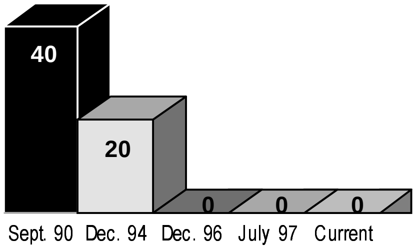
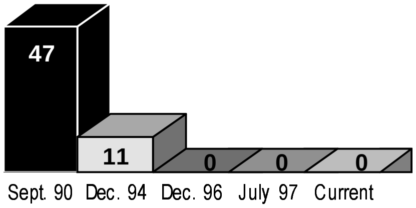
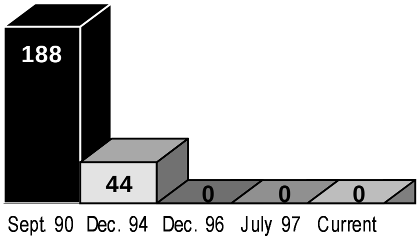
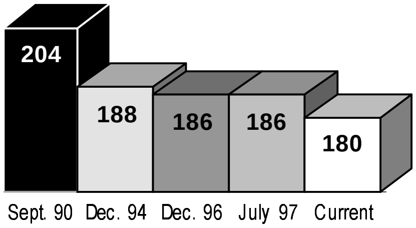
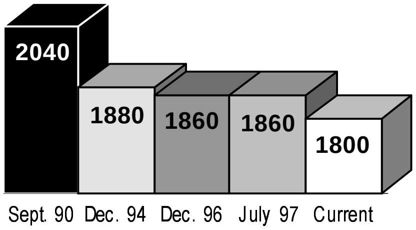
<table>
<tr><th colspan="4">RUSSIAN ICBMs</th></tr>
<tr><th>TYPE</th><th>LAUNCHERS/ICBMs</th><th>WARHEADS</th><th>LOCATIONS</th></tr>
<tr><td>Total ICBMs</td><td>
</td><td>
</td><td></td></tr>
<tr><td rowspan="2">SS-11 ICBMs
Range:
13,000 km
Payload:
900-7,600 kg
Warheads/ missile: 1-3</td><td>
</td><td>
</td><td>Svobodny: 0
Yasnaya: 0
Drovyanaya: 0
Krasnoyarsk: 0
Bershet: 0
Teykovo: 0</td></tr>
<tr><td colspan="3">Comments: All SS-11s were deactivated by the first half of 1995, and dismantled when the last silos were eliminated in the last half of 1995.[9]</td></tr>
<tr><td rowspan="2">SS-13 ICBMs
Range:
9,400 km
Payload:
380-685 kg
Warheads/ missile: 1</td><td>
</td><td>
</td><td>Yoshkar-Ola: 0</td></tr>
<tr><td colspan="3">Comments: All SS-13s have been dismantled.</td></tr>
</table>

Table 1-C Nuclear Weapon Systems and Associated Warheads

<table>
<tr><th colspan="4">RUSSIAN ICBMs (cont.)</th></tr>
<tr><th>TYPE</th><th>LAUNCHERS/ICBMs</th><th>WARHEADS</th><th>LOCATIONS</th></tr>
<tr><td rowspan="2">SS-17 ICBMs
Range: 10,000 km
Payload: 2,900 kg
Warheads/ missile: 1-4</td><td> </td><td> </td><td>Vypolzovo: 0</td></tr>
<tr><td colspan="3">Comments: All SS-17s, formerly stationed at Vypolzovo, have been dismantled. Russia has maintained Vypolzovo as a missile base, however, using it to site road-mobile SS-25s transferred from Belarus and possibly some of the newly deployed SS-25s.[10] Eighteen SS-25s were listed at Vypolzovo in the July 1997 MOU.</td></tr>
<tr><td rowspan="2">SS-18 ICBMs
Range: 11,000 km
Payload: 7,600 kg
Warheads/ missile: 10</td><td> </td><td> </td><td>Uzhur: 52
Aleysk: 30
Kartaly: 46
Dombaroskiy: 52</td></tr>
<tr><td colspan="3">Comments: In the July MOU, Russia indicated that 180 SS-18s were deployed, although 186 remain accountable under START I. Under the START II treaty now pending ratification by the Russian State Duma and Federation Council, Russia will be allowed to convert 90 SS-18 silos to hold single-warhead ICBMs (the SS-25 or SS-27) and it has therefore not destroyed surplus silos.
Under START I, Russia is required to reduce its SS-18 deployment to a maximum of 154 silos. Under the pending START II treaty, Russia would be required to eliminate all land-based, multiple-warhead ICBMs, including all SS-18s. Although START I rules attribute 10 warheads per SS-18, some may carry fewer.</td></tr>
</table>

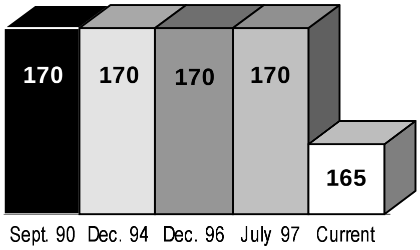
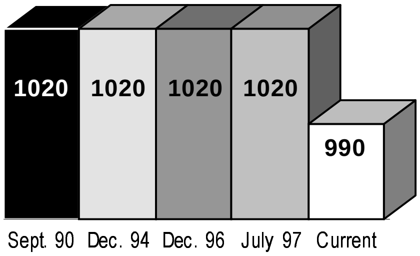
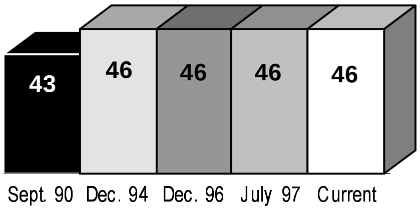
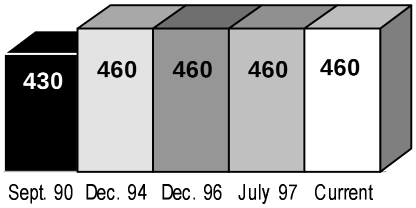
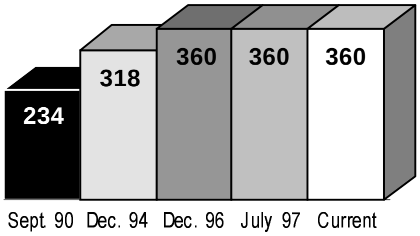
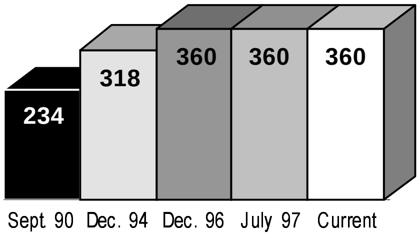
<table>
<tr><th colspan="4">RUSSIAN ICBMs (cont.)</th></tr>
<tr><th>TYPE</th><th>LAUNCHERS/ICBMs</th><th>WARHEADS</th><th>LOCATIONS</th></tr>
<tr><td rowspan="2">SS-19 ICBMs
Range:
10,000 km
Payload:
3,600 kg
Warheads/ missile: 6</td><td>
</td><td>
</td><td>Tatishchevo: 105
Kozel’sk: 60</td></tr>
<tr><td colspan="3">Comments: In the July 1997 MOU, Russia indicated that 105 SS-19s were deployed in the 110 silos at Tatishchevo. Under START II, Russia is permitted to retain 105 SS-19s if they are downloaded to be armed with one warhead, only.
Over 1,800 warheads, many of them SS-19 warheads, have been transferred from Ukraine to Russia, where most are expected to be dismantled.[11]</td></tr>
<tr><td rowspan="2">SS-24 ICBMs
Range:
10,000 km
Payload:
3,200 kg
Warheads/ missile: 10</td><td>
</td><td>
</td><td>Bershet: 15 (rail)
Kostroma: 12 (rail)
Krasnoyarsk: 9 (rail)
Tatishchevo: 10 (silo)</td></tr>
<tr><td colspan="3">Comments: The 36 rail-based SS-24s were removed from alert status according to the initiative announced by former Soviet President Mikhail Gorbachev in October 1991.</td></tr>
</table>

Table 1-C Nuclear Weapon Systems and Associated Warheads

<table>
<tr><th colspan="4">RUSSIAN ICBMs (cont.)</th></tr>
<tr><th>TYPE</th><th>LAUNCHERS/ICBMs</th><th>WARHEADS</th><th>LOCATIONS</th></tr>
<tr><td rowspan="2">SS-25 ICBMs
Range: 10,500 km
Payload: 600-1,200 kg
Warheads/ missile: 1</td><td> </td><td> </td><td>Irkutsk: 36
Kansk: 45
Novosibirsk: 45
Yoshkar-Ola: 36
Nizhniy Tagil: 45
Yur’ya: 45
Teykovo: 36
Vypolzovo: 18
Barnaul: 36
Drovyanaya: 18</td></tr>
<tr><td colspan="3">Comments: To compensate for the elimination of its land-based MIRVed ICBMs, as would be required by START II, Russia is expected to continue deploying the SS-25, which is the only strategic delivery system under production in Russia. Russia completed a flight test program for a silo-based version of a new SS-25, the Topol-M (will be NATO classified as SS-27 when it enters service), and has stationed two experimental missiles at Tatishchevo; neither is thought to be armed with a nuclear warhead.[12] Russia plans to deploy 10 Topol-Ms by the end of 1998.[13] The Topol-M will be manufactured entirely within Russia, unlike existing SS-25s which have components produced by non-Russian, former Soviet states.[14]
All SS-25s currently deployed in Russia are road-mobile. Although the existing Topol-Ms are silo-based, a planned, mobile variant could be deployed to supplement or replace existing SS-25 forces. Some of the SS-25s transferred to Russia from Belarus have been redeployed at Vypolzovo, Yoshkar-Ola, and Irkutsk.[15]</td></tr>
</table>

RUSSIAN BOMBERS

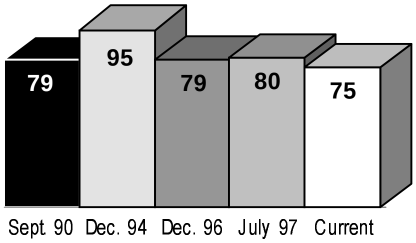
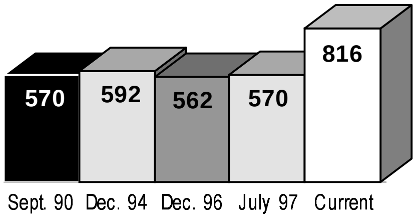
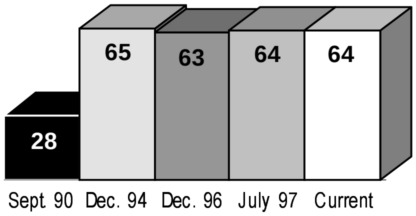
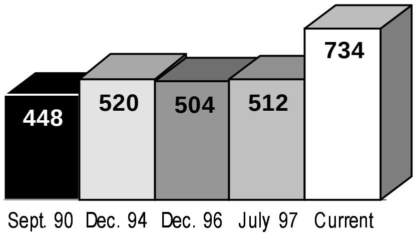
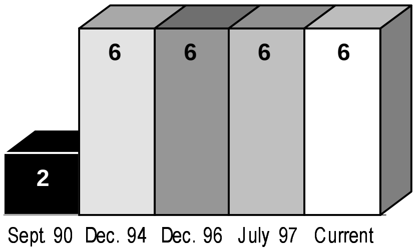
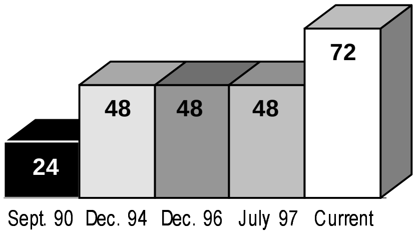
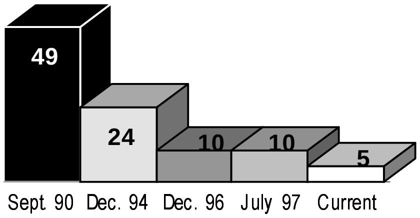
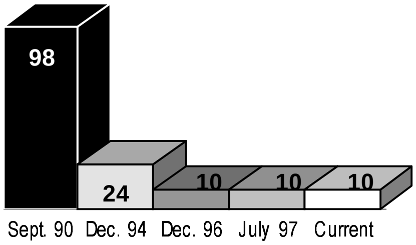
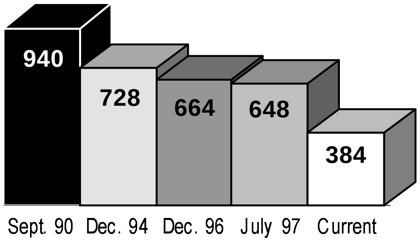
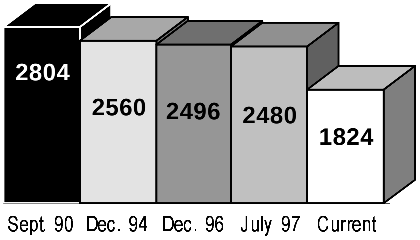
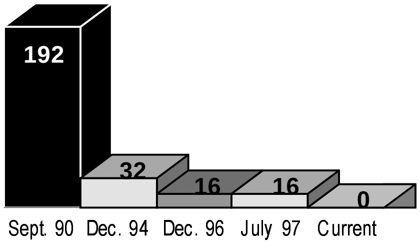
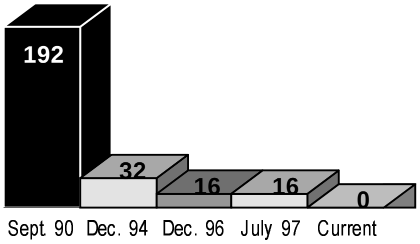
TYPE	LAUNCHERS	WARHEADS	LOCATIONS
Total Bombers			
	Comments: Current totals reflect 64 Bear-H, 6 Blackjack, and 5 Bear-G bombers. Current bomber loadings are calculated using START II counting rules, and thus reflect the number of warheads for which the heavy bombers of a listed variant are actually equipped, rather than the number of warheads attributed to each aircraft by the START MOUs.[16]		
Bear-H Bombers **Range**: 8,300 km (longer with mid-air refueling) **Warheads**: Long-range ALCMs			Mozdok: 19 Bear-H16s 2 Bear-H6s Ukrainka: 16 Bear-H16s 27 Bear-H6s[17]
	Comments: 40 Bear-H bombers were transferred from Kazakhstan to Russia in February 1994.[18]		
Blackjack Bombers **Range**: 7,300 km **Warheads**: long-range ALCMs			Engels: 6

Table 1-C Nuclear Weapon Systems and Associated Warheads

RUSSIAN BOMBERS (cont.)

TYPE	LAUNCHERS	WARHEADS	LOCATIONS
Bear-G Bombers **Range**: 8,300 km (longer with mid-air refueling) **Warheads**: Gravity bombs and short-range ballistic missiles			Ryazan: 5 Engels: 5 The five Bear-Gs at Engels are awaiting elimination and are therefore not reflected in the current number.

RUSSIAN SLBMs

TYPE	LAUNCHERS/SLBMs	WARHEADS	LOCATIONS
Total SLBMs			
	Comments: SLBM figures represent START I accountable figures, based on 42 deployed ballistic missile submarines.[19] Current figures are lower because many submarines and SLBMs are not operable.		
SS-N-6s **Range**: 2,400-3,000 km **Payload**: 680 kg **Warheads/ missile**: 1			Rybachiy: 1 Yankee I sub
	Comments: Although 16 SS-N-6s are accountable under START I, none are operational.[20]		

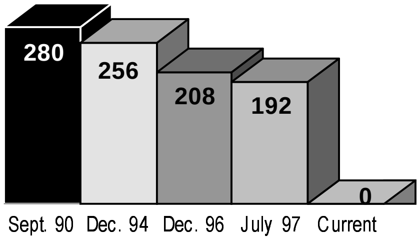
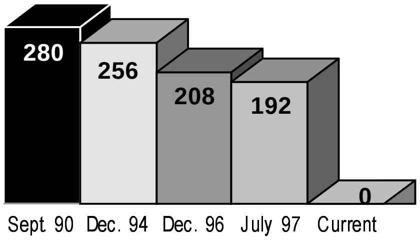
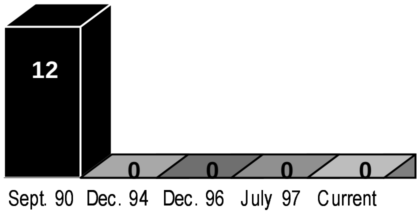
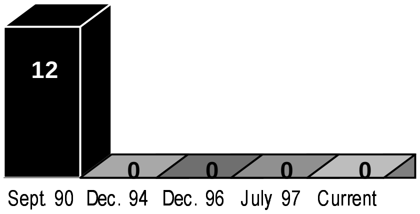
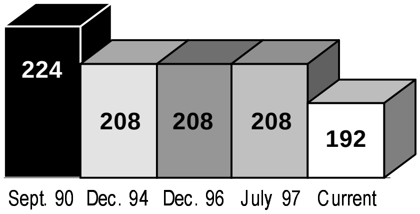
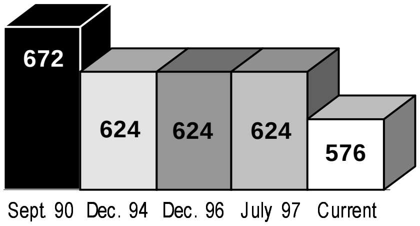
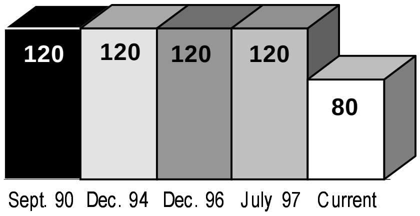
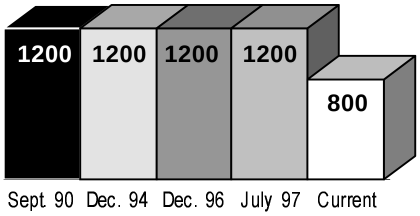
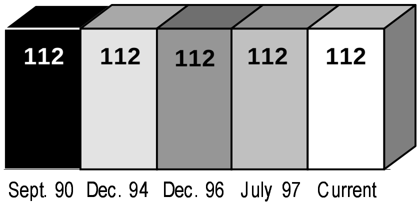
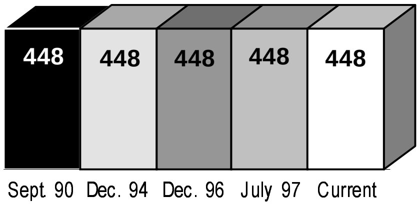
<table>
<tr><th colspan="4">RUSSIAN SLBMs (cont.)</th></tr>
<tr><th>TYPE</th><th>LAUNCHERS</th><th>WARHEADS</th><th>LOCATIONS</th></tr>
<tr><td rowspan="2">SS-N-8s
Range:
7,800-9,100 km
Payload:
680-3,400 kg
Warheads/ missile: 1</td><td> </td><td> </td><td>Ostrovnoy:
3 Delta I subs
Rybachiy:
2 Delta I subs
Yagel'naya:
2 Delta I subs
3 Delta II subs
Pavlovskoye:
5 Delta I subs</td></tr>
<tr><td colspan="3">Comments: Although 192 SS-N-8s are accountable under START I, none are operational.[21]</td></tr>
<tr><td>SS-N-17s
Range:
3,900 km
Payload:
700-800 kg
Warheads/ missile: 1</td><td> </td><td> </td><td></td></tr>
<tr><td rowspan="2">SS-N-18s
Range:
6,500-8,000 km
Payload:
800-1,300 kg
Warheads/ missile: 3</td><td> </td><td> </td><td>Rybachiy:
9 Delta III subs
Yagel'naya:
4 Delta III subs</td></tr>
<tr><td colspan="3">Comments: Although 208 SS-N-18s are accountable under START I, only 192 are operational.[22]</td></tr>
</table>

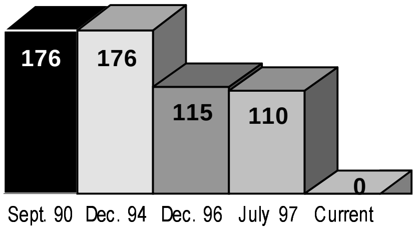
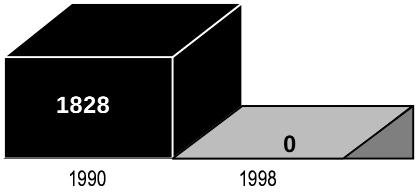
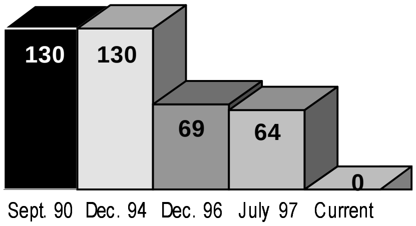
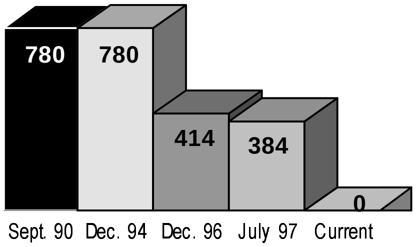
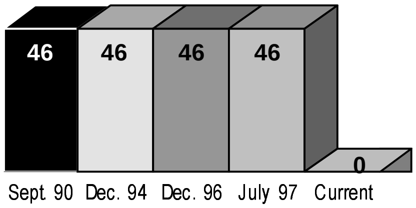
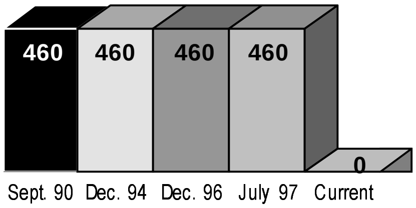
Table 1-C Nuclear Weapon Systems and Associated Warheads

RUSSIAN SLBMs (cont.)

TYPE	LAUNCHERS/SLBMs	WARHEADS	LOCATIONS
SS-N-20s **Range**: 8,300 km **Payload**: >1,300 kg **Warheads/ missile**: 10			Nerpich'ya: 6 Typhoon subs
	Comments: Although 120 SS-N-20s are accountable under START I, only 80 are operational.[23]		
SS-N-23s **Range**: 8,300 km **Payload**: >1,300 kg **Warheads/ missile**: 4			Yagel'naya: 7 Delta IV subs

OTHER RUSSIAN NUCLEAR WEAPONS		
	WARHEADS	**LOCATIONS**
Tactical Nuclear Weapons	The exact number of Russian tactical nuclear warheads remains unknown. Estimates of the total number of warheads on tactical nuclear weapons range from 15,000 to upwards of 20,000; the number deployed may be considerably lower, with the rest in storage, or at dismantlement facilities.[24]	About 4,000 tactical nuclear weapons were transferred to Russia from Belarus, Kazakhstan, and Ukraine in 1992.[25] In addition, tactical nuclear weapons have been withdrawn from Russian submarines and surface ships.[26] Deployment sites for land-based tactical weapons and storage sites for all types of tactical nuclear weapons are located throughout Russia. The total number of these sites was reduced in 1994 to enhance security.
Anti-Ballistic Missiles (ABMs)	One hundred single-warhead interceptors are deployed in the Moscow ABM system.	Moscow oblast.
Strategic Warheads in Storage and Dismantlement Facilities	There are probably at least several thousand intact, non-deployed, strategic war-heads at storage and dismantlement facilities. The exact numbers or proportion is not known.[27] As of late November 1996, all Soviet strategic warheads once deployed at missile or bomber bases in Belarus, Kazakhstan, and Ukraine (more than 3,200) had been returned to Russia. Russia is thought to be dismantling about 2,000 warheads annually.[28]	Dismantlement facilities: Sarov (formerly Arzamas-16) Zarechniy (formerly Penza-19) Lesnoy (formerly Sverdlovsk-45) Trekhgornyy (formerly Zlatoust-36)
Tactical/INF Warheads in Storage and Dismantlement Facilities	The exact number of warheads in storage or dismantlement facilities is unknown (see section above on tactical nuclear weapons). Any warheads taken from missiles withdrawn from Europe and destroyed pursuant to the 1991 Intermediate-Range Nuclear Forces (INF) Treaty are most likely in storage or slated for dismantlement.	In late 1994, Russia reduced the number of secure storage areas for tactical nuclear weapons; previously, Russia stored its tactical nuclear weapons at approximately 100 locations.[29] Dismantlement facilities: Sarov (formerly Arzamas-16) Zarechniy (formerly Penza-19) Lesnoy (formerly Sverdlovsk-45) Trekhgornyy (formerly Zlatoust-36)

Table 1-C Nuclear Weapon Systems and Associated Warheads

UKRAINE			
TYPE	**LAUNCHERS/ICBMs**	**WARHEADS**	**LOCATIONS**
Totals			
SS-19 ICBMs **Range**: 10,000 km **Payload**: 3,600 kg **Warheads/ missile**: 6			Khmel'nitskiy: 45 silos Pervomaysk: 19 silos
	Comments: Under START I rules, 64 SS-19 silos and 27 ICBMs remain accountable even though Ukraine has shut down power to all SS-19s, and removed and transferred all SS-19 nuclear warheads to Russia.[30] In December 1997, Ukraine announced it had thus far destroyed 69 of the original 130 SS-19s, and 107 SS-19 silos; the 61 remaining SS-19s will be destroyed in 1998.[31]		
SS-24 ICBMs **Range**: 10,000 km **Payload**: 3,200 kg **Warheads/ missile**: 10			Pervomaysk: 46 silos
	Comments: Under the terms of the 1994 Trilateral Statement, Ukraine has removed the warheads from all SS-24s and returned them to Russia.[32] Under START I rules, however, all SS-24 launchers remain accountable until the silos are destroyed. After a May 1997 meeting with U.S. Vice President Al Gore, Ukrainian President Leonid Kuchma agreed to destroy the SS-24s with U.S. CTR assistance. The destruction of the missiles is slated to begin in spring 1998.		
Bombers	**Comments**: 44 former Soviet strategic bombers, capable of carrying 588 ALCMs, remain in Ukraine; Ukraine agreed in 1995 to sell the bombers to Russia, but Russia subsequently refused to purchase them due to a deterioration in their condition.[33]		Uzin: 4 Bear-H6s 21 Bear-H16s Priluki: 19 Blackjacks

NOTES

1. As nuclear weapons analyst Robert Norris of the Natural Resources Defense Council notes: "Counting numbers of missiles and bombs can be somewhat inexact. For example, the deactivation and retirement of intercontinental ballistic missiles (ICBMs) and their launchers proceeds through at least four stages. In step one, an ICBM is electrically and mechanically removed from alert status. Next, the shroud is removed and the warheads are detached from the missile. In step three, the missile is withdrawn from the silo. Finally, to comply with START I, the silo is blown up and eventually filled in. Even though the missile was not operational after step one, it is not excised from the START Memorandum of Understanding (MOU) until after the final step." "NRDC Nuclear Notebook," *The Bulletin of the Atomic Scientists*, March/April 1996, p. 62.

2. All missile characteristics derived from Thomas B. Cochran, *et al.*, *Nuclear Weapons Databook--Volume IV: Soviet Nuclear Weapons*, (New York: Harper and Row, 1989). Some missiles with MIRV (multiple independently-targetable reentry vehicle) capabilities actually may carry fewer than their full MIRV attribution.

3. Angela Charlton, "Belarus Marks Nuke Withdrawal," *Associated Press*, November 27, 1996. See also “Cooperative Threat Reduction,” U.S. Department of Defense, August 1997, p. 7, which notes that 81 strategic nuclear warheads were transferred from Belarus to Russia.

4. *Radio Free Europe/Radio Liberty Daily Report*, December 23, 1993, quoting a spokesman from the Belarusian Defense Ministry. See also *Arms Control Association Fact Sheet*, January 1994.

5. *UPI*, January 14, 1995; *Post-Soviet Nuclear & Defense Monitor*, January 31, 1996, p.11.

6. Interview with DOD Special Coordinator for Cooperative Threat Reduction Laura Holgate, February 27, 1996.

A Russian Strategic Missile Forces official told *ITAR-TASS* that by April 25, 1995, all Soviet-era nuclear warheads had been transferred from Kazakhstan to Russia. This was confirmed by the Kazakhstani Foreign Ministry on May 24. (Doug Clarke, "Kazakhstan Free of Nuclear Weapons," *OMRI Daily Digest*, April 26, 1995, p. 2-3; Doug Clarke, "Kazakhstan Confirms It Is Nuclear Free," *OMRI Daily Digest*, May 25, 1995, p. 3; Prepared Remarks of U.S. Undersecretary of Defense for Policy Walter B. Slocombe before the Senate Armed Services Committee, May 17, 1995.)

A Russian Strategic Missile Forces official also stated in February 1995 that 632 warheads had been withdrawn from Kazakhstan and 266 remained. This total of 898 warheads suggests that a portion of the 104 SS-18s in Kazakhstan were single-warhead Mod 1/3/6 versions. ("Strategic Missile Forces Chief Interviewed," *Krasnaya Zvezda*, February 8, 1995, in *FBIS-SOV-95-027*, February 9, 1995, p. 15; Dunbar Lockwood, "New Data on the Strategic Arsenal of the Former Soviet Union," *Jane's Intelligence Review*, June 1995, pp. 246-249.)

7. According to the December 1995 MOU, 7 unrepaired Bear-G heavy bombers, which cannot be relocated due to their condition, are located at Semipalatinsk air base. The July 1997 MOU indicated that elimination of the bombers will be carried out on-site according to the schedule agreed to by Kazakhstan and the United States.

8. A joint Russian-Kazakhstani commission had considered dismantling the device and shipping it to the Chelyabinsk-70 nuclear center for further disassembly. Concern over a possible accident, however, led the commission to recommend that the device be destroyed by conventional explosives. The device, which was to be used in a 1991 physical irradiation experiment, had been buried in a 592-meter long tunnel approximately 130 meters from the surface. In August 1991, the test range was closed. The test was never conducted, and the undetonated bomb was left buried in Degelen Mountain until its subsequent destruction. (Bruce Pannier, "Kazakhstan Nuclear-Free," *OMRI Daily Digest*, June 1, 1995, p. 3; Douglas Busvine, "Kazakhstan to Blow Up Four-Year-Old Nuclear Device," *Reuters*, May 25, 1995; Bruce Pannier, "Kazakhstan to Explode Nuclear Device," *OMRI Daily Digest*, May 24, 1995, p. 2; "Nuclear Bomb to be Removed from Kazakhstan Test Site," *Komsomolskaya Pravda*, May 13, 1994, in *FBIS-SOV-94-093*, May 13, 1994, pp. 13-14.)

9. Statement by Commander-in-Chief of Russia’s Strategic Rocket Forces, in *Krasnaya Zvezda*, February 8, 1995.

10. *Izvestiya*, November 13, 1992, p. 1, as cited in "Belarus and Nuclear Weapons," February 2, 1994, *Research Brief from Radio Free Europe/Radio Liberty Research Institute*.

11. Holgate, interview, *op. cit.*; "Ukraine: Russia Nears Completion of Ukraine Warhead Disassembly," *Kiev Intelnews*, December 19, 1997, in *FBIS-TAC-97-353*, December 19, 1997.

12. Russia completed a series of four test launches beginning in December 1994 before declaring the Topol-M ready for deployment in July 1997. The first two missiles were installed in refurbished SS-19 silos at the Tatishchevo base in December 1997. See "DOD sees only one Russian SS-X-27 missile potentially operational," *Aerospace Daily*, January 13, 1998, p. 57; "Russia Inaugurates First Topol-M ICBM In Refurbished Silo," *Aerospace Daily*, January 7, 1998, p. 25.

13. U.S. officials have stated that production of the missile is proceeding slowly, and therefore they do not expect a garrison of ten missiles to be installed and fully operational until at least summer 1998. See *ibid.*, January 13, 1998.

14. *Krasnaya Zvezda*, September 7, 1995, in *FBIS-SOV-95-177*, September 13, 1995, p.27; Norris, "NRDC Nuclear Notebook," *op. cit.*, March/April 1996.

15. *Izvestiya*, November 13, 1992, *op. cit.*; "SS-25 Topol Missiles Redeployed From Belarus to Russia," April 20, 1994, in *JPRS-TND-94-*

011, May 16, 1994.

16. START II counting rules will eliminate the rules of START I, which intentionally undercounted bomber loadings. Under START II, Bear-H16 bombers are equipped to carry 16 warheads, Bear-H6 bombers up to 6 warheads, Blackjack bombers up to 12 warheads, and Bear-G bombers up to 2 warheads. See *Memorandum of Understanding on Warhead Attribution and Heavy Bomber Data Relating to the Treaty Between the United States of America and the Russian Federation on Further Reduction and Limitation of Strategic Offensive Arms*, ACDA web site, http://www.acda.gov/treaties/st2mou.htm.

17. The December 1996 MOU indicated that there were 26 Bear-H6 bombers at Ukrainka, but the July 1997 MOU notes that one test Bear-H6 bomber was transferred from Zhukovskiy and deployed at Ukrainka.

18. "Kazakhstan: Nuclear Weapons," NIS Nuclear Profiles Database, Center for Nonproliferation Studies, Monterey Institute of International Studies.

19. The Yankee I, Delta II, Delta III, and Delta IV class submarines have 16 tubes each. The Delta I class submarine has 12 tubes and Typhoon class submarines have 20 tubes.

20. Norris, "NRDC Nuclear Notebook," *op. cit.*., March/April 1996.

21. *Ibid.*

22. One Delta III sub with 16 tubes recently became inoperable. "NRDC Nuclear Notebook," *The Bulletin of the Atomic Scientists,* March/April 1998, pp. 70-71.

23. Two Typhoon subs with 20 tubes each are inoperable. *Ibid.*, pp. 70-71.

24. See Deputy Secretary of Defense John Deutch, U.S. Defense Department Briefing, September 22, 1994; and "Estimated Russian Nuclear Stockpile, September 1996," *The Bulletin of the Atomic Scientists*, September/October 1996, p. 17. Unfortunately, there is no authoritative baseline information on the number of tactical nuclear weapons deployed and stockpiled by the former Soviet Union as of 1991. Information released subsequently has been fragmentary and allows no reliable estimates either of the numbers or of the status of Russia’s tactical nuclear weapons, whether deployed on launchers, stored but operationally ready for use by military units, retired from service but stored, or both retired and dismantled.

Alexei Arbatov, Russian Duma member, published a report listing the number of Soviet tactical nuclear weapons at 21,700 in 1991. Of these, 13,700 were, he suggested, subject to elimination under the 1991 reciprocal unilateral reductions declared by Presidents Gorbachev and Bush. An additional 4,200 from outside Russia would also have been subject to elimination. Arbatov claims that of the remaining weapons, perhaps 4,000, most are in storage. *Yadernye Vooruzheniya Rossii*, ed. by Alexei Arbatov, Moscow: IMEMO, 1997, p. 56. The U.S. Defense Department recently reported, however, that most Russian warhead dismantlement appears to have been of strategic rather than tactical nuclear warheads, and that relatively few of the 15,000 tactical warheads that were estimated to have been withdrawn from service under the 1991 unilateral initiative, and presumably subject to dismantlement, actually were dismantled. The report states that "Russia has not divulged specific information on warhead reductions." OSD, *Proliferation: Threat and Response, November 199*7, Washington, D.C.: Department of Defense, November 1997, p. 43.

25. "Testimony of Ashton Carter, Assistant Secretary of Defense," before the Senate Armed Services Committee, April 28, 1994.

26. "Tactical Nuclear Arms Removed from Vessels," *ITAR-TASS*, February 4, 1994, in *FBIS-SOV-94-022*, February 4, 1994, p.1.

27. "The Soviet nuclear warhead stockpile is believed to have peaked at about 45,000 warheads in 1986. It has probably been reduced to about 25,000 warheads today. We would estimate that perhaps one-half of these 25,000 warheads are operational, and the other half scheduled for dismantlement." Testimony of NRDC nuclear specialist Thomas Cochran before the Senate Foreign Relations Subcommittee on European Affairs, August 22-23, 1995.

28. *Ibid.* This figure could include the dismantlement of both strategic and tactical nuclear weapons. In February 1998, Russian Defense Minister Sergeyev noted that Russia had performed "more than 10,000 operations in dismantling nuclear weapons." Assuming that Russia began dismantling warheads in 1992, this would reflect a dismantlement rate of slightly less than 2000 warheads per year. However, Minatom Minister Mikhailov also stated in February that if Russia were to continue dismantling warheads, the question of START II would have to be resolved; this suggests that Russia has dismantled the strategic warheads it intended to (i.e., met its quota for the year), but has not begun dismantling the large stockpile of warheads taken from tactical weapons it is still believed to possess. See Jonathan Wright, "Cold War Melts At Russia's Nuclear Nerve Center," *Reuters*, February 14, 1998; and "Press Conference With Nuclear Energy Minister Viktor Mikhailov," Official Kremlin International News Broadcast, February 18, 1998.

29. Because of concerns over the stability of Russia's armed forces -- highlighted by the refusal of certain units to follow orders during the conflict to suppress the revolt in Chechnya -- Washington urged the Russian government to consolidate tactical nuclear weapons in fewer locations with special security arrangements. Russia took such action in late 1994. Interviews, Moscow, February 1995; Testimony of Gloria Duffy, Deputy Assistant Secretary of Defense for Cooperative Threat Reduction, before the Subcommittee on Europe and the Middle East of the House Foreign Affairs Committee, March 24, 1994.

30. The July 1997 START MOU indicated that 64 SS-19 silos remained intact out of the original 130. The first silo was destroyed in the presence of U.S. Defense Secretary William Perry, Russian Defense Minister Pavel Grachev, and Ukrainian Defense Minister Valery Shmarov. See *UPI*, January 14, 1996. "Kuchma Issues Statement on Removal of Nuclear Weapons," UT-1 Television, June 1, 1996, in *FBIS-SOV-96-107*, June 5, 1996.

31. The July 1997 MOU notes that Ukraine has 64 SS-19s, but later reports indicate that 3 more SS-19s were destroyed by the end of 1997. "Ukraine Is Fulfilling Nuclear-Free Pledge," *St. Louis Post-Dispatch*, December 27, 1997, p. 27; "Ukraine To Destroy 62 Ballistic Missiles In 1998 - Senior Officer," *BBC*, December 19, 1997; "Ukraine will destroy remaining SS-19 missiles in 1998," *Agence France Presse*, December 17, 1997.

32. Secretary of Defense William Perry, "Remarks Prepared for Delivery by Secretary of Defense William J. Perry to the Henry L. Stimson Center, September 20, 1994," News Release, Office of the Assistant Secretary of Defense, Public Affairs.

33. Due to the deteriorating condition of the bombers, Russia has indicated that it no longer will purchase them, and the transfer is not expected to take place. Ukraine has subsequently requested U.S. assistance for the destruction of the bombers. See Barbara Starr, "Stalemate On ‘Scuds’ As Latest US-Kiev Talks Fail," *Jane’s Defence Weekly*, July 23, 1997, p. 3; Piotr Butowski "Russia’s Air Forces Face Up To Their Dilemmas - Part I," *Jane’s Intelligence Review*, October 1997, pp. 447-52; Norris, "NRDC Nuclear Notebook," *op. cit.*, March/April 1996.

Ukraine and Russia had earlier reached an agreement under which Ukraine would sell all of its strategic bombers to Russia in exchange for a reduction in Ukraine's energy debt to Russia by $190 million. The bombers would most likely have been flown to the airfield at Engels, where they would have been cannibalized for spare parts to maintain Russia’s bomber fleet. See "Shmarov: Russia Not to Use Ukraine's Long-Range Bombers," *Interfax*, June 14, 1995, in *FBIS-SOV-95-115*, June 14, 1995; "Report on Removal of Strategic Bombers to Russia," *Segodnya*, April 6, 1995, in *JPRS-TAC-95-002*, April 6, 1995; Doug Clarke, "Russia Undecided on Buying Bombers from Ukraine," *OMRI Daily Digest*, May 3, 1995, p. 3; "Russia Set to Buy Back Ex-Soviet Bombers," *Jane's Defence Weekly*, 18 March, 1995; Anton Zhigulsky, "Future of Disputed Black Sea Fleet Remains Uncertain," *Defense News*, March 13-19, 1995, p. 8; "Russia Says Ukraine to Hand Over Strategic Bombers," *Reuters*, February 24, 1995.

Table I-D Current U.S.-Russian Nuclear Negotiations

The United States and Russia are currently engaged in more than a dozen important negotiations and exchanges concerning the future of their respective nuclear arsenals and stocks of weapons-usable nuclear materials. These interactions include negotiations on new bilateral agreements, discussions to clarify or modify existing agreements or understandings, and exchanges to facilitate the implementation of on-going cooperative programs. Many of these talks are referred to elsewhere in this volume. To underscore the breadth of current U.S.-Russian exchanges on nuclear affairs and to help explain their complexities, this table summarizes the status of the most significant of these activities.[1]

SUBJECT	BACKGROUND & STATUS OF NEGOTIATIONS
Deployed Strategic Nuclear Weapons	**START I** -- Entered into force on December 5, 1994. Now being implemented, it includes verified destruction of strategic launchers (intercontinental-range missile silos, bombers, and missile-launching submarines) as well as data exchanges regarding current deployments of strategic weapons. Total Russian and U.S. strategic arsenals are to be reduced to 6,000 accountable warheads by December 2001. Frequent interactions regarding implementation are carried out through the Joint Compliance and Inspection Commission (JCIC) established by the treaty. Both sides are implementing on-site inspections to verify destruction of strategic launchers. Destruction activities under the treaty are two full years ahead of schedule.[2] In 1997, Russia and the U.S. agreed to amend START I to give it permanent duration. This will resolve a concern that delays in implementing START II and negotiating START III could decouple them from START I, which contains the basic procedures for reductions and verification for all the treaties. Amending START I also needs the agreement of the other three parties, Belarus, Kazakhstan and Ukraine, and will be codified by the JCIC. **START II** -- Approved for ratification by the U.S. Senate on January 26, 1996; Russian parliament currently considering pact, with review of the treaty taking place in lower house, or State Duma. START II would cap the number of deployed strategic warheads at 3,000-3,500 and eliminate all land-based ICBMs with multiple independently-targetable reentry vehicles (MIRVs) by January 1, 2003. The Russian parliament is delaying action on the treaty because of several concerns, notably that: (1) the treaty's terms impose significant unnecessary costs on Russia because it will require Russia to build new single-warhead ICBMs (to reach 3,500 START II limits) that Russia would soon have to eliminate to meet the 2,000-2,500 warhead limit of the anticipated START III treaty; (2) because of downloading differences in the U.S. and Russian strategic arsenals that will remain after the START II treaty is implemented, the United States would be able to rebuild its nuclear forces far more rapidly than Russia; (3) concerns that the United States might withdraw from or insist upon amendments to the Anti-Ballistic Missile (ABM) Treaty in order to build national missile defenses, or highly-capable theater missile defenses, that could erode the effectiveness of Russia's nuclear deterrent; and (4) the Yeltsin Administration has not developed a program or committed the necessary funds to restructure Russia's strategic forces at START II levels. Adding to parliamentary doubts about START II is the anxiety that it would require Russia to give up its most powerful weapons (including the 10-warhead SS-18 ICBM) at the very time that Russia perceives a growing threat from the enlargement of NATO. To address a number of these concerns, at the March 20-21, 1997, Helsinki Summit, Presidents Clinton and Yeltsin signed a "Joint Statement on Parameters on Future Reductions In Nuclear Forces" in which they agreed: (1) to adopt a protocol to the START II treaty (subject to approval by the appropriate legislative bodies in both countries) that would extend the treaty's implementation deadlines to December 31, 2007; (2) to begin negotiations on a START III treaty, immediately after START II enters into force, that would limit deployed strategic forces on both sides to 2,000 to 2,500 warheads, also by December 31, 2007; and (3) that in order to avoid significantly extending the period during which deployed nuclear forces would remain above START II levels, all systems scheduled for elimination under START II will be deactivated by removing their nuclear warheads or taking other jointly agreed steps by December 31, 2003.[3] In a separate initiative, the Presidents also agreed on a Joint Statement Concerning the ABM Treaty that reaffirms the commitment of the United States and Russia to the pact and provides the basis for the conclusion of negotiations to demarcate strategic from theater missile defenses (TMD) -- an agree-

SUBJECT	BACKGROUND & STATUS OF NEGOTIATIONS
Deployed Strategic Nuclear Weapons continued...	ment that would permit the United States to develop and deploy certain TMD systems, while maintaining the prohibitions in the ABM Treaty against the development and deployment of systems capable of defending against Russian strategic missiles.[4] Separately, Russian concerns regarding the enlargement of NATO were partially addressed with the signing in Paris of the NATO-Russia Founding Act on May 27, 1997. Among other initiatives, the Founding Act established a NATO-Russia Permanent Joint Council, giving Russia a voice in European security affairs.[5] According to U.S. officials, the Russian side indicated at the Helsinki Summit that the prospects for ratification of START II by the Russian parliament would greatly improve after the signing of the NATO-Russia Founding Act, the completion of the ABM/TMD Demarcation Agreement, the signing of the START II extension protocol, and the commitment to begin START III negotiations, at which time President Yeltsin would begin a major drive to gain parliamentary approval for the START II pact. As envisaged at Helsinki in March, Russia and the U.S. signed the START II extension protocol in New York on September 26, 1997. Once ratified, this amendment will postpone the deadline for completing START II reductions by five years, from January 1, 2003 to December 31, 2007. Secretary of State Albright and Foreign Minister Primakov also exchanged letters in New York that codify the Helsinki commitment to “deactivate” those ICBMs that are to be eliminated under START II (Russian SS-18s and SS-24s, and the American MX), by December 31, 2003. Deactivation will either entail removal of warheads or be carried out by other jointly agreed steps, which are yet to be negotiated. On Russia’s behalf, Primakov issued a unilateral statement indicating that once START II has entered into force, experts from both sides should immediately begin work on methods of deactivation and on an appropriate program of U.S. assistance to implement these deactivation methods, and that Russia will proceed on the understanding that the START III treaty will be negotiated and enter into force well before the deactivation deadline. Also in September, the Russian government began new steps to win Duma approval of START II; the Duma did not act on the treaty in 1997, however, and Russian ratification was postponed at least until the fall of 1998. **START III --** As noted above, at the March 20-21, 1997, Helsinki Summit, Presidents Yeltsin and Clinton signed a joint statement in which they agreed to begin negotiations on a START III treaty immediately after START II enters into force, and identified certain parameters for that treaty. In addition to agreeing that the pact would limit deployed strategic forces on both sides to between 2,000 to 2,500 warheads by the end of 2007, the presidents agreed that START III would be the first strategic arms control agreement to include measures relating to the transparency of strategic nuclear warhead inventories and the destruction of strategic nuclear warheads.[6] The presidents also agreed that the two sides would consider the issues related to transparency in nuclear materials. In addition, the presidents agreed to explore possible measures relating to long-range nuclear sea-launched cruise missiles and tactical nuclear systems. These discussions are to take place separate from, but in the context of, the START III negotiations. Formal START III negotiations have awaited Russia’s ratification of START II. Soon after the New York signature of the START II protocol in September, however, U.S. and Russian experts began to meet informally to discuss issues that will need to be resolved in START III. These expert discussions continued through the winter of 1997-98, including October 1997 consultations between Deputy Foreign Minister Mamedov and the new U.S. Ambassador in Moscow James Collins, Foreign Minister Primakov and Deputy Secretary of State Talbott, and Prime Minister Chernomyrdin and Vice President Gore. **U.S. Cooperative Threat Reduction (CTR) Program** -- Provides assistance for deactivation, transportation, and dismantlement of strategic nuclear weapons. Numerous ad hoc negotiations between the U.S. Department of Defense (DOD) and the Russian Ministry of Defense (MOD). (For additional details, see Table I-F.) **Anti-Ballistic Missile (ABM) Treaty Demarcation Talks** -- Through periodic meetings of the Standing Consultative Commission (SCC), established by the treaty, and other bilateral channels, the talks are attempting to clarify theater missile defense (TMD) criteria that would distinguish TMD (non-strategic) from ABM (strategic) systems. ABM systems are limited by the ABM Treaty, whereas TMD systems, according to the U.S. interpretation, are not.

SUBJECT	BACKGROUND & STATUS OF NEGOTIATIONS
Deployed Strategic Nuclear Weapons continued...	On October 23, 1995, the United States and Russia agreed that: theater missile defense (TMD) systems would be tested only against targets with a range of less than 3,500 km and a velocity of less than 5 km/sec; TMD interceptors with velocities of 3 km/sec or less would be deemed compliant with the ABM Treaty; and that an agreement concerning higher-speed TMD interceptors would be deferred. Since that time, the United States has taken the position that each side should make its own determinations as to the compliance of such systems with the treaty. In addition, the two sides agreed to a series of transparency measures aimed at providing reassurance that in the course of developing TMD systems, neither was developing an ABM system prohibited by the treaty.[7] Discussions to codify these understandings were pursued at a December 4, 1995, meeting of the SCC. At their bilateral meeting following the April 19-20, 1996, Nuclear Safety and Security Summit, Presidents Yeltsin and Clinton agreed to formalize the arrangements regarding the lower velocity interceptors by June 1996 and to continue discussions on higher velocity interceptors through the SCC. Although negotiations during the summer and fall of 1996 apparently led to the completion of an agreement on lower velocity interceptors, in late October Russia informed the United States that it was not prepared to sign an agreement addressing only these systems without an accompanying agreement on higher velocity systems. At the Clinton-Yeltsin Summit in Helsinki in March 1997, however, the two leaders announced that they had reached consensus on the principles of an agreement covering the higher speed systems. Also in March, the Clinton administration announced that it would submit any agreement on TMD to Congress for approval; the Russian parliament must also approve such an accord. The long-awaited TMD demarcation breakthrough finally occurred in the SCC in August 1997, producing several ABM Treaty-related agreements for signature in New York on September 26. In addition to the START II extension protocol, the “strategic package” included: (1) a Memorandum of Understanding that multilateralizes the ABM Treaty by adding the three other Soviet successor states -- Belarus, Kazakhstan and Ukraine -- with ABM assets on their territories; (2) the low-velocity TMD interceptor accord, the content of which had been agreed since October 1995 (see above); and (3) a high-velocity TMD interceptor accord. According to the latter agreement, both sides undertake to deploy neither TMD systems for use against the other party, nor TMD systems that could pose a realistic threat to the strategic nuclear force of the other party; not to test TMD components against target vehicles that exceed 5 km/sec velocity and 3,500 km range; and not to develop, test or deploy space-based TMD interceptor missiles or space-based TMD systems based on other physical principles (e.g., lasers) that could function as TMD interceptors. Achieving the TMD accords together with the START II extension protocol was supposed to clear the path for Russian ratification of START II, which had not happened by the end of 1997. The Clinton administration’s decision to submit the TMD accords to the Senate for approval through the treaty process could also present difficulties. Some analysts and members of Congress have criticized any effort to formalize TMD demarcation as having the effect of placing limits on TMD systems, which were outside the scope of the ABM Treaty as written. Others have suggested that if the multilateralization MOU is defeated, the ABM Treaty becomes void.
Deployed Tactical Nuclear Weapons	**U.S. Department of Defense--Russian Ministry of Defense Dialogue** -- Periodic meetings between representatives of the two organizations address the status of these systems on an ad hoc basis. **CTR Program (U.S. DOD/Russian MOD)** -- Provides assistance for transportation and deactivation of these weapons. **START III** -- At the March 20-21, 1997, Clinton-Yeltsin Helsinki Summit, the two leaders agreed “that in the context of START III negotiations their experts will explore, as separate issues, possible measures relating to nuclear long-range sea-launched cruise missiles and tactical nuclear systems, to include appropriate confidence-building and transparency measures.”[8]

Table I-D U.S.-Russian Nuclear Negotiations

SUBJECT	BACKGROUND & STATUS OF NEGOTIATIONS
Nuclear Warhead and Fissile Material Stockpile: Intergovernmental Agreement for Cooperation on the Exchange of Classified Data ***Negotiations Suspended***	As noted below, this agreement is a precondition for several bilateral transparency and verification arrangements. Negotiations on this agreement (conducted by officials of the U.S. Department of State and the Russian Ministry of Foreign Affairs) have stalled since late summer 1995, as Russia has sought additional time to refine its stance on the issues posed by the agreement. This, in turn, has delayed action on the related bilateral measures that depend on the completion of the cooperative agreement.
Nuclear Warheads: Stockpile Transparency ***Negotiations Suspended***	**Safeguards, Transparency, and Irreversibility (STI) Talks -- Nuclear Warheads** -- Building on earlier high-level commitments, at the May 10, 1995, Moscow Presidential Summit, the United States and Russia undertook to negotiate "agreements to increase the transparency and irreversibility of nuclear arms reductions that, *inter alia*, establish an exchange on a regular basis of detailed information on aggregate stockpiles of nuclear warheads, on stocks of fissile materials, and on their safety and security."[9] The United States proposal regarding warheads calls for a "Stockpile Data Exchange Agreement" that would provide for the exchange of information by warhead type and location, including those in both states' active inventories and those removed from weapons, to be partially confirmed by on-site inspections. In addition, warheads slated for destruction would be subject to inspection. Status: Progress stalled since late 1995, because of Russian inability to pursue completion of an intergovernmental agreement for cooperation to permit the exchange of classified information. (See next paragraph). Precondition: Because the agreement would result in the exchange of classified and sensitive information, U.S. law was amended in 1994 to permit such disclosures to Russia, which it previously prohibited. U.S. law, however, also requires that an intergovernmental agreement for cooperation between the United States and Russia establishing the conditions for such exchanges be negotiated and come into force before the exchanges can take place. In Russia, an executive decree or legislation authorizing the release of such information must be adopted and a cooperative agreement with the United States concluded. (See "Intergovernmental Agreement for Cooperation," above.)
Fissile Material (I): Transparency of "Excess" Material ***Negotiations Suspended***	**Safeguards, Transparency, and Irreversibility (STI) Talks -- "Fissile Material Data Exchange Agreement" --** Pursuant to undertakings at the May 10, 1995, Moscow Summit (see previous entry), the United States has proposed an agreement calling for reciprocal declarations of excess fissile material stockpiles, to be partially confirmed by on-site inspections. Under the proposal, excess material would include all fissile material, except that used in nuclear weapons, in naval propulsion reactors, or reserved for these purposes. Status: Progress stalled since late 1995 because of Russia's unwillingness to pursue completion of an intergovernmental agreement for cooperation to permit the exchange of classified information. (See next paragraph). However, on February 6, 1996, the U.S. Department of Energy declassified and disclosed the location and form of all U.S. excess fissile material, amounting to 20% of the total U.S. stocks of plutonium and highly enriched uranium, and in his remarks to the IAEA General Conference on September 29, 1997, Secretary of Energy Pena noted that since 1995, the U.S. has declared 225 tons of fissile material as "excess" to defense requirements.[10] Similarly, Minatom Minister Mikhailov declared in his statement before the same conference on September 30, 1997, that Russia was removing 500 tons of HEU and 50 tons of Pu from the defense sector.[11] Precondition: Before concluding a Fissile Material Data Exchange Agreement, which would go beyond current disclosures, the United States requires the entry into force of an intergovernmental agreement for cooperation on the exchange of classified data; Russia also requires such an agreement and must also enact an executive decree or legislation authorizing such an agreement. (See previous entry.)

SUBJECT	BACKGROUND & STATUS OF NEGOTIATIONS
Fissile Material (II): Stockpile Security	**Material Protection, Control, and Accounting/Securing Nuclear Materials** -- Two broad categories of discussions and activities were initially undertaken: a “government-to-government” program, negotiated by senior officials at the U.S. Department of Energy and the Russian Ministry of Atomic Energy (Minatom), and a “laboratory-to-laboratory” program, negotiated by managers at individual U.S. National Laboratories and their Russian counterparts. Both programs involved the provision of U.S. assistance to Russian facilities for improved fissile material protection, control, and accounting, (MPC&A), as well as reciprocal visits by U.S. and Russian specialists to nuclear facilities handling fissile materials. The separate “government-government” and “lab-lab” elements were consolidated into a unified program in February 1997. These activities were originally funded through the Department of Defense CTR program, but most U.S. activities to enhance the security of fissile materials in Russia are managed by the Department of Energy and have been funded through its budget since FY1996. (The principal exception is the project to build a facility at Mayak for the storage of fissile material components from dismantled Russian nuclear warheads, a project which is managed and funded by the U.S. Department of Defense. Also, the program to provide fissile material containers for the Mayak facility is managed by DOD.) According to an “MPC&A Program Strategic Plan,” DOE is providing assistance to 53 facilities in the former Soviet Union.[12] By the end of 1997, physical security upgrades had been completed at 17 smaller sites and DOE projects that upgrades will have been completed at 27 total sites by the end of 1998. In addition, DOE has helped establish training and education centers for Russian specialists at the Russian Methodological Training Center in Obninsk, the Moscow Engineering Physics Institute, and the Tomsk Polytechnic University; by January 1998, more than 2000 individuals had received training under these programs. Recent developments include expansion of the list of facilities to be covered under the program;[13] the initiation of work with the Russian Navy to improve the security of highly enriched uranium fuel for submarine propulsion reactors; the conclusion of a comprehensive agreement with the Russian Navy for MPC&A at all naval sites, formalized in a protocol signed in December 1997; and new initiatives to improve nuclear materials transportation security. By the end of 1997, DOE was engaged in cooperative MPC&A projects at all sites in the former Soviet Union known to contain fissile material. DOE officials emphasize, however, that many large Russian facilities, especially those in the nuclear cities, still need comprehensive MPC&A improvements. The DOE budget for MPC&A activities has increased from $3 million in FY1993, to $137 million for FY 1998. (For funding details, see Table I-F.) The announced budget for FY1999 is $160 million. This increase in funding is directed toward the rapid security upgrades phase, which is predicted to be complete by 2002. Funding is therefore expected to diminish after FY1999.[14] For additional details about activities at individual installations under both programs, see Table I-E.
Fissile Material (III): Cessation of Production of Plutonium at the Zheleznogorsk (Krasnoyarsk-26) and Seversk (Tomsk-7) Reactors	**The Plutonium Production Reactor Agreement (PPRA) Talks** -- In May 1994, Russia agreed to cease operating two plutonium production reactors at Seversk (Tomsk-7) and one at Zheleznogorsk (Krasnoyarsk-26) by December 31, 2000, with the expectation that alternative sources of energy would be available to these cities by that date to substitute for the district heating the reactors provide. Russia also agreed that in the interim no plutonium produced in these reactors would be used for nuclear arms and that the United States could verify this. The agreement was formalized at the June 1994 meeting of the Gore-Chernomyrdin Commission (GCC), chaired by U. S. Vice President Albert Gore and Russian Prime Minister Viktor Chernomyrdin.

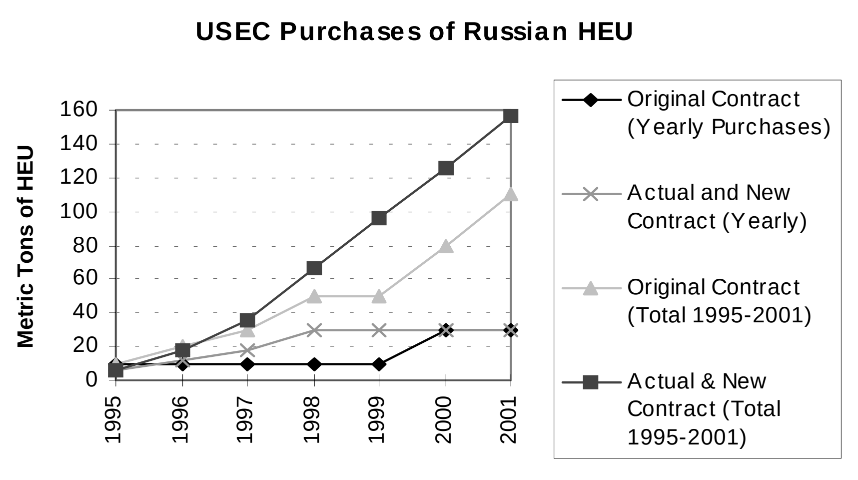
SUBJECT	BACKGROUND & STATUS OF NEGOTIATIONS
Fissile Material (III): Cessation of Production of Plutonium at the Zheleznogorsk (Krasnoyarsk-26) and Seversk (Tomsk-7) Reactors continued...	Russia has declared that it ceased using plutonium produced in the three reactors for nuclear weapons as of October 1, 1994.[15] Russia, however, refused to bring the June 1994 agreement into force, claiming that the United States was reneging on a pledge made in conjunction with the agreement to provide funding for the installations that will replace the energy lost through the shut-down of the three reactors. Washington insisted, however, that the 1994 agreement did not make the shut-down of the reactors contingent on the availability of replacement energy and that the United States never agreed to provide funds for this purpose. Russia also expressed concerns that providing access to the reprocessing (plutonium separation) facilities at the two cities would divulge classified information. At the June 30, 1995, GCC meeting, Russia and the United States agreed to implement the accord by allowing the United States to monitor the operation of the three reactors and to monitor the plutonium separated from the spent fuel produced in these units, without inspecting the reprocessing plants where the plutonium is separated. In addition, the United States agreed to assist Russia in conducting feasibility studies to assess possible energy alternatives to the reactors, including: the construction of conventional power plants; construction of new nuclear power reactors, whose spent fuel, unlike that of the existing reactors, could be stored without the need for reprocessing; and conversion of the existing nuclear reactor cores to use fuel that would not produce weapons-grade plutonium and that would include uranium from dismantled nuclear weapons. By mid-May 1996, the studies had been completed, and it was agreed that the core conversion option would be selected. Thereafter, a detailed engineering study was completed. The United States agreed to pay $10 million for a joint U.S.-Russian feasibility study on converting the reactors. The U.S. also agreed to contribute $70 million to pay for the conversion of the three reactor cores based on a favorable result of the feasibility study and if the Russian side meets certain agreed milestones. The core conversion is to be funded through the U.S. Department of Defense under the Cooperative Threat Reduction (Nunn-Lugar) Program, conditional on completion of a CTR Implementing Agreement. In August 1996, negotiations began on a revised agreement, providing for the conversion of the three reactors, and a new text was agreed upon in January 1997. Despite expectations that the accord would be signed at the February GCC meeting, the Russian side was unable to do so because of difficulties obtaining clearance from all the Russian governmental agencies involved. A number of further modifications were made to the document in the spring of 1997. Negotiations on a CTR Core Conversion Implementing Agreement began in June 1997 and concluded in September. Both the Plutonium Production Reactor Agreement and the Minatom-DOD Implementing Agreement were signed on September 23, 1997, in Moscow at the ninth GCC meeting. The new text calls for the reactors to be modified by 2000 and provides for U.S. monitoring of all plutonium produced in the reactors and separated after January 1, 1995, to ensure that it is not used for weapons. (The original agreement concerning the reactors also provided for U.S. monitoring to begin at roughly this time.) The United States will be able to monitor the operation of the converted reactors, but will not have access to Russian reprocessing facilities. The agreement also specifies that the reactors will be shut down at the end of their normal lifetimes, approximately in 2009-2010. The agreement will not only end the further production of weapons-grade plutonium at the three reactors and provide monitoring of recently produced material, but it will also help reduce existing stocks of weapons-usable uranium.

SUBJECT	BACKGROUND & STATUS OF NEGOTIATIONS
Fissile Material (IV): Mutual Reciprocal Inspections ***Discussions Suspended***	Originally launched by the March 16, 1994, joint statement by U.S. Secretary of Energy Hazel O'Leary and Russian Minister of Atomic Energy Viktor Mikhailov, this initiative was superseded by the undertaking of Presidents Yeltsin and Clinton at the May 10, 1995, Moscow Summit, to pursue "a cooperative arrangement for reciprocal monitoring at storage facilities of fissile materials removed from nuclear warheads and declared to be excess to national security requirements to help confirm the irreversibility of the process of reducing nuclear weapons . . ."[16] Discussions on the development of this inspection arrangement have been stalled since late 1995, however, because of Russian inability to pursue completion of an intergovernmental agreement for cooperation to permit the exchange of classified information. However, important technical discussions have continued regarding one of the most difficult challenges presented by such reciprocal monitoring: developing arrangements that limit or avoid the disclosure of classified nuclear-weapon-design data while permitting verification that fissile material subject to monitoring is, in fact, from dismantled nuclear weapons.[17] This issue must also be addressed as part of the transparency arrangements covering the Mayak fissile material storage facility and in the context of future negotiations on the START III treaty concerning measures to promote transparency in the destruction of strategic, and possibly tactical, nuclear warheads.
Fissile Material (V): Fissile Material Storage Facility (Mayak)	The United States and Russia are undertaking negotiations regarding transparency arrangements at a facility now under construction at Mayak for storing fissile material components (*viz.,* plutonium "pits" and weapons-grade uranium) from dismantled Russian nuclear weapons.[18] The costs of the facility are being shared by the U.S. Department of Defense CTR program and the Russian Ministry of Atomic Energy. Because of its financial contribution, the United States is seeking special transparency mechanisms, separate from any broader reciprocal monitoring arrangement, to ensure that the material stored at the facility has, in fact, come from dismantled nuclear warheads. At the May 10, 1995, Presidential Summit, the two sides agreed to transparency measures that will take effect once components from dismantled weapons enter the Mayak storage facility, but Russia refused to permit U.S. monitoring of the facility at which the weapons are to be dismantled. As an alternative, Washington has sought to gain acceptance for other measures to track nuclear warheads as they move from facility to facility in the dismantlement process, such as scanning and tagging sealed canisters containing nuclear-weapon parts. The two sides have agreed upon a number of technical measures that might be used to verify this "chain of custody," but the Mayak facility verification protocol, which would incorporate such arrangements, has not been completed. During 1996, technical discussions continued on an MPC&A system for the facility, with the United States seeking to ensure that this system will facilitate U.S. efforts to verify the origin of the stored material. It is uncertain whether the verification protocol for Mayak will necessitate the sharing of classified information. If this were required, then the protocol could be concluded only after a U.S.-Russian agreement for the sharing of classified information had entered into force. To avoid this obstacle, U.S. and Russian negotiators have concentrated on transparency measures that would avoid the release of sensitive data. Separately, in an April 10, 1996 address to the Russian Security Council, President Boris Yeltsin, referring to the fissile material storage facility at Mayak, declared that "After completion we propose to place it under IAEA control." Talks on this aspect of the Mayak Facility are being pursued in the context of the U.S.-Russian-IAEA Trilateral Initiative, discussed below. After a period without discussion, negotiations were expected to resume in earnest in 1998.

<table>
<tr><th>SUBJECT</th><th>BACKGROUND & STATUS OF NEGOTIATIONS</th></tr>
<tr><td>Fissile Material (VI): U.S. Purchase of 500 Metric Tons of Russian Highly Enriched Uranium (HEU) from Dismantled Nuclear Weapons</td><td>

This agreement, signed on February 18, 1993, provides for the United States Enrichment Corporation (USEC) to purchase, over a 20-year period, 500 metric tons of weapons-grade highly enriched uranium (HEU) from dismantled Russian nuclear warheads for nearly $12 billion. The material (enriched to 92% or more U-235) is to be blended in Russia with 1.5% enriched uranium to produce low-enriched uranium (LEU) -- material enriched to between 4-5% -- for use as nuclear power plant fuel. The agreement contemplated sales of the equivalent of 10 tons per year for five years and then the equivalent of 30 tons per year for the remaining 15 years of the contract. After a number of initial difficulties in implementing the arrangement, USEC ultimately received LEU containing the equivalent of 6 tons of weapons-grade uranium in 1995, and 12 tons in 1996.

In November 1996, USEC and Minatom signed a contract amendment establishing quantities to be purchased and pricing for a five-year period that significantly accelerated this schedule. The agreement provides for USEC to purchase the equivalent of 18 metric tons of weapons-grade uranium in 1997; 24 in 1998; 30 in 1999, 30 in 2000 and 30 in 2001. This will speed up the purchases over these years from previous goals by approximately 50 percent and will account for nearly one-third of the 500 metric tons covered by the original agreement. The equivalent of 7,500 nuclear warheads will be converted to nuclear fuel over the next five years through this contract.[19] USEC is to pay $2 billion for the material.



The overall USEC-Minatom agreement treats the purchased material as having two components -- uranium and the work expended to enrich it. In light of U.S. anti-dumping laws limiting sales of foreign uranium in the United States and to comply with a settlement in a recent anti-dumping lawsuit, the original USEC-Minatom contract provided that the uranium portion of the purchased material would be held back from the U.S. market by USEC for a number of years and that payment to Minatom for this portion of the sale would be delayed for a comparable period. In early 1995, Minatom objected to this arrangement. To meet Minatom's concerns, USEC agreed in June 1995 to compensate Minatom on a current basis for the uranium component of the material USEC purchased. At the same time, the U.S. government sought legislation to permit the earlier introduction of the uranium into the U.S. market as a last resort, if sales in other markets proved unattainable.

Eventually, in conjunction with legislation providing for USEC to become a privately held corporation, the U.S. Department of Energy agreed to purchase the natural uranium component from the first two years of Russian HEU sales to USEC, with the expectation that a portion would be gradually sold in the U.S. market and a portion sold back to Russia, for use in the HEU-to-LEU blending process and/or for sale on the international market. From 1997 onward, Russia is to receive back the natural uranium component of the sales (and its value is to be deducted from the U.S. purchase price for the Russian HEU), for domestic use or international sale. Russia will be allowed to sell a small portion of the material in the United States, a quota that will gradually increase in future years.[20]

</td></tr>
</table>

SUBJECT	BACKGROUND & STATUS OF NEGOTIATIONS

Fissile Material (VI): U.S. Purchase of 500 Metric Tons of Russian Highly Enriched Uranium (HEU) from Dismantled Nuclear Weapons continued...	A separate question concerns verification that the material purchased by USEC has, in fact, been removed from dismantled Russian nuclear weapons. This matter, which has been discussed separately from the other verification issues noted above, was addressed at the June 30, 1995, Gore-Chernomyrdin Commission (GCC) meeting. At that meeting, Minatom agreed to permit U.S. monitors to take samples at two points in the process: the point at which weapons-grade enriched uranium is introduced and the point at which it is blended with 1.5 percent enriched material. This will permit verification that weapons-grade material was used to create the final product at the two Russian blending facilities, the Ural Electrochemical Integrated Plant, Novouralsk (Sverdlovsk-44), and the Krasnoyarsk Electrochemical Plant. The details of these verification measures, as well as those to be implemented at Seversk (Tomsk-7), where Russian nuclear-weapon components are ground into chips and transformed from metallic HEU to oxide form, were negotiated during the early part of 1996 in a series of documents known as “facility annexes.”[21] Additional outstanding issues were resolved at the April 20-21, 1996, Clinton-Yeltsin Summit in Moscow. A related aspect of the problem has been that Russia, to ensure that the material it transfers to the United States is not used for weapons, has insisted upon reciprocal monitoring rights at USEC’s Portsmouth Gaseous Diffusion Plant (where the Russian material is processed upon arrival in the United States) and at the non-government-owned facilities where the material is subsequently fabricated into reactor fuel. Facility annexes were also needed in these cases. By early May 1996, the annexes for the relevant Russian and U.S. facilities had been completed and signed, and the transparency measures were being implemented. Transparency measures were expanded under an additional agreement signed in December 1996. Monitoring activities, which currently include up to six visits per year to relevant U.S. and Russian installations and permanent monitors at Novouralsk (Sverdlovsk-44) and Portsmouth, will be expanded to permit continuous observation of enrichment flows and blend points in Novouralsk (Sverdlovsk-44) and at the Krasnoyarsk Electrochemical Plant. The United States will also have greater access at Seversk (Tomsk-7), allowing U.S. monitors to conduct experiments on Russian nuclear weapon components arriving from Russian dismantling facilities.[22] In addition, as Russia begins to conduct blending activities at new facilities to fulfill the increased requirements of the November 1996 five-year USEC-Minatom HEU purchase contract, U.S. monitoring will be extended to these sites.[23]
Fissile Material (VII): Research Reactor Conversion	The U.S. Department of Energy and Minatom are coordinating efforts to establish a Russian program to develop the technology and fuels required to allow Soviet-style research reactors now burning HEU to use LEU fuel. This initiative is an outgrowth of the U.S. Reduced Enrichment in Research and Test Reactors (RERTR) program. U.S. officials believe that once established, the Russian program could seek to convert to LEU fuel Soviet-era reactors outside Russia, including facilities in Kazakhstan, Latvia, Ukraine, Uzbekistan, Eastern Europe, and, especially, reactors in Libya, North Korea, and Vietnam. Ultimately, Russia could begin to convert its own research reactors to such fuel. Currently, Argonne National Laboratory and Russia’s Scientific Research and Design Institute of Power Technology (NIKIET) in Moscow are implementing a contract to develop high-density fuels made of low-enriched uranium that would serve as a substitute for high-enriched uranium fuels in Soviet-design research reactors. Also participating in the effort are the Bochvar All-Russian Scientific Research Institute for Inorganic Materials in Moscow (fuel development), the Novosibirsk Chemical Concentrates Plant (fuel fabrication), and three facilities where new fuels will be tested, the Kurchatov Institute, the Scientific Research Institute for Atomic Reactors (Dimitrovgrad), and the St. Petersburg Nuclear Physics Institute (Gatchina). The first Soviet-style reactors that will be candidates for conversion are expected to be those in the Czech Republic, Hungary, and Poland.
Fissile Material (VIII): Long-Term Plutonium Disposition	These largely technical talks are examining options for the long-term disposition of plutonium, including extended storage, immobilization and direct disposal, and use of the material as fuel in nuclear power reactors. Most recently, these talks have built on the recommendations of a September 1996 report of the U.S.-Russian Independent Scientific Commission on Disposition of Excess Weapons Plutonium. The group’s

SUBJECT	BACKGROUND & STATUS OF NEGOTIATIONS
Fissile Material (VIII): Long-Term Plutonium Disposition continued...	report urged both countries to move forward as quickly as possible with both the immobilization and reactor options for plutonium disposition, beginning with the use of existing reactors for the reactor option.[24] Also forming the background to the talks is the Record of Decision on the storage and disposition of weapons-usable fissile materials, taken by U.S. Secretary of Energy Hazel O'Leary in January 1997, which similarly calls for pursuing these two options for the disposition of U.S. excess plutonium. Current activities in the context of the U.S.-Russian talks are a series of analyses and small-scale demonstrations of disposition technologies. The United States has also proposed the joint development of a plutonium pit disassembly, conversion, and non-destructive assay plant in Russia. The objective is to promote the demilitarization and conversion of surplus plutonium pits and the placing of the materials under an international safeguards regime within several years.[25]
Gosatomnadzor-Department of Energy Agreement	Entered into at the June 1995 Gore-Chernomyrdin Commission meeting, the agreement calls for DOE to provide assistance to Gosatomnadzor (Russian Nuclear and Radiation Safety Supervision Committee) in establishing national and facility specific MPC&A systems. Working groups of officials from both agencies meet periodically. Gosatomnadzor also has entered into a separate agreement with the U.S. Nuclear Regulatory Commission, under which the U.S. agency will provide support for Gosatomnadzor's safety and environmental regulatory programs.
Trilateral Initiative with the International Atomic Energy Agency	The purpose of this U.S.-Russia-IAEA initiative is to develop a new set of tools for international monitoring of excess fissile materials, especially those in sensitive forms, in the context of U.S. and Russian disarmament activities. The initiative was launched on September 19, 1996, following separate U.S. and Russian pledges to place fissile materials no longer needed for defense purposes under IAEA safeguards.[26] It is expected that to verify storage of nuclear weapon components (such as the plutonium "pits" expected to be stored at Mayak) traditional IAEA safeguarding methods, which involve sampling, visual inspection, and various quantitative measurements, will have to be modified significantly to avoid the disclosure of sensitive nuclear weapons design data.[27] After a pause in negotiations, the U.S. and Russia issued a progress report presented to the IAEA General Conference in September 1997 on discussions regarding the trilateral initiative. And in December 1997, U.S., Russian, and IAEA experts met in the United States to examine possible methods for conducting IAEA monitoring under the initiative.

NOTES

1. This table is based on discussions with U.S. officials at the White House Office of Science Policy, the U.S. National Laboratories, and the Departments of State, Energy, and Defense.

2. Robert Bell, National Security Council official for defense and arms control, in a February 17, 1998 presentation to the Arms Control Association, Washington, DC.

3. Joint Statement on Parameters of Future Reductions in Nuclear Forces, Clinton-Yeltsin Summit, Helsinki, Finland, March 20-21, 1997, http://www.usis.fi/whatshap/summit31.htm.

4 Joint Statement Concerning the ABM Treaty, Clinton-Yeltsin Summit, Helsinki, Finland, March 20-21, 1997, http://www.usis.fi/whatshap/summit27.htm.

5. Founding Act on Mutual Relations, Cooperation and Security Between the Russian Federation and the North Atlantic Treaty Organization, Paris, May 27, 1997, http://www.usia.gov/topical/pol/atlcomm/natoact.htm.

6. See note 3.

7. "14 November through 20 December," *Arms Control Reporter (1996)* (Cambridge, MA: Institute for Defense and Disarmament Studies), p. 603.B.262 ff.

8. Joint Statement On Parameters Of Future Reductions In Nuclear Forces, *op. cit*.

9. Joint Statement on the Transparency and Irreversibility of the Process of Reducing Nuclear Weapons, Clinton-Yeltsin Moscow Summit, May 10, 1995.

10. U.S. Department of Energy, Office of the Press Secretary, "DOE Facts: 'Department of Energy Declassifies Location and Forms of Weapon-Grade Plutonium and Highly Enriched Uranium Inventory Excess to National Security Needs,'" February 6, 1996. See also Statement Summaries of the 41st General Conference, IAEA web site, http://www.iaea.or.at.

11. See Statement Summaries of the 41st General Conference, IAEA web site, *op. cit*.

12. U.S. Department of Energy, Office of Nonproliferation and National Security, "MPC&A Program Strategic Plan," January 1998.

13. See *ibid*., p. 11, for a comprehensive list of locations in Russia where DOE is engaged in MPC&A activities.

14. MPC&A program funding levels will peak in 1999, but project planning extends to 2003. U.S. Department of Energy, Office of Arms Control and Nonproliferation, "MPC&A Program Strategic Plan," January 1998.

15. Russia has stated that it is retaining the plutonium produced at Zheleznogorsk (Krasnoyarsk-26) and Seversk (Tomsk-7) in oxide form and is not transforming it into the metallic form used in weapons.

16. Joint Statement on the Transparency and Irreversibility of the Process of Reducing Nuclear Weapons, *op. cit.*

17. As of early 1997, a draft "Mutual Reciprocal Inspection" demonstration agreement had been developed to allow the application of proposed verification measures to "classified forms," i.e., weapon components. Although a consensus exists regarding the use of certain measurements there are continuing discussions on measuring the shape of inspected items. Guy Lunsford, "Mutual Reciprocal Inspections," *Journal of Nuclear Materials Management*, June 1997, p. 60. It is expected that inspection involving plutonium components will involve some disclosure of classified data, which can take place only after the adoption of the currently stalled intergovernmental agreement for cooperation authorizing the exchange of such information. Inspections of weapons-grade uranium from dismantled nuclear weapons may be possible on an unclassified basis.

18. The facility will eventually hold approximately 40% of Russia's stocks of weapons-grade plutonium. "Address of President Boris Yeltsin to the Russian Security Council," April 10, 1996.

19. Chronology of the agreement for Russian HEU purchases by USEC, http://ceip.org/npusec2.htm.

20. "Spot Prices Down Again," *Nuclear Fuel*, June 30, 1997, p. 15; "HEU Feed Talks Continue; DOE Sale Notice Appears," *Nuclear Fuel*, August 11, 1997, p. 2; "Little Progress Reported in HEU Talks," *Nuclear Fuel*, July 28, 1997, p. 15.

21. For additional information see *Arms Control Reporter (1996)* (Cambridge, MA: Institute for Defense and Disarmament Studies), p. 612.B-1.17.

22. *Ibid.* pp. 612.B-1.17 and 612B-1.33.

23. It is anticipated that Seversk (Tomsk-7) will expand its current activities to include transformation of weapons-grade uranium oxide to uranium hexafluoride and the blending of this material with LEU. Second, it is expected that the transformation of weapons-grade uranium metal components into bulk uranium oxide, now performed exclusively at Seversk (Tomsk-7), will also be undertaken at Mayak.

Some controversy arose in October 1997 when U.S. State Department officials announced that they were rejecting one canister of Russia LEU purchased by USEC. The officials believe the canister contained LEU that had not been blended down from HEU taken from nuclear warheads. No decision has been taken on whether to ship the canister back to Russia, or go ahead with the purchase. For further discussion, see "Market Impact of Moscow Announcement Uncertain; U.S. Rejects One LEU Cylinder," *Nuclear Fuel*, December 15, 1997, p. 2.

24. Interim Report of the U.S.-Russian Independent Scientific Commission on the Disposition of Excess Plutonium (Washington, DC: Office of Science and Technology Policy, September, 1996). The group was chartered by the Russian Academy of Sciences and the U.S. President's Committee of Advisors on Science and Technology. See also, John P. Holdren, et al. "Excess Weapons Plutonium: How To Reduce a Clear and Present Danger," *Arms Control Today*, November/December 1996, p. 3.

25. Howard Canter, "Record of Decision and U.S. Program for Plutonium Disposition," *Journal of Nuclear Materials Management*, June 1997, p. 50.

26. The United States has declared 225 metric tons of fissile material to be excess to defense needs and has placed 12 tons of this total under IAEA inspection. At the September 1996 IAEA General Conference, U.S. Secretary of Energy Hazel O'Leary declared that the United States would place 26 additional tons of this material under IAEA oversight. Similarly, in an April 1996 address to the Russian Security Council, President Boris Yeltsin, referring to the fissile material storage facility under construction at Mayak, declared that "after completion we propose to place it under IAEA control."

27. For an analysis of the initiative from the perspective of the IAEA, see Bruno Pellaud, "International Verification of U.S. and Russian Materials Released for Storage and Disposition," *Journal of Nuclear Materials Management*, June 1997, p. 13.

Table I-E Locations with Weapons-Usable (Fissile) Material[1]

NOTE: For these tables, *weapons-usable uranium* is defined as uranium containing more than 20% of the isotope U-235.[2] Uranium enriched above 20% is referred to as *highly-enriched* (HEU) and uranium enriched to below 20% is denoted as *low-enriched* (LEU). All isotopic mixtures of plutonium are considered weapons-usable, except those containing more than 80% of the isotope Pu-238. Most of the locations in the chart below also contain *weapons-grade material*, defined as uranium containing more than 90% of the isotope U-235 or plutonium containing 6% or less of isotopes Pu-240 and Pu-242 combined. About 15 kilograms of weapons-grade uranium or six kilograms of weapons-grade plutonium are required to build an implosion type fission weapon. Weapons-usable uranium and plutonium can also be used to build nuclear weapons if large enough amounts are used and some additional technical hurdles are overcome. In this table all units of "tons" are metric tons, or 1,000 kilograms (kg), equivalent to about 2,200 lbs.

The following acronyms are used in this table:
MPC&A – nuclear material protection, control, and accounting; **MC&A** – nuclear material control and accounting; **DOE** – United States Department of Energy; **DOD** – United States Department of Defense; **Minatom** – Russian Ministry of Atomic Energy; **Gosatomnadzor** – Russian State Committee for Supervision of Nuclear and Radiation Safety; and **IAEA** – International Atomic Energy Agency.

INTRODUCTION TO BELARUS

All weapons-usable nuclear material in Belarus is located at the Institute of Power Engineering Problems at the Sosny Science and Technology Center, just outside Minsk. The IAEA received an initial inventory report of Belarusian nuclear material on October 19, 1995. Initial inventory verification is underway, but as of mid-1997 had not yet been completed.[3] Discussions between the U.S. government and Belarus regarding U.S. assistance for MPC&A at this site began as early as September 1992, but cooperative efforts using DOE funding did not begin until 1994. In June 1995, the Belarusian Ministry of Defense signed an implementing agreement with the United States designating DOE and the parallel Belarusian regulatory agency Promatomnadzor as the administrators of the U.S.-Belarusian cooperation program.[4] In October 1996, Belarus and the United States announced the completion of MPC&A upgrades. Other countries that provided MPC&A equipment include Japan and Sweden.

<table>
<tr><th colspan="5">BELARUS</th></tr>
<tr><th>LOCATION</th><th>ACTIVITY</th><th>PLUTONIUM</th><th>WEAPONS-USABLE URANIUM</th><th>IAEA SAFEGUARDS STATUS</th></tr>
<tr><td rowspan="2">Institute for Power Engineering Problems (IPEP), Sosny Science and Technology Center[5]
(Located in Sosny, near Minsk)</td><td>Two critical assemblies; decommissioned research reactor; fresh fuel and spent fuel storage.</td><td>Approximately 14 g.</td><td>Approximately 40 kg of HEU enriched to at least 90%; approximately 330 kg of HEU enriched to between 20% and 89%.[6]</td><td>Safeguarded.[7]</td></tr>
<tr><td colspan="4">Comments: In addition to the weapons-usable fissile material listed above, Sosny is reported to possess approximately 94 kg of LEU.[8]
The 5 MW (IRT-M), pool-type research reactor was shut down in 1988 and has been formally decommissioned.[9] Two critical assemblies, "Rosa" and "Cristal,"[10] have not been decommissioned but are currently non-operational due to lack of funding. The fuel from these assemblies has been moved to the fresh fuel storage facility.[11]
MPC&A upgrades at the Sosny facility were completed in October 1996 under the IAEA-coordinated assistance of the United States, Japan and Sweden. Physical protection assistance concentrated on creating secure areas within two buildings (Buildings 33 and 40). All weapons-usable materials have now been moved to these two areas for storage.[12] The physical protection upgrades include the following five components: 1) physical barriers; 2) entry control systems; 3) an alarm assessment system; 4) interior and exterior sensors; and 5) enhanced communication systems.[13] Both Japan and the United States provided assistance to modernize the accounting and control system, supplying computer software, information systems and advanced telecommunications equipment to facilitate data exchange between Belarus and the IAEA.[14]
Longer-term cooperative efforts between Belarus and the United States will include follow-up visits to make sure that equipment is working properly and problems are addressed jointly.[15]</td></tr>
</table>

INTRODUCTION TO KAZAKHSTAN

There are four major nuclear sites in Kazakhstan, including both industrial and research facilities. Weapons-usable nuclear material is stored at three of these sites. The IAEA received an initial inventory report on nuclear materials subject to safeguards from Kazakhstan on September 4, 1995; as of mid-1997 the IAEA was still in the process of conducting inventory verifications.[16] In an effort to better safeguard the material at these sites, on December 13, 1993, the United States and Kazakhstan signed an agreement on U.S. assistance to Kazakhstan in the sphere of MPC&A.[17] Kazakhstani nuclear facility staff have been working together with DOE technical teams to identify ways to improve MPC&A and bring the Kazakhstani facilities up to international standards. In accordance with the wishes of the Kazakhstani government, U.S. assistance focused first on the Ulba Metallurgy Plant, then on the fast-breeder reactor, and finally on the two National Nuclear Center research facilities near Semipalatinsk and Almaty. Although DOE has completed physical protection upgrades at Ulba and one NNC site, it will continue to work with all four sites to address long-term sustainability of the MPC&A enhancements.[18] Other countries providing MPC&A assistance to Kazakhstan are Japan, Sweden, and the United Kingdom.[19]

<table>
<tr><th colspan="5">KAZAKHSTAN</th></tr>
<tr><th>LOCATION</th><th>ACTIVITY</th><th>PLUTONIUM</th><th>WEAPONS-USABLE URANIUM</th><th>IAEA SAFEGUARDS STATUS</th></tr>
<tr><td rowspan="2">Institute of Atomic Energy – Almaty branch, National Nuclear Center (NNC)
(Located in Alatau, outside Almaty[20])</td><td>Research reactor; nuclear material storage; hot cells.</td><td>No.</td><td>15 kg of HEU enriched to 36%;[21] HEU enriched to 90%.</td><td>Safeguarded.[22]</td></tr>
<tr><td colspan="4">Comments: On-site facilities include a 10 MW VVR-K research reactor, hot cells, and seven research laboratories.[23] In addition to the weapons-usable material, there is spent fuel stored on-site. Although there had been some reports that Russian-owned material was also located at this site, all the material currently at Alatau is Kazakhstani material, and is under IAEA safeguards.[24] The IAEA has completed an inventory verification at this site.[25]
All nuclear materials are located in the reactor building, which is protected by a small guard force provided by the Ministry of Internal Affairs. Spent fuel is stored in cooling ponds, and there are plans to move it to indefinite dry storage in the future. The VVR-K reactor was shut down in 1988 in order to bring it up to higher seismic standards. All the necessary improvements were made, and the reactor was recommissioned in 1997. The reactor resumed operation on December 19, 1997.[26]
Cooperative U.S.-Kazakhstani efforts to upgrade MPC&A began at the site in September 1995. During a visit in March 1996, DOE provided some physical security equipment. In May 1996, DOE improved e-mail capacity, installed two computers to assist with MC&A, and delivered a prototype version of an automated accounting program.[27] The accounting program is still being tested and was not yet in use as of mid-1997.[28] Additional DOE assistance will be provided through 1998.[29]</td></tr>
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<table>
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<tr><td rowspan="2">Institute of Atomic Energy – Kurchatov branch, National Nuclear Center (NNC)
(Located in Kurchatov City, outside Semipalatinsk, also known as Semipalatinsk-21)</td><td>Research reactors; nuclear material storage.</td><td>No.</td><td>Over 30 kg of 90% enriched HEU in research reactor fuel.
Some Russian-owned highly irradiated HEU.</td><td>Kazakhstani material is safeguarded.
Remaining Russian material is not safeguarded.</td></tr>
<tr><td colspan="4">Comments: Three reactors are located at the Kurchatov branch of the Institute of Atomic Energy: an Impulse Graphite Reactor (IGR), fueled with 10.6258 kg of 90% enriched HEU fuel; a water-cooled pulsed-type reactor (IVG-1M), which is fueled with approximately 5 kg of HEU, and an experimental gas-cooled reactor (RA) fueled with approximately 7 kg of HEU.[30] The IVG-1M and RA reactors are located at the Baikal-1 site on the former Semipalatinsk test site.[31] There are only 600 g of fresh HEU fuel in storage at Baikal-1. The IGR reactor is not located at Baikal-1, but at a separate location on the former test site. There are 7 kg of fresh fuel and 7 kg of spent fuel at this site.[32] An IAEA inventory verification is still in progress at this site.[33]
In 1995, Kazakhstani authorities notified the IAEA that approximately 205 kg of weapons-grade HEU, left over from Soviet-era experiments, was still located at Baikal-1.[34] As the material was claimed by the Russian Federation, it was not subject to IAEA safeguards. After a series of trilateral discussions between Kazakhstan, Russia, and the IAEA, a protocol was signed in which Russia agreed to finance and organize the return of the material to Russia.[35] Although Russia's financial constraints delayed the project, on October 25, 1996, the non-irradiated portion of the material was returned to Russia. There have been subsequent shipments of irradiated material as well, but a portion of the irradiated material remains in storage on-site.[36] The NNC has filed a project proposal with the International Science and Technology Center to remove the remaining material to Russia, but as of mid-1997 there was no word on the proposal’s status.[37]
DOE has been working with these facilities to improve their MPC&A systems since fall 1994. From 1995 – 1996, DOE technical teams visited the site four times to assess MPC&A needs.[38] DOE has provided physical protection equipment, including alarms, magnetic locks, monitoring equipment such as infrared sensors, and three computers to automate the previously existing manual accounting system. In addition, DOE conducted five training courses on physical protection and vulnerability assessments.[39] The new physical protection systems were formally commissioned on September 13, 1997.[40]</td></tr>
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Table I-E Locations with Fissile Material

<table>
<tr><th colspan="5">KAZAKHSTAN (cont.)</th></tr>
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<tr><td rowspan="2">Mangyshlyak Atomic Energy Complex
(Located in Aktau, previously known as Shevchenko)</td><td>BN-350 fast breeder Reactor.</td><td>Approximately 3 metric tons in low-irradiated spent fuel.[41]</td><td>Yes.</td><td>Safeguarded.</td></tr>
<tr><td colspan="4">Comments: The BN-350 sodium-cooled (liquid metal) fast breeder reactor at Aktau (one unit), which generates power and desalinates water for the Mangyshlyak Peninsula, was designed to use uranium fuel enriched to 17-26%, as well as uranium-plutonium mixed-oxide (MOX) fuel (23.19% Pu).[42] The BN-350 is capable of generating more than 110 kg of plutonium annually.[43] As Kazakhstan does not return its spent fuel to Russia, at least three metric tons of high-grade plutonium in the form of low-irradiated spent fuel from the reactor blanket remain on-site at Aktau in cooling ponds.[44] An IAEA inventory verification is still in progress at this site.[45]
In 1990, experiments were conducted in which weapons-grade plutonium-based MOX fuel assemblies were loaded into the reactor. This research and development program, which appears to have been halted in 1991 after Kazakhstan gained independence, foreshadowed proposals by the Russian Ministry of Atomic Energy (Minatom) to introduce plutonium from dismantled warheads into the civilian nuclear fuel cycle.[46]
DOE MPC&A specialists first surveyed the site in September 1995, with a subsequent visit in March 1996. Assistance at the Aktau site initially focused on MC&A, but physical protection upgrades will continue through September 1998.[47] DOE has provided training for Aktau reactor physicists, as well as computer hardware and software for reactor physics computations that will increase the accuracy of the inventory process.[48] In addition, during an October 1997 visit by President Nazarbayev to Washington, D.C., an "Implementing Arrangement Between the Ministry of Science-Academy of Sciences of the Republic of Kazakhstan and the Department of Energy of the United States of America Concerning the Long-Term Disposition of the BN-350 Nuclear Material" was signed.
Japan's MPC&A assistance to Kazakhstan has been focused on this site as well. Japan has provided a large computer network to help account for and monitor the flow of nuclear materials within the facility.[49] The United States and Japan also are cooperating to help upgrade physical protection at the site, and have already installed a spent fuel gate monitor.[50]</td></tr>
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<table>
<tr><th colspan="5">KAZAKHSTAN (cont.)</th></tr>
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<tr><td rowspan="2">Ulba Metallurgy Plant
(Located in Ust-Kamenogorsk)</td><td>Fuel pellet fabrication for VVER and RBMK reactors.</td><td>No.</td><td>No longer.</td><td>Safeguarded.</td></tr>
<tr><td colspan="4">Comments: Nearly 600 kilograms of weapons-grade HEU was stored at this site until November 1994, when it was transferred to the United States in an operation known as "Project Sapphire."[51] Currently, tons of LEU are located at this site.[52] The IAEA has completed an inventory verification of the material at Ulba.[53]

Sweden was the first country to provide assistance to the Ulba plant. Swedish assistance consisted primarily of training, as well as the delivery and installation of a computer-based material accountancy system in 1994. This system, which became operational in 1994, is linked to a state-wide material accountancy program.[54]

U.S. assistance at this site also has focused on MC&A, and has included training courses, the delivery of accounting software, and assistance with the verification of the physical inventory. In October 1995, a DOE team worked with the facility staff to assess needs and place equipment orders for a software accounting system, scales, automated titrators, and a mass spectrometer.[55] Most of this equipment has already been delivered. The U.S. accounting software is a Windows-based, automated data entry system, designed to reduce human error. It was not yet operational as of May 1997.[56] DOE also assisted with the verification of the physical inventory at the site, which was completed in summer 1996. In addition, DOE has provided some physical protection training and equipment for this site, which was completed in September 1997. In spite of these efforts, Kazakhstani specialists remain skeptical about the feasibility of securing the Ulba facility due to the large number of buildings and great physical size of the site.[57]</td></tr>
</table>

Table I-E Locations with Fissile Material

INTRODUCTION TO RUSSIA

The existing inventory of HEU in Russia has been estimated at approximately 1300 tons, and the existing inventory of Pu at about 165 tons.[58] A significant portion of this material has been fabricated into weapons components, but weapons-usable material is also present at facilities throughout Russia's vast civilian and military fuel cycle and nuclear research complex. In order to better secure the nuclear materials at these sites, the United States has been providing MPC&A assistance through DOE and its national laboratories. In September 1993, United States–Russian cooperation in this sphere began with an implementing agreement between DOD and Minatom under the Nunn-Lugar Cooperative Threat Reduction (CTR) Program.[59] In 1994, DOE launched its parallel Laboratory-to-Laboratory Nuclear Material Protection, Control and Accounting Program.[60] Then in September 1995, the CTR-funded MPC&A programs were handed over to DOE, where they evolved into the Government-to-Government MPC&A program.[61] In an effort to streamline U.S. assistance in this area, the two programs were merged in early 1997, becoming simply the DOE MPC&A Program.[62] The facilities below represent those sites where weapons-usable material is known to be present, according to open source literature and interviews with Russian scientists and officials.

RUSSIA

LOCATION	ACTIVITY	PLUTONIUM	WEAPONS-USABLE URANIUM	IAEA SAFEGUARDS STATUS
Arzamas-16 **All-Russian Scientific Research Institute of Experimental Physics (VNIIEF)** (Located in Arzamas-16, renamed Sarov)	Nuclear weapons research, design and development; advanced weapons research;[63] research reactors and critical assemblies.[64]	Yes, large quantities.[65]	Yes, more than a ton of weapons-usable nuclear material.[66]	Unsafeguarded.[67]
	Comments: There are at least six nuclear research reactors at VNIIEF, two of which are shut down. The operating reactors include the BIGR, the VIR-2M, the NEPTUNE, and the KVANT.[68] These reactors, together with a number of critical assemblies, are located at the VNIIEF Research Site.[69] DOE is working with VNIIEF to implement MPC&A upgrades at its Research Site under the DOE MPC&A program.[70] The Research Site consists of a cluster of five buildings, surrounded by a fence that is guarded by military personnel. While not all fissile materials at VNIIEF are located at this site, the reactors and critical assemblies mentioned above, as well as considerable amounts of HEU and Pu, including fresh fuel, are stored there. The enhanced safeguards system includes vehicle and personnel access control; control and accounting for nuclear materials located in the reactors, critical assemblies, and associated storage areas; and monitoring of nuclear materials that are moved between buildings within the Research Site. The system includes both U.S.- and Russian-designed equipment, but the accounting software was written exclusively by VNIIEF programmers. Installation of this system began after the completion of a test facility in 1995, and was completed in March 1997.[71] Work has begun on the design of additional MPC&A systems for the Industrial Facility and the Experimental Testing Facility within VNIIEF.[72] Russia has established special security forces to "ensure physical protection of nuclear facilities" at Arzamas-16, Chelyabinsk-70 (Snezhinsk), and Zlatoust-36 (Trekhgornyy).[73]			

<table>
<tr><th colspan="5">RUSSIA (cont.)</th></tr>
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<tr><td rowspan="2">Arzamas-16
Avangard Electromechanical Plant
(Located in Arzamas-16, renamed Sarov; previously also known as Kremlev)</td><td>Final warhead assembly and dismantlement.</td><td>Yes.</td><td>Yes.</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: Avangard was the first Soviet enterprise to mass-produce nuclear armaments. At present, old nuclear weapons and nuclear weapons removed from launchers under the START I treaty are dismantled here.[74] Fissile material components from retired warheads are stored here before being sent to Chelyabinsk-65 or Tomsk-7.[75] There is more than a ton of weapons-usable nuclear material at this site.[76]
The Avangard Electromechanical Plant is one of four nuclear weapons dismantlement (or "serial production facilities" as they are called in Russia) to be added to the DOE MPC&A program in 1998. Initial projects will involve the installation of portal monitors at all perimeter access points.[77]</td></tr>
<tr><td rowspan="2">Baltiyskiy Zavod (Baltic Factory)
(Located in St. Petersburg)</td><td>Construction of nuclear icebreakers and other naval ships.[78]</td><td></td><td>Yes, in fresh fuel.</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: Fresh naval fuel is temporarily stored here before being loaded into nuclear-powered icebreakers. According to Russian officials, fresh fuel can be temporarily stored here for up to one year.[79]
DOE MPC&A assistance began at Baltiyskiy Zavod in 1997, and will continue through 1998.[80]</td></tr>
<tr><td rowspan="2">Beloyarsk Nuclear Power Plant (NPP)
(Located in Zarechniy, 30 km from Yekaterinburg)</td><td>BN-600 fast breeder reactor.</td><td>Yes, in spent fuel.</td><td>Yes, in driver fuel.</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: The BN-600, which became operational in 1980, is the only fast-breeder power reactor currently operating in Russia today. It operates with 20-25% HEU driver fuel in a natural uranium blanket.[81]
In January 1996, at the sixth meeting of the Gore-Chernomyrdin Commission, Minatom and DOE signed a "Joint Statement on Control, Accounting and Physical Protection of Nuclear Materials," which extended DOE physical protection assistance to a number of facilities, including the Beloyarsk NPP.[82] In September 1996, DOE conducted workshops on tamper-indicating devices and on physical protection at this site.[83] In December 1997, a new site-wide upgraded MPC&A system began operation.[84]</td></tr>
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<tr><td rowspan="2">A. A. Bochvar All-Russian Scientific Research Institute for Inorganic Materials (VNIINM)
(Located in Moscow)</td><td>Research on weapons-grade materials.</td><td>Yes.</td><td>Yes.</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: VNIINM is involved in the development of MOX fuel fabrication technology and conducts research on spent fuel reprocessing and waste treatment technology.[85] It is the designated institute in Russia specializing in measurement of nuclear materials in bulk form.[86]
In early 1994, Gosatomnadzor ordered certain activities at this facility to shut down for six months because of lax arrangements for protecting plutonium at the site.[87] Since 1995, five U.S. national laboratories (Brookhaven, Lawrence Livermore, Los Alamos, Oak Ridge, and Pacific Northwest) have been involved in cooperative MPC&A projects with VNIINM under the DOE MPC&A program. Separate projects with all five laboratories include research on various types of material measurements for enhanced MC&A systems. The results of the research may be used at other facilities throughout the Minatom complex. Los Alamos National Laboratory is also assisting with the development of a computerized MC&A system, and Lawrence Livermore National Laboratory is working at this site to enhance physical protection at the nuclear materials storage facility.[88] MPC&A projects are scheduled to continue through 2002.[89]
Germany also assisted VNIINM to upgrade its physical security. This joint work was completed in fall 1997.</td></tr>
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<tr><td rowspan="2">**Chelyabinsk-65**
(Formerly known as Chelyabinsk-40)
Mayak Production Association
(Located in Chelyabinsk-65, renamed Ozersk)</td><td>Five non-operational plutonium production reactors; two tritium production reactors; reprocessing of spent fuel; production of mixed-oxide (MOX) fuel pellets;[90] plutonium and HEU warhead components production and storage.</td><td>Approximately 25-30 tons of reactor-grade plutonium,[91] as well as plutonium recovered from dismantled weapons.[92]</td><td>Yes, includes HEU recovered from dismantled weapons.[93]</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">**Comments:**
Production Reactors: All five plutonium production reactors at Chelyabinsk-65 were permanently shut down between 1987 and 1992. Two tritium production reactors ("Ruslan" and "Lyudmila") continue to operate, using HEU fuel.[94]
Reprocessing: Chelyabinsk-65 is the site of the RT-1 Radiochemical Combine reprocessing facility, which reprocesses spent fuel from VVER-440, fast breeder, naval fuel, and research reactors. Approximately one ton of Pu is extracted from spent fuel at the RT-1 facility each year.[95] DOE is providing assistance to substantially upgrade MPC&A systems at the RT-1 facility and safeguard the plutonium dioxide generated at the plant.[96] Six DOE laboratories are involved in the MPC&A upgrades: Brookhaven, Lawrence Livermore, Los Alamos, Oak Ridge, Pacific Northwest, and Sandia. Upgrades include enhancement of existing physical protection at RT-1, and development of MC&A at the plutonium dioxide storage facility (Buildings 104 and 142) within RT-1. Multiple upgrade projects that are underway include: repairing and enhancing the perimeter fence; upgrading communications capabilities; installing personnel and vehicle access controls and portal monitors; and computerizing plutonium dioxide inventory records.[97] The United Kingdom is also assisting with the development of a more modern MC&A system at RT-1.[98]
Fissile Material Storage: Chelyabinsk-65 has been selected as the principal site for long-term (up to 100 years) storage of nuclear material from dismantled Russian warheads.[99] A central storage facility to provide safe and secure storage of these nuclear materials is now under construction at Mayak. Design, construction, and specialized equipment for the storage facility are being funded, in part, by the United States. DOD's Cooperative Threat Reduction (CTR) program initially allocated $15 million for facility design and $75 million for construction and specialized facility equipment (see Table 1-F). At the June 1995 meeting of the Gore-Chernomyrdin Commission (GCC), the United States committed an additional $75 million for actual construction costs in 1996-1997.[100] Concept design for the facility has been completed, and construction is currently underway. Although a U.S. contractor is overseeing the construction, Russian labor and materials are being used. When finished, the storage facility will be able to accommodate material from more than 12,000 nuclear warheads. It is anticipated that the first insertion of former weapons material will take place in 2000.
The city of Chelyabinsk-65 is surrounded by a double fence and guarded by troops under the command of the Ministry of Internal Affairs. Access reportedly is limited and thoroughly controlled.[101] A paramilitary unit is reportedly being established at Chelyabinsk-65 to combat potential nuclear smuggling.[102]</td></tr>
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<tr><td rowspan="2">Chelyabinsk-70
All-Russian Scientific Research Institute of Technical Physics (VNIITF)
(Located in Chelyabinsk-70, renamed Snezhinsk)</td><td>Warhead design; research reactors; fabrication of experimental and prototype warheads; tritium target fabrication for inertial confined fusion.[103]</td><td>Yes.</td><td>Yes.</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: Chelyabinsk-70's primary mission has been to design nuclear warheads, but it also fabricates experimental and prototype warheads. By 1992, however, 50% of the work force at Chelyabinsk-70 was engaged in non-military research.[104] There is more than a ton of weapons-usable nuclear material at this site.[105]
The Department of Experimental Physics at VNIITF includes a Pulse Reactor Facility Complex with one BARS-5 pulsed nuclear reactor with a metal core, and two pulsed liquid-type reactors (IGRIK and YAGUAR.) Six U.S. national laboratories are providing MPC&A assistance under the DOE MPC&A program. After completing conceptual designs for physical protection and MC&A in 1995, the labs began upgrading physical security at the Pulse Reactor Facility Complex and assisting VNIITF to develop a more rigorous material accounting program. Physical protection upgrades include barriers, alarms, improved communications, hand-geometry access control, and pedestrian and vehicle portal controls.[106] In April 1997, DOE announced that all pedestrian pathways at the VNIITF site had been equipped with portal monitors "to detect attempted thefts of nuclear materials."[107] By December 1997, vehicle portal monitors had also been installed and were operational throughout VNIITF.[108]
Russia has established special security forces to "ensure physical protection of nuclear facilities" at Arzamas-16 (Sarov), Chelyabinsk-70 (Snezhinsk), and Zlatoust-36 (Trekhgornyy).[109] Security was enhanced at Chelyabinsk-70 in February 1995 to respond to threats of Chechen terrorism.[110]</td></tr>
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<tr><td rowspan="2">Dimitrovgrad Scientific Research Institute for Atomic Reactors (NIIAR)
(Located 7 km from Dimitrovgrad, Ulyanovsk region)</td><td>Research reactors; one fast-breeder reactor; development of MOX fuel fabrication technologies; experimental reprocessing; hot cells.</td><td>Yes.</td><td>Yes.</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: The Dimitrovgrad Institute is Russia's premier institution for nuclear power research. According to recent media reports, however, the institute has virtually stopped conducting research due to financial constraints. Currently, its primary activity is producing radioactive isotopes for export.[111] There is more than a ton of weapons-usable nuclear material at this site.[112]
Research Reactors: There are six or seven operational research reactors at Dimitrovgrad: the NIR-M1 and SM-2, fueled with 90% HEU; the RBT-10/1, fueled with 50-85% HEU; the RBT-10/2, fueled with 3% LEU; the RBT-6, fueled with 63% HEU; and the PRIMA.[113] Two additional reactors, the VK-50 and the AST-1, have been shut down.[114]
Fast-Breeder Reactor: Dimitrovgrad is also the location of the BOR-60, a 60MW, sodium-cooled fast breeder reactor fueled with either 45-90% HEU or a mixture of HEU and Pu.[115] The BOR-60 is located in the fast reactor facility, Building 160. [116]
MOX fuel facility: Fuel fabrication and experimental reprocessing facilities are located in Building 180. There are approximately 50 hot cells at the fuel fabrication facility. Research at this facility includes the study of manufacturing fast reactor fuel assemblies using the vibropac method. Nuclear materials used in fuel fabrication include HEU and 55%–94% Pu-239. Currently 10% of the nuclear fuel at Dimitrovgrad is reprocessed. A total of roughly 500 kg of Pu has been reprocessed at the experimental facility.[117]
DOE has been providing assistance for MPC&A upgrades at Dimitrovgrad since early 1996, focusing its efforts on the central nuclear materials storage facility at Building 160, Building 180, and Building 132,. The majority of nuclear materials at Dimitrovgrad are located at these three sites. Upgrades will include vehicle and pedestrian portals, a perimeter fence at Building 132, a computerized inventory record system, enhanced communications and alarm systems, automated access control, and centralized badging. In addition, many training workshops have been planned.[118]</td></tr>
<tr><td rowspan="2">Dubna Joint Institute of Nuclear Research (JINR)
(Located in Dubna)</td><td>Research reactors.</td><td>About 100 kg of plutonium.[119]</td><td>No.[120]</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: There are two research reactors at Dubna. The IBR-2 is a pulsed reactor that uses 90 kg of plutonium dioxide fuel (containing approximately 80 kg of plutonium). The reactor has an average power of 2 MW, but its pulses can peak at 1,500 MW. The second reactor, an IBR-30, is no longer operational, but its 20 kg of plutonium metal fuel are used as a neutron generator in a linear accelerator.[121]
The JINR was one of six non-Minatom sites designated to receive MPC&A upgrades in a June 1995 agreement between DOE and Gosatomnadzor. In December 1997, a new site-wide upgraded MPC&A system began operation.[122] Upgrades include: improved access control, intrusion sensors, vault hardening, personnel portals, upgrades to the central alarm station, and the development of upgraded inventory-taking procedures.[123]</td></tr>
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<tr><td rowspan="2">**Elektrostal Machine-Building Plant**
(Located in Elektrostal, near Moscow)</td><td>HEU fuel fabrication for naval propulsion and fast-breeder reactors; LEU fuel fabrication for VVER-440, and RBMK reactors; critical assemblies.</td><td>No.</td><td>Yes, some 90% enriched HEU and large quantities of 26% enriched HEU for use in fast-breeder and submarine reactor fuel;[124] overall, more than a ton of weapons-usable material.[125]</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">**Comments:** The Elektrostal Machine-Building Plant is one of Russia's primary nuclear fuel fabrication plants. Seven critical assemblies are located at this site.[126]

Elektrostal was chosen as the model or "test" facility for U.S. MPC&A assistance under the auspices of the Nunn-Lugar Cooperative Threat Reduction Program in February 1994.[127] Within the Elektrostal facility, the LEU fuel fabrication line, a relatively non-sensitive site that produced fuel assemblies for VVER and RBMK nuclear power reactors, was selected for upgrades as a "confidence-building" exercise. Later, the fast-breeder fuel fabrication line, which uses HEU enriched up to 26%, was added to the program.[128]

Cooperative work on the LEU line began in June 1994. It was recognized early on that due to funding restrictions it would not be possible to complete MC&A enhancements for the full LEU production process. Therefore, two specific sites within the LEU line, the pellet rod production area (Building 274) and the fuel assembly area (Building 189), were chosen for full development. Many MC&A projects were initiated, including multiple training workshops and the installation of a computerized MC&A network. Because elaborate physical protection is not as essential for an LEU site, initial physical protection assistance focused on the fast-breeder fuel pellet production line, which also is located in Building 274. Physical protection assistance included enclosing and separating the fast-breeder line within the building, adding access controls, an enhanced alarm system, portal monitors, sensors and perimeter fencing.[129] The first phase of MPC&A upgrades was completed in October 1996.[130] A new MPC&A system was commissioned at Building 274 in fall 1997.[131]

In July 1997, Elektrostal informed DOE that it would make 36 of its buildings available for MPC&A upgrades, 12 of which contain HEU enriched to 90%. At least one of these buildings is likely to include the HEU naval fuel production line. DOE has explained to Elektrostal management that it currently is focusing exclusively on HEU sites.[132]</td></tr>
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<tr><td rowspan="2">Institute of Physics and Power Engineering (IPPE)
(Located in Obninsk, 107 km SW of Moscow)</td><td>Research reactors; Research on weapons grade materials; critical assemblies.</td><td>Approximately 1000 kg of plutonium.[133]</td><td>More than 7 tons of HEU.[134]</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: There are at least four research reactors and up to 18 critical assemblies at IPPE, which is a major research and development laboratory for nuclear power engineering. The four reactors include the BR-1 and the BR-10, both fast breeder reactors; the AM-1, a water-graphite reactor that is the first nuclear power reactor ever built in the Soviet Union; and the BARS-6, a double core, pulsed reactor that is part of a nuclear-pumped laser experimental facility.[135]
Of the 18 critical assemblies, the BFS-1 and the BFS-2 are fast critical assemblies and are located in the BFS Fast Critical Assembly Facility. Several hundred kilograms of Pu and several tons of HEU are located in the BFS facility.[136] The BFS facility was the focus of a pilot project for MPC&A upgrades, initially under the DOE Lab-to-Lab program. In 1995, a number of sophisticated security technologies were installed at BFS, including vehicle and pedestrian portal monitors, access control systems, video surveillance systems, and instruments for taking measurements of materials. This equipment was formally demonstrated in September 1995.[137] By late 1997, DOE had completed all MPC&A upgrades at the BFS facility.[138]
After 1995, cooperative DOE-IPPE MPC&A projects were extended to the Technological Laboratory for nuclear fuel research and to the Central Storage Facilities.[139] At the Technological Laboratory, HEU metal fuel disks for the BFS critical assemblies are reclad. In an effort to consolidate all fresh nuclear materials at one site within IPPE, the Central Storage Facility has been moved to a building adjacent to the BFS facility, forming a "nuclear island." The facilities within the nuclear island will be protected by common physical protection elements.[140] The consolidation will account for about 80-85% of nuclear materials at Obninsk. The remaining 15-20% of nuclear materials are being used in the AM research reactor, in various experiments, and at facilities that are too sensitive for cooperative work with the U.S. government.[141]
In addition, the Russian Methodological Training Center on Nuclear Material Control and Accountability, a national training center for MPC&A specialists, is being developed at IPPE with assistance from DOE and the European Commission Joint Research Center.[142] As of June 1997, 38 MPC&A training courses have been held for more than 700 individuals from Gosatomnadzor and many Russian nuclear facilities. In the future, MPC&A training may be extended to scientists from other NIS countries.[143]</td></tr>
<tr><td rowspan="2">Karpov Institute of Physical Chemistry
(Located in Obninsk)</td><td>Research reactor.</td><td>No.</td><td>Yes, "substantial amounts."[144]</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: This institute, which is under the auspices of the Ministry of Chemical Industries, conducts research for chemical applications.[145] The research reactor is a 10 MW, VVR-Ts tank reactor.[146]
The JINR was one of six non-Minatom sites designated to receive MPC&A upgrades in a June 1995 agreement between DOE and Gosatomnadzor. The initial site survey was completed in February 1996. In December 1997, a new site-wide upgraded MPC&A system began operation.[147] Upgrades include increased physical protection for the reactor building and storage vault, including portal monitors and access controls, and MC&A upgrades, including tags, seals, and computers. In addition, Karpov personnel have received MPC&A training at the IPPE training facility in Obninsk.[148]</td></tr>
</table>

RUSSIA (cont.)

LOCATION	ACTIVITY	PLUTONIUM	WEAPONS-USABLE URANIUM	IAEA SAFEGUARDS STATUS
Khlopin Radium Institute (Located in St. Petersburg)	Research on reprocessing technologies.	Yes.[149]	Yes (small amounts).[150]	Unsafeguarded.
	Comments: The Radium Institute conducts research and development for the nuclear industry. In particular, it has conducted a substantial amount of research on reprocessing technologies.[151] Currently, it is involved in a project, which received an award from ISTC in 1995, examining the feasibility of using ex-weapon and civilian plutonium as fuel in fast and thermal reactors.[152] In January 1996, at the sixth meeting of the Gore-Chernomyrdin Commission, Minatom and DOE signed a "Joint Statement on Control, Accounting and Physical Protection of Nuclear Materials," which extended DOE physical protection assistance to a number of facilities, including the Radium Institute.[153] In December 1997, a new site-wide upgraded MPC&A system began operation.[154]			
Krasnoyarsk-26 **Mining & Chemical Combine** (Located in Krasnoyarsk-26, now called Zheleznogorsk)	Two non-operational plutonium production reactors; one operational plutonium production reactor; spent fuel reprocessing.[155]	Tons of plutonium.[156]	Yes.	Unsafeguarded.
	Comments: Three graphite-moderated, ADE-type underground reactors were used to produce plutonium until 1992, when the AD and the ADE-1 were shut down. The ADE-2 remains in operation and is used primarily to produce heat and electricity for the local population.[157] However, the ADE-2 reactor, together with the ADE-4 and ADE-5 in Tomsk-7, still produces 1.5 tons of weapon-grade plutonium per year. In October 1994, Russia ceased using the newly produced plutonium in nuclear weapons, instead converting it into plutonium oxide and placing it in storage.[158] In accordance with a September 1997 agreement between Russia and the United States, by the year 2000 Russia will convert the core of the ADE-2 reactor so that it no longer is able to produce weapons-grade plutonium.[159] The United States will provide assistance for the conversion.[160] (See Table I-D.) According to various estimates, Krasnoyarsk-26 has, over its lifetime, produced more than 45 tons of weapons-grade plutonium in dioxide form.[161] Krasnoyarsk-26 is also the site of the Radiochemical Plant, a military reprocessing facility, and the planned site for the RT-2 Reprocessing Plant. The primary activity of the RT-2 Plant would be to reprocess spent fuel from VVER-1000 nuclear power reactors, as well as fuel from foreign light-water reactors.[162] Its operation would also include spent fuel storage ponds, a MOX fuel fabrication plant, and waste management facilities. Eventually, the RT-2 would absorb the smaller military facility.[163] Construction of the RT-2 reprocessing facility began in 1984, but was halted in 1989 due to insufficient funding and protests from local environmental groups.[164] It is uncertain whether or not the plant will ever be completed.[165] Meanwhile, Russia is storing spent fuel at reactors and at the spent fuel storage pond in the partially completed RT-2 Plant.[166] The city of Krasnoyarsk-26 is surrounded by a double fence and guarded by troops under the command of the Ministry of Internal Affairs. Access reportedly is limited and thoroughly controlled.[167] However, attempts to steal nuclear materials from this facility have been recorded.[168] The Mining and Chemical Combine at Krasnoyarsk-26 was added to the DOE MPC&A program in January 1996, at the sixth meeting of the Gore-Chernomyrdin Commission.[169] Joint MPC&A projects were underway by June 1996 and are scheduled to continue through 2000.[170]			

<table>
<tr><th colspan="5">RUSSIA (cont.)</th></tr>
<tr><th>LOCATION</th><th>ACTIVITY</th><th>PLUTONIUM</th><th>WEAPONS-USABLE URANIUM</th><th>IAEA SAFEGUARDS STATUS</th></tr>
<tr><td rowspan="2">Krasnoyarsk-45
Electrochemical Plant
(Located in Krasnoyarsk-45, renamed Zelenogorsk)</td><td>Uranium enrichment; LEU production; blending down of HEU to LEU.</td><td>No.</td><td>Yes, HEU from dismantled nuclear warheads.</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: Krasnoyarsk-45 is the site of a major centrifuge enrichment plant. Although at one time HEU for nuclear weapons was produced here,[171] the primary mission of the plant is to produce LEU enriched up to 5% for use in nuclear reactor fuel.[172] In addition, the Electrochemical Plant is one of three Russian facilities at which HEU from dismantled warheads is converted to gaseous uranium hexafluoride and blended down to approximately 4% enriched LEU, which eventually will be sold to the United States, in accordance with the February 1993 U.S.-Russia HEU agreement.[173] The Krasnoyarsk-45 site has been referred to as the "second largest uranium site" in Russia.[174]
The Electrochemical Plant was added to the DOE MPC&A program in July 1996 at the seventh meeting of the Gore-Chernomyrdin Commission.[175] Cooperative MPC&A projects, which began in September 1996, are focused on the HEU to LEU blend-down process.[176] By December 1997, nuclear material detectors were installed at the primary HEU storage facility. MPC&A upgrades are scheduled to continue through 2000.[177]</td></tr>
<tr><td rowspan="2">Krylov Central Scientific Research Institute
(Located in St. Petersburg)</td><td>Research reactor and critical assemblies.[178]</td><td>No.</td><td>Yes.</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: This facility is involved in the research and design of submarine reactors, as well as the testing of reactors for surface ships and submarines. The research reactor is a U-3 pool-type, 500 KW reactor,[179] and the critical assemblies (G-1 and MER) are connected with the naval fuel cycle.[180] The Krylov Institute also has prototypes of liquid metal, gas-cooled, and water-cooled reactors.[181]
The Krylov Institute is a non-Minatom site and was added to the DOE MPC&A program in mid-1997 under the DOE-Gosatomnadzor agreement.[182]</td></tr>
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<tr><th colspan="5">RUSSIA (cont.)</th></tr>
<tr><th>LOCATION</th><th>ACTIVITY</th><th>PLUTONIUM</th><th>WEAPONS-USABLE URANIUM</th><th>IAEA SAFEGUARDS STATUS</th></tr>
<tr><td rowspan="2">Kurchatov Institute
(Located in Moscow)</td><td>Research reactors; critical and subcritical assemblies.</td><td>Yes.</td><td>Hundreds of kgs of HEU, if not more.[183]</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: The Kurchatov Institute is a leading research and development institution in the field of nuclear energy and is made up of eleven Research Institutes and four Scientific and Engineering Divisions.
In addition to the weapons-usable materials noted above, Dr. Vladimir Sukhoruchkin of the Kurchatov Institute stated in a 1994 interview that the Kurchatov Institute also possessed approximately 50 tons of natural uranium and 50 tons of LEU.[184] There are at least nine research reactors at Kurchatov, three of which have probably been shut down.[185] Four of the research reactors are known to employ weapons-grade HEU. Three of these are designed to use 2-4 kg of HEU, while a fourth, a 40 MWt pond-type reactor, uses between 4 kg and 22 kg of weapons-grade HEU. In addition, two research reactors are fueled with weapons-usable HEU: a 125 KWt reactor using 4-23 kg of HEU enriched to 36-90% and a 300 KWt reactor that uses 17-23 kg of HEU enriched to 36% U-235.[186] There are also approximately 16 critical assemblies and 3 subcritical assemblies at the Kurchatov Institute.[187]
The Kurchatov Institute was one of the first Russian participants in the DOE Lab-to-Lab program. Initial efforts in 1994 focused on improving the MPC&A at Building 116, which contains substantial amounts of HEU in two critical assemblies. These first improvements, which were completed by early 1995, included numerous physical security upgrades and a computerized MC&A system. Most of the equipment was designed and produced in Russia at the "Eleron" facility.[188] The Central Storage Facility, which contains tons of nuclear material and has been called "the largest single nuclear facility at the institute," has also received a number of MPC&A upgrades, including physical barriers, entry control systems, alarm systems, sensors, and an expansion of the computerized MC&A system that was initially developed for Building 116.[189] These upgrades were completed in November 1996.[190]</td></tr>
<tr><td rowspan="2">Luch Scientific Production Association
(Located in Podolsk, 35 km south of Moscow)</td><td>HEU fuel fabrication for space-based nuclear reactors; research reactors.</td><td></td><td>Yes, more than a ton of weapons-usable nuclear material overall.[191]</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: Luch is a research and production facility that conducts research in many areas, including in high-temperature nuclear fuel for rocket propulsion and gas reactors.[192] It also manufactures HEU fuel for space reactors,[193] and processes and stores significant quantities of HEU metal and HEU uranium oxide. The total HEU inventory originally was dispersed throughout 40 processing or storage locations in four different buildings, although all material shipped in and out of Luch was processed through the Central Storage Facility.[194] However, the number of sites with HEU probably has been reduced due to consolidation of material. There are three research reactors at Luch: a 1000 MW uranium-graphite IGR reactor, a 300 MW channel-type IVG reactor, and a 100 MW prototype 11B91-IR reactor.[195]
DOE has been working with Luch to implement MPC&A upgrades at this site since 1995, focusing on the Central Storage Facility and the primary HEU processing and fabrication buildings (Buildings 1, 2, and 34). In addition to conducting many workshops and training sessions, DOE MPC&A assistance will include improved access control to the sites noted above, improved alarm and communications systems, enhanced surveillance and monitoring of nuclear materials, development of a long-term plan for inventory taking, and computerized accounting upgrades. This work will be implemented over the next few years.[196] In late 1997, MPC&A upgrades were installed and began operation at the Central Storage Facility.[197]</td></tr>
</table>

RUSSIA (cont.)

LOCATION	ACTIVITY	PLUTONIUM	WEAPONS-USABLE URANIUM	IAEA SAFEGUARDS STATUS
Lytkarino Research Institute for Instruments (Located in Lytkarino, 30 km SE of Moscow)	Research reactors.[198]	Possible.[199]	Yes, hundreds of kilograms.[200]	Unsafeguarded.
	Comments: There are five pulsed research reactors at this facility, at least four of which are fueled by HEU. The reactors are: the TIBR-1M, the BARS-2, the BARS-3M, and the BARS-4, all of which use 90% enriched HEU fuel. The fifth reactor is a 2 MW IRV reactor, which uses fuel of an unspecified enrichment.[201] Minatom and DOE agreed to include this facility in the DOE MPC&A program in July 1997, during U.S. Secretary of Energy Federico Pena's visit to Moscow. DOE had been informed of the existence of the facility during an earlier briefing by officials from Gosatomnadzor, who were concerned about the possibility of diversion of fissile materials by facility insiders.[202] MPC&A upgrades will be implemented through early 1999.[203]			
Moscow Engineering Physics Institute (MEPhI) (Located in Moscow)	Research reactor, educational institution.	No.[204]	Yes, kilogram quantities.[205]	Unsafeguarded.
	Comments: A single 2.5 MWt pond-type research reactor (IRT) is located at MEPhI, fueled by uranium of varying enrichment levels, including HEU enriched to 90%.[206] Fuel enriched to 80% and 36% has also been used.[207] MEPhI was one of six non-Minatom sites designated to receive MPC&A upgrades in a June 1995 agreement between DOE and Gosatomnadzor. The initial site survey was conducted in February 1996. Physical protection will be upgraded at the reactor building and the central fuel storage facility, and will include better communications equipment and installation of personnel portals and nuclear material detectors. MC&A upgrades include design and installation of an MC&A system, including computers, tags, and seals.[208] In addition, MEPhI has initiated a new 1.5 year master's degree (MS) program on "Nuclear Materials Safe Management, Protection, Control, and Accounting." The program covers both the technical and the political aspects of MPC&A, and provides intensive English language training. The first students began this program in September 1997.[209] The technical aspects of the program are funded by DOE, and the political aspects are funded in part by the Center for Nonproliferation Studies at the Monterey Institute of International Studies.			
Moscow Institute of Theoretical and Experimental Physics (Located in Moscow)	Heavy water research reactor and critical assembly.[210]		Yes.	Unsafeguarded.
	Comments: The 2.5 MW TVR heavy water research reactor has been shut down, but the critical assembly, called "Maket," is still in operation.[211] This institute traditionally was responsible for investigating heavy water applications for nuclear weapons production.[212] The Moscow Institute of Theoretical and Experimental Physics was added to the DOE MPC&A program in July 1996 at the seventh meeting of the Gore-Chernomyrdin Commission.[213] In December 1997, a new site-wide upgraded MPC&A system began operation.[214]			

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<tr><td rowspan="2">Novosibirsk Chemical Concentrates Plant
(Located in Novosibirsk-38)</td><td>Fuel fabrication for VVER-1000 reactors, research reactors and Pu-production reactors.[215]</td><td>No.</td><td>Yes.</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: The plant has produced LEU fuel for civilian power reactors (VVER-1000s), and HEU fuel for nuclear research reactors, and plutonium and tritium production reactors. There are up to 100 tons of fuel on site, more than a ton of which is weapons-usable.[216] In June 1996, this plant became part of the Russian TVEL joint-stock company.[217]
The Novosibirsk Chemical Concentrates Plant is one of only two facilities to have had its operating license terminated by Gosatomnadzor for MPC&A violations. The plant quickly corrected the problems, and its license was reinstated.[218] The Novosibirsk Chemical Concentrates Plant was added to the DOE MPC&A program in January 1996, at the sixth meeting of the Gore-Chernomyrdin Commission.[219]</td></tr>
<tr><td rowspan="2">Penza-19
Start Production Association
(Located in Penza-19, renamed Zarechniy)</td><td>Component fabrication; warhead assembly & disassembly.</td><td>Yes.</td><td>Yes.</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: Penza-19 manufactures electronic components for nuclear warheads. It also assembles and dismantles nuclear warheads, and stores the components on site.[220]
In a 1995 article on security problems in Russia's closed cities, the manager of Penza-19 was quoted as saying, "the lack of physical protection is the biggest problem faced by all the closed cities. The previous system was based on regulations and ordinances, which either are no longer in place or are not effective, and upon military discipline and a sense of responsibility that no longer exists."[221]
Penza-19 is one of four nuclear weapons dismantlement facilities (or "serial production facilities" as they are called in Russia) to be added to the DOE MPC&A program in 1998. Initial projects will involve the installation of portal monitors at all perimeter access points.[222]</td></tr>
<tr><td rowspan="2">Scientific Research and Design Institute of Power Technology (NIKIET), Moscow branch
(Located in Moscow)</td><td>Research reactor, subcritical assemblies.[223]</td><td></td><td>Yes.</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: NIKIET designs nuclear reactors for power generation, naval propulsion, heat production, research, and space-based apparati. There is one IR-50 50 KW pool-type reactor, as well as four subcritical assemblies located at the Moscow branch of NIKIET. [224]
The Moscow branch of NIKIET was added to the DOE MPC&A program in July 1996 at the seventh meeting of the Gore-Chernomyrdin Commission.[225] In December 1997, a new site-wide upgraded MPC&A system began operation.[226]</td></tr>
</table>

RUSSIA (cont.)

LOCATION	ACTIVITY	PLUTONIUM	WEAPONS-USABLE URANIUM	IAEA SAFEGUARDS STATUS
Scientific Research and Design Institute of Power Technology (NIKIET), Sverdlovsk branch (Located in Yekaterinburg)	Research reactor, critical assemblies, hot cells.[227]		Yes, HEU enriched to 90%.	Unsafeguarded.
	Comments: The Sverdlovsk-branch of NIKIET designs RBMK-type reactors and conducts safety analyses of these reactor types. It is the site of a pool-type 15 MW research reactor (IVV-2M) fueled by 1.7 kg of HEU enriched to 90%. A second, 200 MW reactor ("Sfinks") is planned for this site. Once operational, it will be fueled with 3.6 kg of HEU enriched to 90%.[228] In addition, three critical assemblies (FS-2, FS-4, and FS-5) and hot cells are used for the investigation of irradiated fuel.[229] This site was added to the DOE MPC&A program at the sixth meeting of the Gore-Chernomyrdin Commission in January 1996. The initial site visit took place in May 1996, after which work proceeded on a number of MPC&A projects including the design of a new computerized MC&A system.[230] In December 1997, a new site-wide upgraded MPC&A system began operation.[231] Upgrades include the installment of tamper-indicating devices, a fresh fuel measurement system, and nuclear material detectors.[232]			
St. Petersburg Nuclear Physics Institute **(formerly Lenin Institute of Physics)** (Located in St. Petersburg)	Research reactors; critical assemblies.		Yes, HEU enriched to 90%.	Unsafeguarded.
	Comments: One 18 MWt pool-type research reactor (VVR-M), fueled with 90% HEU, is operating at the St. Petersburg Institute, and a 100 MW tank-vessel type research reactor (PIK) is under construction. The larger reactor, when operational, will use about 30 kgs of 90% HEU, some of which may already be stored at the site. Construction is scheduled to be completed by 1998. In addition there are two critical assemblies located here (the FM PIK and the BIOR), one of which may have been shut down.[233] The St. Petersburg Nuclear Physics Institute was one of six non-Minatom sites designated to receive MPC&A upgrades in a June 1995 agreement between DOE and Gosatomnadzor. The initial site survey was conducted in February 1997. MPC&A upgrades are currently being implemented, and include the design and implementation of a computerized MC&A system, and perimeter and interior physical security upgrades at the main reactor building. Physical security upgrades include access controls, portal monitors, and sensors. In addition, MPC&A training workshops have been held for institute personnel.[234]			

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<tr><td rowspan="2">Sverdlovsk-44
Urals Electrochemical Integrated Plant
(Located in Sverdlovsk-44, renamed Novouralsk; near Yekaterinburg)</td><td>Past weapons-grade and other HEU production; LEU production; blending down of HEU to LEU.</td><td>No.</td><td>Yes, more than one ton.[235]</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: The Urals Electrochemical Integrated Plant at Sverdlovsk-44 was the first uranium enrichment plant in the Soviet Union. It began producing HEU for nuclear weapons in 1949, and ceased production of weapons-material in 1989.[236] Currently, the plant produces LEU for domestic nuclear power reactors, and exports a significant quantity of enriched uranium to such countries as England, Belgium, Germany, Spain, France, Finland, and South Korea.[237] In addition, it remains the only Russian facility licensed to produce HEU enriched to 30% and higher.[238] Sverdlovsk-44 is the largest uranium enrichment plant in Russia.[239]
Sverdlovsk-44 is one of three Russian facilities at which HEU from dismantled warheads is converted to gaseous uranium hexafluoride and blended down to 4% enriched LEU.[240] The LEU will eventually be sold to the United States under the February 1993 U.S.-Russia HEU agreement.[241]
Sverdlovsk-44 was added to the DOE MPC&A program in January 1996, at the sixth meeting of the Gore-Chernomyrdin Commission.[242] DOE specialists made their first visits to the site in July 1996, identifying initial areas for MPC&A cooperation.[243] MPC&A upgrades are underway at the Uranium Recovery/HEU Storage Vaults, as well as at the Centrifuge Building.[244]</td></tr>
<tr><td rowspan="2">Sverdlovsk-45
Elektrokhimpribor Combine
(Located in Sverdlovsk-45, renamed Lesnoy, near the city of Nizhnaya Tura)</td><td>Final warhead assembly and Dismantlement.</td><td>Yes.</td><td>Yes.</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: Sverdlovsk-45 is a nuclear warhead assembly, dismantlement and storage site. It has been referred to as one of Russia’s larger weapons dismantlement sites.[245] In 1992, Minatom Minister Viktor Mikhailov indicated that Sverdlovsk was dismantling 1500 warheads per year.[246] Fissile material components from retired warheads are stored here before being sent to Chelyabinsk-65 or Tomsk-7.[247]
Sverdlovsk-45 is one of four nuclear weapons dismantlement facilities (or "serial production facilities", as they are called in Russia) to be added to the DOE MPC&A program in 1998. Initial projects will involve the installation of portal monitors at all perimeter access points.[248]</td></tr>
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<tr><th>LOCATION</th><th>ACTIVITY</th><th>PLUTONIUM</th><th>WEAPONS-USABLE URANIUM</th><th>IAEA SAFEGUARDS STATUS</th></tr>
<tr><td rowspan="2">Tomsk-7[249]
Siberian Chemical Combine
(Located in Tomsk-7, renamed Seversk, 15 km north of the city of Tomsk)</td><td>Pu- production reactors; UF6 production and uranium enrichment ; reprocessing; past production of Pu and HEU pits for warheads; storage of Pu and HEU components from dismantled warheads; oxidation of HEU metal from dismantled warheads.</td><td>Yes, many tens of tons.[250]</td><td>Yes, many tens of tons,[251] including HEU from dismantled warheads.</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: The Siberian Chemical Combine is the largest multi-function production compound in the Russian nuclear complex, with large quantities of fissile material.
Production Reactors: By 1992, three out of five plutonium production reactors at Tomsk-7 had been shut down.[252] The ADE-4 and ADE-5 reactors, the two largest Pu-production reactors in Russia, continue to operate but are used primarily to produce heat and electricity for the local population. However, these two reactors, together with the ADE-2 in Krasnoyarsk-26, still produce 1.5 tons of weapons-grade plutonium per year. In October 1994, Russia ceased using the newly produced plutonium in nuclear weapons, instead converting it into plutonium oxide and placing it in storage.[253] In accordance with a September 1997 agreement between Russia and the United States, by the year 2000 Russia will convert the cores of the ADE-4 and ADE-5 reactors so that they no longer are able to produce weapons-grade plutonium.[254] Spent fuel from ADE-4 and ADE-5 is reprocessed at the Tomsk-7 reprocessing plant. Over its lifetime, Tomsk-7 has produced as much as 70 tons of weapons-grade plutonium.[255]
Uranium Enrichment: Fourteen percent of Russia's uranium enrichment capacity is located at Tomsk-7. Tomsk-7 has facilities to produce UF6, which is then used as feed for its enrichment plants. Previously, HEU was produced at Tomsk-7 for use in nuclear weapons. Today, LEU is produced for use in nuclear power plants.[256]
Fissile Material Storage: Tomsk-7 is one of two principal storage sites for HEU and Pu recovered from dismantled weapons.[257] There are approximately 23,000 canisters, each containing 1-4 kg of fissile material from disassembled nuclear weapons, located at Tomsk pending more secure storage. Each canister contains one of the following: about 1.5 kg of plutonium metal, about 2 kg of plutonium oxide, or 3-4 kg of uranium in metal or oxide form. [258] The canisters were shipped to Tomsk-7 between 1989 and 1992. Shipments then ceased due to a lack of storage space; there are no specially built and equipped storage facilities for these materials.[259]
Uranium Conversion: Under the United States-Russia HEU agreement, HEU metal from dismantled warheads is converted to purified uranium oxide at Tomsk-7. The HEU oxide is then converted to gaseous uranium hexafluoride and blended down to 4% enriched LEU, or is shipped to either Sverdlovsk-44 or Krasnoyarsk-26 to be blended down to LEU.
Security: The city of Tomsk-7 is surrounded by a double fence and guarded by troops under the command of the Ministry of Internal Affairs. Access reportedly is limited and thoroughly controlled.[260] In addition, the DOE has been providing MPC&A assistance through six U.S. national laboratories since June 1995.[261] MPC&A assistance includes the provision of vehicle and portal monitors, enhanced radio communications equipment, digital monitoring equipment, and computer equipment to enable the facility to move to a computerized accounting and inventory system. Assistance has also included a number of workshops for facility personnel, including one on conducting vulnerability assessments.[262] In April 1997, DOE announced that portal monitors with special radiation detectors and metal detectors had been installed on all pedestrian pathways at Tomsk-7 to monitor all personnel entering and leaving the nuclear facilities there.[263] By December 1997, vehicle portal monitors had also been installed and were operational throughout the site.[264]</td></tr>
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<tr><td rowspan="2">Tomsk Polytechnical University
(Located in Tomsk)</td><td>Research reactor.</td><td></td><td>Yes, kilogram quantities.[265]</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: There is one 6 MW tank-type, IRT-G research reactor, which uses HEU fuel, at the Tomsk Polytechnical University.[266] One kg of fresh 90% enriched HEU fuel was discovered missing from this site in mid-1995, and may have been illegally diverted in late 1994 or early 1995.[267]
The Tomsk Polytechnical University was one of six non-Minatom sites designated to receive MPC&A upgrades in a June 1995 agreement between DOE and Gosatomnadzor. DOE conducted an initial site survey in April 1996. Cooperative MPC&A projects include training workshops, design and implementation of improved physical protection for the reactor and storage area, improved nuclear material measurement, and development of a computerized accounting system.[268]</td></tr>
<tr><td rowspan="2">Zlatoust-36
Instrument Making Plant
(Located in Zlatoust-36, which was renamed Trekhgornyy, Chelyabinsk Oblast)</td><td>Final warhead assembly and dismantlement.</td><td>Yes.</td><td>Yes.</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: Zlatoust-36 is a nuclear warhead assembly, dismantlement, and storage facility. Assembly line production of ballistic missile reentry vehicles also takes place at this site.[269] According to a 1995 report, U.S. satellite imagery indicates that most nuclear warhead dismantlement by Russia thus far has taken place at Zlatoust-36. [270] There is more than a ton of weapons-usable material at this site.[271]
Russia has established special security forces to "ensure physical protection of nuclear facilities" at Arzamas-16, Chelyabinsk-70 (Snezhinsk), and Zlatoust-36 (Trekhgornyy).[272] Zlatoust-36 is one of four nuclear weapons dismantlement facilities (or "serial production facilities", as they are called in Russia) to be added to the DOE MPC&A program in 1998. Initial projects will involve the installation of portal monitors at all perimeter access points.[273]</td></tr>
</table>

RUSSIA (cont.)

LOCATION	ACTIVITY	PLUTONIUM	WEAPONS-USABLE URANIUM	IAEA SAFEGUARDS STATUS
Northern Fleet Naval Bases and Shipyards; Nuclear-Powered Civilian Vessel Shipyard (Location: Murmansk area, Kola Peninsula)	Fresh and spent fuel storage; submarine refueling; submarine construction and decommissioning.	No.	Large stocks of naval reactor fuel, including HEU enriched up to 92%.[274]	Unsafeguarded.
	Comments: Early generations of Soviet naval reactors used fuel enriched to less than 20%. However, most later generations of naval reactors used fuel enriched between 20-60% U-235. Some naval and icebreaker reactors, however, use fuel enriched up to 90%.[275] There are several naval shipyards and bases on the Kola Peninsula where fresh naval reactor fuel is known to be stored, as well as several sites where fresh fuel may be stored. Only those sites that are known to have fresh fuel storage are listed below: *Atomflot*, Murmansk Shipping Company, located 2 km north of the city of Murmansk. Storage facilities for fresh naval and icebreaker fuel, refueling operations for nuclear icebreakers.[276] According to Russian officials, fuel stored at this site has an enrichment level between 36–92% U-235.[277] *Northern Machine Building Plant* ("*Sevmash*"), located in the city of Severodvinsk, Arkhangelsk Oblast. Sevmash is the primary submarine construction and decommissioning shipyard in Russia,[278] as well as the START I designated dismantlement facility for SSBNs. Fresh naval fuel assemblies are stored here.[279] *Sevmorput Shipyard No. 35*, Rosta District, Murmansk. This was one of the primary refueling sites for nuclear submarines until 1991. The fresh fuel storage facility is located at Pier 20, Nos. 3-30. In 1993, 4.5 kg of 20% enriched HEU was stolen from three fuel rods located in this facility. As a result of this theft, all fresh fuel assemblies were reportedly transferred from this site to another Northern Fleet site.[280] *Zapadnaya Litsa Naval Base*, Andreeva Bay Facility. Zapadnaya Litsa is located on the westernmost point of the Kola Peninsula, 45 km from the Norwegian border. Andreeva Bay is one of four sites at Zapadnaya Litsa, and the largest spent fuel storage site for the Northern Fleet. Fresh fuel is stored in Building 34.[281] In 1993, 1.8 kg of 36% enriched HEU was stolen from two fuel rods at this storage facility.[282] "*Site 49*," near Severomorsk. According to DOE, this is the main fresh fuel storage facility for the Northern Fleet.[283] MPC&A of nuclear fuel at Russian Navy sites has been notoriously poor. As noted above, there were two significant diversions of nuclear material from Northern Fleet naval sites. In September 1995, DOE began to discuss possible cooperation in the field of MPC&A with the Russian Navy, facilitated by the Kurchatov Institute. Oakridge, Sandia, Lawrence Livermore, and Los Alamos are involved in DOE efforts to secure naval fuel.[284] In May 1996, DOE specialists made their first site visit to a Northern Fleet fresh fuel storage facility -- Site 49. Construction of a physical protection annex for fresh fuel at Site 49 was completed in September 1997. Interior work on enhanced intrusion detection devices, improved communications, computerized accounting, and installation of seals and barcodes on fuel assemblies will continue through early 1998.[285] The second Kola Peninsula site that was added to the DOE program was the Atomflot facility of the Murmansk Shipping Company, where security upgrades are being implemented at the Murmansk port and on the fresh fuel storage ship "Imandra". Under a December 12, 1997, Protocol, signed by the Russian Navy and DOE, the most recent sites to be added to the MPC&A program are the Sevmash shipyard, the "PM-63" fresh fuel storage ship, and the "PM-12" fresh fuel storage ship.[286]			

<table>
<tr><th colspan="5">RUSSIA (cont.)</th></tr>
<tr><th>LOCATION</th><th>ACTIVITY</th><th>PLUTONIUM</th><th>WEAPONS-USABLE URANIUM</th><th>IAEA SAFEGUARDS STATUS</th></tr>
<tr><td rowspan="2">Pacific Fleet
(Location: Kamchatka Peninsula and Primorskiy Kray in the Russian Far East)</td><td>Fresh and spent fuel storage; naval reactor maintenance and submarine decommissioning.</td><td>No.</td><td>Yes, large stocks of naval reactor fuel.</td><td>Unsafeguarded.</td></tr>
<tr><td colspan="4">Comments: Early generations of Soviet naval reactors used fuel enriched to less than 20%. However, most later generations of naval reactors used fuel enriched between 20-60% U-235. Some naval and icebreaker reactors, however, use fuel enriched up to 90%.[287] There are several naval sites in the Far East where fresh naval reactor fuel is known to be stored, as well as several sites where fresh fuel may be stored. The three sites listed below are those known to have fresh fuel storage facilities:
<i>Shipyard No. 199</i>, located in the city of Komsomolsk-na-Amure, north of Khabarovsk. Storage of fresh naval fuel assemblies in conjunction with submarine construction. Maintenance and repair work for submarines is also done at the Lenin Komsomol Factory.[288]
<i>Gornyak Shipyard</i> at Krashennikova Bay in the Petropavlovskaya Oblast, Kamchatka Peninsula. Site of a Russian naval "technical repair base," and a principal storage site for naval reactor fuel.[289]
<i>Shkotovo-22 Shipyard</i> at Chazma Bay (also known as Dunai), southeast of Vladivostok. Functions as a "technical repair base," submarine refueling site, and principal storage facility for fresh naval reactor fuel. Fresh nuclear fuel was delivered regularly to the shipyard from 1990 to 1993, accumulating enough material to fuel 24 submarines (48 reactors).[290]
In addition to the three shipyards noted above, the Zvezda shipyard, located at Bolshoi Kamen not far from Vladivostok, is the START I designated SSBN dismantlement facility for the Pacific Fleet. This is the only site in the Far East where dismantlement is taking place. There are three Pacific Fleet naval bases where active duty nuclear submarines are stationed. They are Pavlovsk at Strelok Bay on Primorskiy Kray; Vladimir Bay, also on Primorskiy Kray, and Rybachiy at Petropavlovsk on the Kamchatka Peninsula. Decommissioned submarines can be found at Sovetskaya Gavan and Zavety Ilyicha on the Khabarovsk Kray; Gornyak Shipyard on the Kamchatka Peninsula; and Bolshoi Kamen, Pavlovsk, and Vladimir Bay on Primorskiy Kray.[291] It is possible that fresh fuel is stored at these sites as well.
Pacific fleet sites were added to the DOE MPC&A program for the first time in a December 12, 1997, protocol, signed by the Russian Navy and DOE. Physical protection upgrades will be provided at a consolidated fresh fuel storage facility on the Kamchatka Peninsula[292] – most likely the Gornyak Shipyard – and for the PM-74.[293] DOE officials hope to make their first visit to a Pacific Fleet site in Spring 1998.[294]</td></tr>
</table>

INTRODUCTION TO UKRAINE

There are three nuclear research sites in Ukraine with weapons-usable nuclear material. There are also five major nuclear power plants in Ukraine, which have not been included in this chart as they use LEU enriched only to between 2.2 and 4.4%. The IAEA received an initial inventory report on nuclear materials subject to safeguards from Ukraine on March 2, 1995, and concluded its initial inventory verification in 1997 at all sites except the Kharkiv Physics and Technology Institute.[295] The United States began providing MPC&A assistance to Ukraine after the December 18, 1993, signing of the Nunn-Lugar Cooperative Threat Reduction Program Implementing Agreement for MPC&A cooperation between DOD and the Ukrainian State Committee for Nuclear and Radiation Safety. (DOE and the Ukrainian Ministry for Environmental Protection and Nuclear Safety have since taken over the program.) The program initially focused on the Institute for Nuclear Research in Kiev and the South Ukraine Nuclear Power Plant in Yuzhnoukrainsk. The institutes in Kharkiv and Sevastopol were added to the DOE MPC&A program in 1995.

UKRAINE

LOCATION	ACTIVITY	PLUTONIUM	WEAPONS-USABLE URANIUM	IAEA SAFEGUARDS STATUS
Institute of Nuclear Research of the National Academy of Sciences (Located in Kiev)	Research reactor; nuclear research; nuclear material storage.	Small amounts.	90% and 36% HEU in fuel assemblies.	Safeguarded.
	Comments: The 10 MWt VVR-M research reactor at this site contains single or triple fuel assemblies enriched to 36% and 90%. A typical reactor core loading is 13.2 kg of 36% enriched HEU. Fresh fuel is stored at this site in a special storage area. The Institute also has small quantities of Pu-239.[296] U.S. MPC&A assistance to the Institute of Nuclear Research, including both training and equipment, began under the framework of the Nunn-Lugar Cooperative Threat Reduction Program in December 1993.[297] By October 1995, a number of MPC&A upgrades had been completed, including upgrades to the central alarm station and the fresh fuel storage vault, and the installation of interior intrusion detection sensors.[298] Upgrades to the facility perimeter were completed in fall 1997.[299]			
National Science Center: Kharkiv Physics and Technology Institute (KhPTI) (Located in Kharkiv)	Research in nuclear physics and other disciplines; nuclear material storage.	No.	Up to 75 kg of HEU enriched up to 90% in bulk and item form.[300]	Safeguarded.[301]
	Comments: HEU in bulk form is relatively difficult to inventory and safeguard, and is therefore quite vulnerable to theft. Uranium in "bulk form" refers to a uranium oxide, which is usually a powder. The IAEA has not yet completed an initial inventory verification at this site.[302] KhPTI and DOE representatives met for the first time in March 1995, leading to a DOE MCP&A initial site survey in June 1995.[303] MPC&A upgrades will include the installation of a vault to store HEU. The nuclear materials storage area is being reconstructed to accommodate the vault.[304] In addition, DOE has provided computer systems, accounting software, and hand-held metal and nuclear material detectors. In September 1995 and March 1996, both Japan and Sweden also expressed interest in assisting with the facility's upgrades.[305] MPC&A upgrades are scheduled to be completed by the end of 1998.[306]			

<table>
<tr><th colspan="5">UKRAINE (cont.)</th></tr>
<tr><th>LOCATION</th><th>ACTIVITY</th><th>PLUTONIUM</th><th>WEAPONS-USABLE URANIUM</th><th>IAEA SAFEGUARDS STATUS</th></tr>
<tr><td rowspan="2">**Sevastopol Institute of Nuclear Energy and Industry**
(Located in Sevastopol on the Black Sea coast)</td><td>Reactor training facility;[307] subcritical assemblies.</td><td>No.</td><td>3.1 to 6.1 kg of U-235.[308]</td><td>Safeguarded.</td></tr>
<tr><td colspan="4">**Comments:** There is one 200 KWt IR-100 research reactor at Sevastopol, which uses fuel enriched up to 36%. There are also two subcritical assemblies at this facility, which use fuel enriched from 0.7% to 36%.[309] The Ministry of Environmental Protection and Nuclear Safety has not yet issued a license for the operation of either the research reactor or the subcritical assemblies. Once the research reactor has been licensed, it will be used as a scientific and training reactor for future nuclear power plant operators.[310] Former Ukrainian nuclear regulatory officials have stated that the facility may also possess 90% HEU material.[311]
The Sevastopol Institute of Nuclear Energy and Research (SINER) was previously called the Sevastopol Naval Research Institute, and was under the auspices of the Naval Academy of the Ukrainian Ministry of Defense. On September 2, 1996, the Cabinet of Ministers passed Resolution No. 884, founding the SINER on the basis of the old naval institute. SINER is currently under the auspices of the Ministry of Energy.[312]
The Sevastopol Naval Research Institute has been receiving MPC&A assistance from DOE since 1995.[313] MPC&A upgrades are scheduled to be completed by the end of 1998.[314]</td></tr>
</table>

NOTES

1. Principal sources for this table are the NIS Nuclear Profiles Database, Center for Nonproliferation Studies Monterey Institute of International Studies 1997; *United States/Former Soviet Union: Program of Cooperation on Nuclear Material Protection, Control, and Accounting*, Department of Energy Nuclear Material Security Task Force, December 1996; and interviews by Emily S. Ewell with NIS nuclear officials throughout 1997.

2. Natural uranium contains 0.7% U-235 and 99.3% U-238.

3. K. Murakami et al., "IAEA Safeguards and Verification of the Initial Inventory Declarations in the NIS," July 1997, p. 3, distributed at a workshop held at Stanford University entitled "A Comparative Analysis of Approaches to the Protection of Fissile Materials," on July 28 – 30, 1997.

4. Roger S. Chase, Jr. et al., "US/Belarusian Government-to-Government Material Protection, Control, and Accounting Cooperation at the Sosny Science and Technology Center," *United States/Former Soviet Union: Program of Cooperation on Nuclear Material Protection, Control and Accounting*, Department of Energy Nuclear Material Security Task Force, December 1996, p. NIS–31.

5. The Belarusian Academy of Sciences has maintained a multi-disciplinary research center at Sosny for several years. Until 1989, the name of this facility was the Institute for Nuclear Power Engineering. In 1989, the facility was divided into three separate research centers, all three of which continue to be overseen by the Academy of Sciences and remain physically located at Sosny (near the Belarusian capital of Minsk). They are: the Institute for Power Engineering Problems; the Institute for Physical and Chemical Radiation Problems; and the Institute for Radiation-Ecological Problems. Some recent reports have referred to the entire Sosny complex as the Academy of Sciences' Science and Technical Center, Sosny. However, weapons-usable nuclear materials at Sosny are located at only the Institute for Power Engineering Problems.

6. Center for Nonproliferation Studies interviews with Belarusian nuclear officials, Sosny, Belarus, June 1994 and April 1995.

7. The IAEA safeguards agreement with Belarus entered into force in July 1995. The Sosny facility is currently under a regular, ad-hoc inspection regime. [See Murakami, "IAEA Safeguards," *op cit.*]

8. "Belarus: Research Facilities," NIS Nuclear Profiles Database, Center for Nonproliferation Studies Monterey Institute of International Studies August 1997.

9. *Ibid.*

10. Murakami, "IAEA Safeguards," *op cit*.

11. *Ibid.*

12. "Improving Nuclear Materials Security at the Sosny Science and Technical Center, Minsk, Belarus," *Russia/NIS Nuclear Material Task Force*, June 1997.

13. Chase, "US-Belarusian Government-to-Government," *op cit.*, p. NIS-33.

14. *Nihon Keizai Shimbun*, November 1, 1994, as reported in "Tokyo to Give Technical Aid on Nuclear Materials to Belarus," JPRS-TND-94-020, 17 November 1994, pp. 6-7 and "Improving Nuclear Materials Security at the Sosny Science and Technical Center, Minsk, Belarus," June 1997, *op cit.*

15. Chase, "US-Belarusian Government-to-Government," *op cit.*, p. NIS-35.

16. Murakami, "IAEA Safeguards," *op cit*.

17. DOE Public Information, Office of Nonproliferation and National Security, January 27, 1995.

18. A. Eras, "DOE Nuclear Material Physical Protection Program in the Republic of Kazakhstan," Sandia National Laboratory, Albuquerque, NM, February 1998.

19. Center for Nonproliferation Studies interview with Kazakhstani nuclear official, May 1997.

20. The Institute of Nuclear Physics also is located at the Alatau site of the National Nuclear Center. However, all nuclear materials are located at the Institute of Atomic Energy.

21. U.S. General Accounting Office, *Nuclear Safety: Concerns With Nuclear Facilities and Other Sources of Radiation in the Former Soviet Union (Letter Report)*, GAO/RCED, November 7, 1995, Appendix II, pp. 23-25.

22. The IAEA safeguards agreement with Kazakhstan entered into force in August 1995. Since that time, the IAEA has been conducting official, ad hoc inspections at all Kazakhstani nuclear sites. The inspections are considered ad hoc because Kazakhstan and the IAEA have not yet signed the necessary subsidiary agreements on protocol arrangements (such as how data should be presented to IAEA inspectors, etc). A draft subsidiary agreement exists, but has not yet been translated into Russian. Center for Nonproliferation Studies discussions with Kazakhstani nuclear official, May 1997.

23. In addition to the Institute of Atomic Energy, the Institute of Nuclear Physics is also located at this site. Nuclear research facilities at the Institute of Nuclear Physics include a cyclotron.

24. During CNS staff interviews with National Nuclear Center (NNC) officials in May 1996, it was indicated that Russian-owned nuclear material was present at both the Semipalatinsk and Almaty sites of the NNC.

25. Murakami, "IAEA Safeguards," *op cit*.

26. Correspondence with Kazakhstani specialist, January, 1998.

27. G. Tittemore et al., "United States Assistance to Kazakhstan in the Area of Nuclear Material Security," *United States/Former Soviet Union: Program of Cooperation on Nuclear Material Protection, Control and Accounting*, Department of Energy Nuclear Material Security Task Force, December 1996, p. NIS-9.

28. Center for Nonproliferation Studies discussion with Kazakhstani nuclear official, May 1997.

29. "MPC&A Program Strategic Plan," U.S. Department of Energy, Office of Nonproliferation and National Security, January 1998, p. 17.

30. Center for Nonproliferation Studies discussions with scientists at the IGR and Baikal-1 reactor sites, September 1997.

31. The Baikal-1 site was previously a branch of the Russian NPO Luch Production Facility. Its primary research activities were on the Soviet nuclear rocket engine program. Center for Nonproliferation Studies discussions with scientists at the IGR and Baikal-1 reactor sites, September 1997.

32. *Ibid.*

33. Murakami, "IAEA Safeguards," *op cit*.

34. Center for Nonproliferation Studies interview with U.S. administration official, December 18, 1995, and Kazakhstani nuclear official, May 1997. See also "More HEU Said To Be In Kazakhstan," *Nuclear Fuel*, December 4, 1995, p. 2.

35. Center for Nonproliferation Studies interview with Kazakhstani nuclear official, May 1997.

36. Presentation by William C. Potter at the American Nuclear Society, November 11, 1996; and Center for Nonproliferation Studies discussion with Baikal-1 engineers, September 1997.

37. Center for Nonproliferation Studies correspondence with Kazakhstani nuclear official, March 1997.

38. Tittemore, "United States Assistance to Kazakhstan," *op cit.*

39. Eras, "DOE Nuclear Material Protection," *op cit.*; and Center for Nonproliferation Studies discussions with Deputy Chief Engineers at the IGR and Baikal-1 reactor sites, September 1997.

40. Center for Nonproliferation Studies discussions with Deputy Chief Engineers at the IGR and Baikal-1 reactor sites, September 1997.

41. Center for Nonproliferation Studies discussion with Kazakhstani nuclear official, September 1997; and Jessica Stern, "Preventing Terrorism with Weapons of Mass Destruction, A Proposed New Initiative," Statement before the House Committee on National Security, Subcommittee on Military Research and Development, October 1, 1997. An article in *Nuclear Fuel* put the amount of plutonium at 3.5 tons. See Mark Hibbs, "Lack of Home for Vitrified Waste Stalls Aktau Spent Fuel Transport," *Nuclear Fuel*, October 20, 1997, p. 5.

42. *Nuclear Engineering International World Industry Handbook 1992*, p. 58.

43. V. Shmelev, "Estimation of the Quantities of Nuclear Materials at the Facilities in the New Independent States," unpublished manuscript, Monterey Institute of International Studies December 1992.

44. Center for Nonproliferation Studies interview with U.S. Government official, April 1996. Kazakhstani officials have preliminary plans either to store the material at Aktau indefinitely, or to move it to a site at the former Semipalatinsk nuclear test range, currently under the auspices of the National Nuclear Center. See Mark Hibbs, "Lack of Home for Vitrified Waste," *op cit.*, p. 6.

45. Murakami, "IAEA Safeguards," *op cit*.

46. Oleg Bukharin and William Potter, "Kazakhstan — A Nuclear Profile," *Jane's Intelligence Review*, April 1994, p. 184.

47. Eras, "DOE Nuclear Material Protection," *op cit.*

48. V. Bolgarin and D.N. Olsen, "Kazakhstan/US Material Control and Accounting Program for the BN-350 Reactor," *United States/Former Soviet Union: Program of Cooperation on Nuclear Material Protection, Control, and Accounting*, Department of Energy Nuclear Material Task Force, December 1996, pp. NIS-11 - NIS-14.

49. Center for Nonproliferation Studies interview with Kazakhstani nuclear official, May 1997.

50. *Ibid.* and Jessica Stern, "Nunn-Lugar Activities to Improve Fissile Material Protection, Control, and Accountability in the Former Soviet Union," in John Shields and William Potter, eds., *Dismantling the Cold War: U.S. and NIS Perspectives on the Nunn-Lugar Cooperative Threat Reduction Program* (Cambridge, MA: MIT Press, 1997).

51. On November 22, 1994, the U.S. government disclosed that 581 kg of HEU, including several hundred kilograms of weapons-grade HEU, had been stored at the Ust-Kamenogorsk facility under inadequate security arrangements. The material was originally destined for use as fuel in Soviet naval reactors, rather than in nuclear arms, and was in seven forms: HEU metal (168.7 kg); HEU oxides (29.7 kg); beryllium-HEU alloy fuel rods (148.6 kg); beryllium-HEU alloy machining scrap and powder (231.5 kg); beryllium oxide-uranium dioxide fuel rods (1.6 kg); graphite with trace HEU (0.7 kg); and laboratory salvage (0.2 kg); [Project Sapphire briefing by Alexander Riedy, Lockheed Martin, at the third meeting of the U.S.-German Study Group on Non-Proliferation, Bonn, Germany, June 12, 1995; William C. Potter, "The 'Sapphire' File: Lessons for International Nonproliferation Cooperation," *Transition*, November 17, 1995, pp. 14-19.]

U.S. spokespersons announced that, in an effort to eliminate the risk of diversion, this material had been transported to Oak Ridge, Tennessee, pursuant to arrangements with the government of Kazakhstan and in consultation with the government of Russia. There it was to be blended with non-weapons-grade uranium to produce fuel for nuclear power plants. Kazakhstan reportedly was to receive several tens of million of dollars in U.S. economic assistance in return for relinquishing the material. [R. Jeffrey Smith, "U.S. Takes Nuclear Fuel," *Washington Post,* November 23, 1994; Steven Erlanger, "Kazakhstan Thanks U.S. On Uranium," *New York Times,* November 25, 1994.] All the HEU has been transferred from Oak Ridge to Lynchburg, Virginia, where Babcock and Wilcox (B&W) began to blend down the material in early 1996. At B&W HEU will be transformed into an interim form such as uranyl nitrate over a period of several months and then shipped to the General Electric facility in Wilmington, North Carolina for the final down-blending into LEU. IAEA officials have monitored the transfer of the HEU to Lynchburg. [*Post-Soviet Nuclear & Defense Monitor,* July 18, 1995; Greg Webb interview with Ron Hite of B&W, December 21, 1995.]

52. Center for Nonproliferation Studies discussion with Oleg Bukharin, January 1998.

53. Murakami, "IAEA Safeguards," *op cit*.

54. Center for Nonproliferation Studies interview with Kazakhstani nuclear official, May 1997.

55. Tittemore, "United States Assistance to Kazakhstan," *op cit.*, p. NIS-7.

56. Center for Nonproliferation Studies interview with Kazakhstani nuclear official, May 1997.

57. Center for Nonproliferation Studies discussion with Kazakhstani official, summer 1997.

58. Oleg Bukharin, "Security of Fissile Material in Russia," *Annual Review: Energy and Environment*, 21: 467-96, 1996, p.471 and p. 473.

59. Steve Mladineo et al., "US Government-to-Government Cooperation On Nuclear Material Protection, Control, and Accounting," *United States/Former Soviet Union Program of Cooperation on Nuclear Material Protection, Control, and Accounting*, December 1996, p. G-G 1.

60. Mark Mullen, "Status Report on US/Russian Laboratory-to-Laboratory Cooperation in Nuclear Material Protection, Control, and Accounting," *United States/Former Soviet Union Program of Cooperation on Nuclear Material Protection, Control, and Accounting*, December 1996, p. LL 1.

61. Mladineo, "US Government-Government Cooperation," *op cit.*, p. G-G 1.

62. Center for Nonproliferation Studies interview with DOE official, July 1997.

63. "Russia: Nuclear Weapons Facilities," NIS Nuclear Profiles Database, Center for Nonproliferation Studies Monterey Institute of International Studies August 1997.

64. G. Skripka et al., "Implementation of MPC&A Systems at the VNIIEF Research (Reactor) Site," *United States/Former Soviet Union Program of Cooperation on Nuclear Material Protection, Control, and Accounting*, December 1996, p. L-L 50.

65. *Ibid.*

66. "MPC&A Program Strategic Plan," *op cit.*, p. 16.

67. As a nuclear-weapon state party to the NPT, Russia is not required to place its nuclear facilities under IAEA safeguards.

68. "Russia: Nuclear Weapons Facilities," *op cit.*

69. Skripka, "Implementation of MPCC& Systems," *op cit.*, p. L-L 50.

70. DOE assistance to this site was previously carried out under the Lab-to-Lab program. However, in the first part of 1997 the DOE Lab-to-Lab and Government-to-Government assistance programs to Russia and the NIS were merged into a comprehensive DOE MPC&A program. The programs were merged in order to facilitate a more uniform approach to MPC&A assistance. Interview with DOE official, August 1997.

71. " Update on MPC&A Developments Since June 1996," U.S. Department of Energy Fact Sheet, April 1997.

72. "MPC&A Program Strategic Plan," *op cit.*, p. 19.

73. O. Lastochkin, "Bonification of the Ozersk," *Chelyabinskiy Rabochiy*, April 14, 1995, p.7.

74. "Russia: Nuclear Weapons Facilities," *op cit.*

75. Bukharin, "Security of Fissile Materials in Russia," *op cit.*, p. 476.

76. "MPC&A Program Strategic Plan," *op cit.*, p. 16.

77. *Ibid.*, pp. 16-19.

78. Center for Nonproliferation Studies discussion with Russian official, summer 1997.

79. *Ibid.*

80. "MPC&A Program Strategic Plan," *op cit.*, p. 17.

81. "Russia: Research, Power, Waste," NIS Nuclear Profiles Database, Center for Nonproliferation Studies Monterey Institute of International Studies August 1997.

82. *Ibid.*

83. Mladineo, "US Government-Government Cooperation," *op cit.*, p. G-G 2.

84. Ken Sheely, "Nuclear Material Protection, Control and Accounting Program," (unclassified fax message), January 1998.

85. MOX is mixed uranium oxide/plutonium oxide fuel. ["Russia: Research, Power, Waste," August 1997, *op cit.*; and interview with U.S. administration official, December 18, 1995.]

86. Center for Nonproliferation Studies discussion with DOE official, January 1998.

87. Leonard S. Spector, Testimony before the Subcommittee on International Security, International Organizations, and Human Rights of the House Foreign Affairs Committee, June 27, 1994.

88. Center for Nonproliferation Studies discussion with DOE official, January 1998; and W. Ruhter et al., "US/Russian Laboratory-to-Laboratory Material, Protection, Control and Accounting Program Efforts at the Institute of Inorganic Materials," *United States/Former Soviet Union Program of Cooperation on Nuclear Material Protection, Control, and Accounting*, December 1996, pp. L-L 25-29.

89. "MPC&A Program Strategic Plan," *op cit.*, p. 16.

90. At a location producing MOX fuel, pure plutonium must be present to make the blend; furthermore, the plutonium content in fresh MOX fuel, typically 4% in MOX fuel for power reactors or 20% in MOX fuel for breeder reactors, can be readily separated out.

91. According to Oleg Bukharin, approximately 30 tons of plutonium has been produced at the RT-1 reprocessing plant and is currently stored on-site. [Bukharin, "Security of Fissile Materials in Russia," *op cit.*, p. 473.]

92. According to Oleg Bukharin, Chelyabinsk-65 is one of two principal storage sites for HEU and plutonium recovered from nuclear warheads. [*Ibid.*, p. 475.]

93. *Ibid.*

94. "Russia: Fissile Material: Plutonium Production: Mayak," NIS Nuclear Profiles Database, Center for Nonproliferation Studies Monterey Institute of International Studies August 1997.

95. Bukharin, "Security of Fissile Materials in Russia," *op cit.*, p. 473.

96. Current U.S. assistance is based on an initial agreement between the U.S. Department of Defense and the Russian Minatom on MPC&A, and a subsequent July 1995 joint statement between the U.S. Department of Energy and Minatom.

97. G.S. Starodubtsev et al., "Cooperation Between the U.S. Department of Energy National Laboratories and Mayak Production Association for Enhancements to Material Protection, Control, and Accounting Systems," *United States/Former Soviet Union Program of Cooperation on Nuclear Material Protection, Control, and Accounting*, December 1996, pp. GG 45 – 48.

98. Bukharin, "Security of Fissile Materials in Russia," *op cit.*, p. 493.

99. Oleg Bukharin, "The Future of Russia's Plutonium Cities," *International Security*, Vol. 21, No. 4, Spring 1997, p. 138.

100. "US Commits Another $75 Million for Fissile Materials Facility," *Post-Soviet Nuclear & Defense Monitor*, July 18, 1995, pp. 1-2; "Contract for Fissile Storage Facility in Russia to be Awarded in February," *Post-Soviet Nuclear & Defense Monitor*, January 31, 1996, p.4.

101. Bukharin, "The Future of Russia's Plutonium Cities," *op cit.*, p. 132.

102. Andrey Lvov, "Nuclear Paramilitary Unit," *Rossiiskaya Gazeta*, April 22, 1995, p. 4.

103. Center for Nonproliferation Studies discussion with Russian scientist, October 1997.

104. "Russia: Nuclear Weapons Facilities," *op cit.*

105. "MPC&A Program Strategic Plan," *op cit.*, p. 16.

106. Gennady Tsyganov et al., "US/Russian Laboratory-to-Laboratory MPC&A Program at the VNIITF Institute, Chelyabinsk-70," *United States/Former Soviet Union Program of Cooperation on Nuclear Material Protection, Control, and Accounting*, December 1996, pp. LL 57-61.

107. "Update on MPC&A Developments Since June 1996," U.S. Department of Energy Fact Sheet, April 1997.

108. Sheely, unclassified fax, *op cit.*

109. Lastochkin, "Bonification of the Ozersk," *op cit.*, p. 7.

110. Alexander Chunosov, "Dudaev Threatens to Bring War to Russian Inland. Anti-Terrorist Measures are Taken in the Urals," *Vecherniy Chelyabinsk*, February 1, 1995, p. 1.

111. "Dimitrovgrad Atomic Center 'Dying' Due to Funds Shortage," *Vesti Newscast*, February 4, 1997; in FBIS-SOV-97-023.

112. "MPC&A Program Strategic Plan," *op cit.*, p. 16.

113 "List of Research Reactors, Critical and Subcritical Assemblies Supervised by Gosatomnadzor," July 1992; in "Russia: Research, Power, Waste," August 1997, *op cit.*

114. "Russia: Research, Power, Waste," August 1997, *op cit.*

115. *Ibid.*

116. Yuri Kharlanov et al., "US/Russia Government-to-Government Cooperation in Material Protection, Control and Accounting at the SSC-RIAR, Dimitrovgrad," *United States/Former Soviet Union Program of Cooperation on Nuclear Material Protection, Control, and Accounting*, December 1996, p. GG-18.

117. *Ibid.*

118. *Ibid.*

119. Carnegie Endowment, interviews with officials at Dubna, April 6, 1996.

120. *Ibid.*

121. *Ibid.*

122. Sheely, unclassified fax, *op cit.*

123. Yuri Volodin and M. Teresa Olascoaga, "Cooperation on Nuclear Material Protection, Control, and Accounting Between the Federal Nuclear and Radiation Authority of Russia (Gosatomnadzor) and the U.S. Department of Energy," *United States/Former Soviet Union Program of Cooperation on Nuclear Material Protection, Control, and Accounting*, December 1996, p. GG-8.

124. DOE Public Information, Office on Nonproliferation and National Security, January 27, 1995.

125. "MPC&A Program Strategic Plan," *op cit.*, p. 16.

126. "Russia: Research, Power, Waste," August 1997, *op cit.*

127. Responsibility for MPC&A projects at Elektrostal was switched from DOD to DOE in mid-1995.

128. Hastings Smith et al., "US/Russian Collaboration for Enhancing Nuclear Material Protection, Control, and Accounting at the Elektrostal Uranium Fuel-Fabrication Plant, " *United States/Former Soviet Union Program of Cooperation on Nuclear Material Protection, Control, and Accounting*, December 1996, pp. GG 23-24.

129. *Ibid.*, pp. GG 26-32.

130. "Update on MPC&A Developments Since June 1996," *op cit.*

131. Sheely, unclassified fax, *op cit.*

132. Center for Nonproliferation Studies correspondence with DOE official, September 1997.

133. Interview with Obninsk scientist, August 1997. This scientist also noted that he did not know when the last physical inventory had been done, and that in fact the term "physical inventory" was often used to mean verification of written records, rather than actual measurement of materials. It is possible that DOE will provide some assistance with a physical inventory at IPPE.

134. *Ibid.*

135. Institute of Physics and Power Engineering Homepage, "Trends of IPPE activity," http://www.ippe.rssi.ru; and "Russia: Research, Power, Waste," August 1997, *op cit.*

136. V.V. Kuzin et al., "Collaborative Russian/US Work in Nuclear Material Protection, Control, and Accounting at the Institute of Physics and Power Engineering—Extension to Additional Facilities," *United States/Former Soviet Union Program of Cooperation on Nuclear Material Protection, Control, and Accounting*, December 1996, pp. GG 51-53.

137. Mark Mullen, "Status Report on US-Russian Cooperation in Nuclear Materials Protection, Control, and Accounting," paper presented at the 37th annual meeting of the Institute of Nuclear Materials Management, July 28-31, 1996, in Naples, Florida.

138. Sheely, unclassified fax, *op cit.*

139. Center for Nonproliferation Studies interview with Obninsk scientist, August 1997.

140. *Ibid.*; and Kuzin, "Collaborative Russian/US Work," *op cit.*

141. Center for Nonproliferation Studies interview with Obninsk scientist, August 1997.

142. Center for Nonproliferation Studies interview with U.S. administration official, December 18, 1995.

143. Center for Nonproliferation Studies interview with Obninsk scientist, August 1997.

144. Center for Nonproliferation Studies interview with Russian nuclear official, August 1997.

145. *Ibid.*

146. "Russia: Research, Power, Waste," August 1997, *op cit*.

147. Sheely, unclassified fax, *op cit.*

148. Volodin and Olascoaga, "Cooperation on Nuclear Material Protection," *op cit.*, pp. G-G 6, 8.

149. Center for Nonproliferation Studies interview with DOE official, August 1997.

150. Center for Nonproliferation Studies discussion with Oleg Bukharin, January 1998.

151. "Russia: Research, Power, Waste," August 1997, *op cit*.

152. "Summary of 26 New ISTC Awards," *Post-Soviet Nuclear & Defense Monitor*, July 7, 1995, pp. 7-10.

153. "Protection and Surveillance of Nuclear Materials in the FSU," Hearings Before the Senate Governmental Affairs Committee Permanent Subcommittee on Investigations, March 20, 1996; in "Russia: Research, Power, Waste," NIS Nuclear Profiles Database, Center for Nonproliferation Studies Monterey Institute of International Studies.

154. Sheely, unclassified fax, *op cit.*

155. "Russia: Fissile Material Production," NIS Nuclear Profiles Database, Center for Nonproliferation Studies Monterey Institute of International Studies August 1997.

156. Center for Nonproliferation Studies discussion with Oleg Bukharin, January 1998.

157. *Ibid.*

158. The Agreement Concerning the Shutdown of Plutonium Production Reactors and Cessation of the Use of Newly Produced Plutonium for Nuclear Weapons, an intergovernmental agreement signed by U.S. Vice President Albert Gore and Russian Prime Minister Viktor Chernomyrdin on June 23, 1994, had obligated the Russian Federation to stop producing weapons-grade plutonium by shutting down the plutonium producing reactors still operating in Krasnoyarsk and in Tomsk by the year 2000. In addition, the agreement stipulated that Russia would not use any plutonium produced by the production reactors in nuclear weapons after the agreement entered into force. [See "Vice President's Statement to the Press at the Signing Ceremony with Russian Prime Minister Chernomyrdin," Office of the Vice President, June 23, 1994. See also Bukharin, "Security of Fissile Materials in Russia," *op cit.*, p. 473.]

159. According to a report issued by the Gore-Chernomyrdin Commission in February 1997, the United States and Russia agreed that the goal of the original 1994 agreement could be reached by converting the cores of plutonium production reactors so that they no longer produce weapons-grade plutonium. On September 23, 1997, this agreement was formalized when the United States and Russia signed the "U.S.–Russian Plutonium Production Reactor Agreement." ["U.S./Russian Joint Commission on Economic and Technological Cooperation: Report of the Energy Policy Committee – Nuclear," February 1997, at http://www.eia.doe.gov/gorec/newdrft.html and "U.S. Commitment to the Treaty on the Non-Proliferation of Nuclear Weapons," U.S. Arms Control and Disarmament Agent Fact Sheet, October 15, 1997.]

160. *Ibid.*

161. Oleg Bukharin, "Nuclear Safeguards and Security in the Former Soviet Union," *Survival*, Winter 1994-95, p. 61.

162. Bukharin, "Security of Fissile Materials in Russia," *op cit.*, p. 473.

163. Bukharin, "The Future of Russia's Plutonium Cities," *op cit.*, p. 142.

164. Bukharin, "Security of Fissile Materials in Russia," *op cit.*, p. 473.

165. In January 1996, Evgeniy Mikerin, head of Nuclear Fuel Production at Minatom, reported that the RT-2 project was only 30% complete and that further construction would not proceed until officials from Gosatomnadzor and local authorities reviewed ecological reports required by Russia's new licensing laws, passed in mid-1995. [See Mark Hibbs, "Minatom Official Calls for Make-or-Break Decision on Krasnoyarsk RT-2 Plant," *Nuclear Fuel*, January 1, 1996, p. 1; "Russian Plutonium May Be Moved to Centralized Site at Ozersk," *Nucleonics Week,* January 4, 1996, p. 9.]

After on-site inspections with international experts, Minatom determined in early 1997 that the construction of RT-2 would pose no threat to the local population. In June 1997, local environmentalists presented 100,000 signatures to local authorities, calling for a referendum banning the construction of the RT-2 plant. The local Duma rejected the appeal, however. It is still unclear whether or not construction will move forward. [See "Russia: Fissile Material Production," August 1997, *op cit.*]

166. Center for Nonproliferation Studies discussion with DOE official, January 1998.

167. Bukharin, "The Future of Russia's Plutonium Cities," *op cit.*, p. 132.

168. Alexander Bolsunovsky and Valery Menshchikov, "Nuclear Security is Inadequate and Outdated," *Moskovskiye Novosti*, No. 14, December 9-15, 1994, p. 14, in *FBIS-JPRS-TAC-95-002*, June 14, 1995, pp. 97-99.

169. "U.S./Russian Joint Commission on Economic and Technological Cooperation: Report of the Energy Policy Committee – Nuclear," February 1997, at http://www.eia.doe.gov/gorec/newdrft.html.

170. " Update on MPC&A Developments since June 1996," *op cit.*; and "MPC&A Program Strategic Plan," *op cit.*, pp. 16-18.

171. Bukharin, "Security of Fissile Materials in Russia," *op cit.*, p. 476.

172. "Russia: Fissile Material: Uranium Enrichment," NIS Nuclear Profiles Database, Center for Nonproliferation Studies Monterey Institute of International Studies August 1997.

173. Center for Nonproliferation Studies discussion with DOE official, January 1998; Bukharin, "Security of Fissile Materials in Russia," *op cit.*, p. 476.

Under the U.S.–Russian HEU Agreement, signed on February 18, 1993, the U.S. agreed to purchase 500 tons of HEU from dismantled warheads over a 20 year period. Under the agreement, the fuel is to be blended down to LEU in Russia, for eventual use as nuclear fuel, before it is shipped to the United States. The agreement was designed as a nonproliferation measure to reduce the threat of diversion of HEU from Russian stockpiles. See Lara Kroop, "Background Report: U.S.–Russian HEU Agreement," NIS Nuclear Profiles Database, Center for Nonproliferation Studies Monterey Institute of International Studies August 1997.

174. Mladineo, "US Government-Government Cooperation," *op cit.*, p. GG-2.

175. *Ibid.*

176. Center for Nonproliferation Studies correspondence with DOE official, September 1997.

177. "MPC&A Program Strategic Plan," *op cit.*, pp. 16-18.

178. Center for Nonproliferation Studies interviews with Russian and U.S. nuclear officials, August 1997.

179. "Russia: Research, Power, Waste," August 1997, *op cit.*

180. Center for Nonproliferation Studies interview with DOE official, August 1997.

181. Center for Nonproliferation Studies interview with Russian nuclear official, August 1997.

182. Center for Nonproliferation Studies correspondence with DOE official, September 1997.

183. Frank von Hippel, "Fissile Material Storage in the Post Cold War World," *Physics Today*, June 1995, pp. 26-31.

184. W.G. Sutcliffe, "Foreign Trip Report, Russia" October 1994, p. 5. In addition, a news account in late 1994 stated that over 100 tons of natural uranium and LEU were present at Kurchatov. See Bolsunovsky and Menshchikov, "Nuclear Safety Is Inadequate and Outdated," *op cit.*

185. "Russia: Research, Power, Waste," August 1997, *op cit.* In addition, Dr. Vladimir Sukhoruchkin noted in a July 1997 interview that there were three new research reactors at Kurchatov.

186. U.S. General Accounting Office, *Nuclear Safety: Concerns in the Former Soviet Union*, *op cit.*, pp. 23-25.

187. "Russia: Research, Power, Waste," August 1997, *op cit.*

188. Mullen, paper presented at the INMM meeting in Naples, Florida, July 28-31, 1996, *op cit.*

189. Vladimir Sukhoruchkin, "US/Russian Laboratory-to-Laboratory Program In Material Protection, Control, and Accounting at the RRC Kurchatov Institute," *United States/Former Soviet Union: Program of Cooperation on Nuclear Material Protection, Control and Accounting*, December 1996, pp. LL 32-33; and " Update on MPC&A Developments Since June 1996," *op cit.*

190. "Update on MPC&A Developments Since June 1996," *op cit.*

191. "MPC&A Program Strategic Plan," *op cit.*, p. 16.

192. *Ibid.*

193. Luch was one of the main developers of the Topaz-2 satellite nuclear-powered space reactor, and is developing the Topaz-3 space reactor, which may use plutonium fuel manufactured from dismantled weapons material. See "Russia: Fissile Material Production," NIS Nuclear Profiles Database, Center for Nonproliferation Studies Monterey Institute of International Studies August 1997.

194. Pavel Mizin et al., "Nuclear MPC&A at the Luch Facility," *United States/Former Soviet Union: Program of Cooperation on Nuclear Material Protection, Control and Accounting*, December 1996, p. GG-37.

195. "Russia: Power, Research, Waste," August 1997, *op cit*.

196. Mizin, "Nuclear MPC&A at the Luch Facility," *op cit.*, pp. GG-38-41.

197. Sheely, unclassified fax, *op cit.*

198. List of Research Reactors, Critical and Subcritical Assemblies Supervised by Gosatomnadzor, July 1992; in "Russia: Research, Power, Waste," August 1997, *op cit*.

199. According to an article in *Nucleonics Week*, there may be an inventory of separated plutonium at the Lytkarino facility. [Mark Hibbs, "Gosatomnadzor Warned U.S. of Insider Threat at Lytkarino Lab," *Nucleonics Week*, August 14, 1997, p. 5.]

200. Interview with DOE official, August 1997.

201. *Ibid.*

202. Hibbs, "Gosatomnadzor Warned U.S.," *op cit.*

203. "MPC&A Program Strategic Plan," *op cit.*, p. 17.

204. Center for Nonproliferation Studies discussion with MEPhI scientist, September 1997.

205. "MPC&A Program Strategic Plan," *op cit.*, p. 17.

206. *Ibid.*

207. Center for Nonproliferation Studies discussion with MEPhI scientist, September 1997.

208. Volodin and Olascoaga, "Cooperation on Nuclear Material Protection," *op cit.*, pp. G-G 6, 8.

209. Center for Nonproliferation Studies correspondence with Professor V. Khromov, Moscow Engineering and Physics Department, Spring 1997.

210. "Russia: Research, Power, Waste," August 1997, *op cit*.

211. *Ibid.*

212. Center for Nonproliferation Studies interview with Russian nuclear official, August 1997.

213. Mladineo, "US Government-Government Cooperation," *op cit.*, p. GG-2.

214. Sheely, unclassified fax, *op cit.*

215. "Russia: Fissile Material: Uranium Processing," NIS Nuclear Profiles Database, Center for Nonproliferation Studies Monterey Institute of International Studies August 1997.

216. "MPC&A Program Strategic Plan," *op cit.*, p. 17; and Center for Nonproliferation Studies interview with DOE official, March 14, 1996.

217. "Rossiya Sozdayet Vertikalnuyu Sistemu Upravleniya Proizvodstvom Yadernogo Topliva," *Interfax*, July 1, 1996.

218. Center for Nonproliferation Studies interview with Russian nuclear official, August 1997.

219. "U.S./Russian Joint Commission on Economic and Technological Cooperation: Report of the Energy Policy Committee – Nuclear," *op cit.*

220. "Russia: Nuclear Weapons Facilities," August 1997, *op cit*.

221. Mark Hibbs, "Physical Protection Reportedly Eroding at Minatom’s 10 ‘Closed Cities’ in Russia," *Nuclear Fuel*, January 2, 1995, pp. 13-14.

222. "MPC&A Program Strategic Plan," *op cit.*, pp. 16-19.

223. "Russia: Research, Power, Waste," August 1997, *op cit*.

224. *Ibid.*

225. Mladineo, "US Government-Government Cooperation," *op cit.*, p. GG-2.

226. Sheely, unclassified fax, *op cit.*

227. Center for Nonproliferation Studies interview with Russian nuclear official, August 1997.

228. "List of Research Reactors, Critical Assemblies and Subcritical Assemblies Supervised by Gosatomnadzor," July 1992; in "Russia: Research, Power, Waste," August 1997, *op cit*.

229. Center for Nonproliferation Studies interview with Russian nuclear official, August 1997.

230. Mladineo, "US Government-Government Cooperation," *op cit.*, p. GG-2.

231. Sheely, unclassified fax, *op cit.*

232. Mladineo, "US Government-Government Cooperation," *op cit.*, p. GG-2.

233. "Russia: Research, Power, Waste," August 1997, *op cit*.

234. Volodin and Olascoaga, "Cooperation on Nuclear Material Protection," *op cit.*, pp. GG 7-8.

235. "MPC&A Program Strategic Plan," *op cit.*, p. 16.

236. "Uralskiy Elektrokhimicheskiy Krupniy Plan," *Atompressa*, #16, April 1997, pp. 2-3.

237. *Ibid.*

238. Center for Nonproliferation Studies interview with U.S. administration official, December 18, 1995.

239. "Update on MPC&A Developments Since June 1996," *op cit.*

240. Center for Nonproliferation Studies discussion with DOE official, January 1998; and Bukharin, "Security of Fissile Materials in Russia," *op cit.*, p. 476.

241. Under the U.S.–Russian HEU Agreement, signed on February 18, 1993, the United States agreed to purchase 500 tons of HEU from dismantled warheads over a 20 year period. Under the agreement, the fuel is to be blended down to LEU in Russia, for eventual use as nuclear fuel, before it is shipped to the United States. The agreement was designed as a nonproliferation measure to reduce the threat of diversion of HEU from Russian stockpiles. [See Lara Kroop, "Background Report: U.S.–Russian HEU Agreement," *op cit*.]

242. "U.S./Russian Joint Commission on Economic and Technological Cooperation: Report of the Energy Policy Committee – Nuclear," February 1997, *op cit.*

243. Mullen, paper presented at the INMM meeting, July 28-31, 1996, Naples, Florida, *op cit*.

244. "MPC&A Program Strategic Plan," *op cit.*, p. 19.

245. Thomas B. Cochran, Robert S. Norris, and Oleg Bukharin, *Making the Russian Bomb: From Stalin to Yeltsin* (Boulder, CO: Westview Press, 1995), p. 49.

246. *Megaoplis-Ekspress*, July 22, 1992, p. 12.

247. Bukharin, "Security of Fissile Materials in Russia," *op cit.*, p. 476.

248. "MPC&A Program Strategic Plan," *op cit.*, pp. 16-19.

249. Proposed site of a fissile material storage center. Japan has indicated that it may provide a portion of the financing for this project.

250. "Update on MPC&A Developments Since June 1996," U.S. Department of Energy Fact Sheet, April 1997.

251. *Ibid.*

252. The Ivan-1 and Ivan-2 reactors were shut down in 1990, and the ADE-3 was shut down in 1992. "Russia: Fissile Material Production," August 1997, *op cit.*

253. The Agreement Concerning the Shutdown of Plutonium Production Reactors and Cessation of the Use of Newly Produced Plutonium for Nuclear Weapons, an intergovernmental agreement signed by U.S. Vice President Albert Gore and Russian Prime Minister Viktor Chernomyrdin on June 23, 1994, had obligated the Russian Federation to stop producing weapons-grade plutonium by shutting down the plutonium producing reactors still operating in Krasnoyarsk and in Tomsk by the year 2000. In addition, the agreement stipulated

that Russia would not use any plutonium produced by the production reactors in nuclear weapons after the agreement entered into force. [See "Vice President's Statement to the Press at the Signing Ceremony with Russian Prime Minister Chernomyrdin," Office of the Vice President, June 23, 1994. See also Bukharin, "Security of Fissile Materials in Russia," *op cit.*, p. 473.]

254. According to a report issued by the Gore-Chernomyrdin Commission in February 1997, the United States and Russia agreed that the goal of the original 1994 agreement could be reached by converting the cores of plutonium production reactors so that they no longer produce weapons-grade plutonium. On September 23, 1997, this agreement was formalized when the U.S. and Russia signed the "U.S.–Russian Plutonium Production Reactor Agreement." ["U.S./Russian Joint Commission on Economic and Technological Cooperation: Report of the Energy Policy Committee – Nuclear," February 1997, at http://www.eia.doe.gov/gorec/newdrft.html and "U.S. Commitment to the Treaty on the Non-Proliferation of Nuclear Weapons," U.S. Arms Control and Disarmament Agent Fact Sheet, October 15, 1997.]

255. "Russia: Fissile Material Production," August 1997, *op cit.*

256. Bukharin, "The Future of Russia's Plutonium Cities," *op cit.*, p. 145.

257. The other site is Chelyabinsk-65. Bukharin, "Security of Fissile Materials in Russia," *op cit.*, p. 475.

258. "Plutonium and Enriched Uranium Storage Tomsk-7," *Yaderniy Kontrol*, February 1995, pp. 2-5.

259. "Russia: Fissile Material Production," August 1997, *op cit.*,.

260. Bukharin, "The Future of Russia's Plutonium Cities," *op cit.*, p. 132.

261. The laboratories involved are Brookhaven, Lawrence Livermore, Los Alamos, Oak Ridge, Pacific Northwest, and Sandia National Laboratories.

262. Jon Kreykes *et al.*, "US/Russian Cooperative Efforts To Enhance Nuclear Material Protection, Control, and Accountability at the Siberian Chemical Combine at Tomsk-7," *United States/Former Soviet Union: Program of Cooperation on Nuclear Material Protection, Control and Accounting*, December 1996, pp. LL 43-46.

263. "Update on MPC&A Developments Since June 1996," *op cit.*

264. Sheely, unclassified fax, *op cit.*

265. "MPC&A Program Strategic Plan," *op cit.*, p. 17.

266. "Russia: Research, Power, Waste," August 1997, *op cit.*

267. According to a Russian nuclear official, one fresh fuel assembly containing approximately one kg of HEU was discovered missing by the Tomsk Polytechnical University in mid-1995. Both the facility and Gosatomnadzor, as well as two independent commissions, conducted investigations into the incident. The facility investigation determined that the assembly may have been accidentally shipped to Tomsk-7 with a shipment of spent fuel in late 1994 or early 1995. When Gosatomnadzor officials went to Tomsk-7 to try and determine if that was indeed what had happened, they were advised that a single fresh fuel assembly would be impossible to find at Tomsk-7. As there was little interest in conducting a more complete investigation, the case was closed. [Center for Nonproliferation Studies interview with Russian nuclear official, August 1997.]

268. Volodin and Olascoaga, "Cooperation on Nuclear Material Protection," *op cit.*, pp. GG 7-8.

269. "Russia: Nuclear Weapons Facilities," August 1997, *op cit.*

270. Cochran et al., *Making the Russian Bomb: From Stalin to Yeltsin, op. cit.*, p. 50.

271. "MPC&A Program Strategic Plan," *op cit.*, p. 16.

272. Lastochkin, "Bonification of the Ozersk," *op cit.*, p. 7.

273. "MPC&A Program Strategic Plan," *op cit.*, pp. 16-19.

274. Center for Nonproliferation Studies interview with Russian nuclear official, August 1997.

275. Vladimir Sukhoruchkin et al., "United States–Russian Laboratory-to-Laboratory Cooperation On Protection, Control, and Accounting for Naval Nuclear Materials," presented at the 37th annual meeting of the Institute of Nuclear Materials Management, July 28-31, 1996, Naples, Florida.

276. Atomflot is the service base for Russian nuclear-powered, civilian vessels (seven icebreakers and one nuclear-powered container ship). Each icebreaker is powered by pressurized-water KLT-40 type reactors with 241 to 274 fuel assemblies each. Most of the reactors use 30-40% enriched HEU fuel. ["Murmansk Shipping Company," Bellona Fact Sheet No. 5, November 14, 1996.]

277. Center for Nonproliferation Studies interview with Russian nuclear official, August 1997.

278. There are six naval shipyards which service submarines in Northern Fleet: Sevmash; Zvezdochka, also located in Severodvinsk, Arkhangelsk; Nerpa Shipyard No. 85, located north of Murmansk on Olenya Bay; Shkval Shipyard No. 10, located near Polyarniy, north of Murmansk; Safonovo Shipyard No. 82, located near Severomorsk, east of Murmansk; and Sevmorput Shipyard No. 35, located in the Rosta district of Murmansk. (Shkval, Safanovo, and Sevmorput are under the auspices of the Ministry of Defense, and Sevmash, Zvezdochka, and Nerpa had been under the auspices of the State Committee for Defense Industries, but are now technically under the auspices of the Ministry of Economy.) Most of these sites are now involved in submarine decommissioning. ["Naval Repair Yards, Current Status," April 1997, Bellona Web Site, http://www.ngo.grida.no/ngo/bellona/ehome/russia/index.htm.] It is possible that fresh fuel is located at all six of these shipyards.

279. Center for Nonproliferation Studies interview with Russian nuclear official, August 1997.

280. Thomas Nilsen, Igor Kudrik, and Alexander Nikitin, "The Russian Northern Fleet Naval Yards," (Chapter 5), *The Northern Fleet*, Bellona Report, Bellona Web Site, http://www.ngo.grida.no/ngo/bellona/ehome/russia/index.htm. See also endnote No. 238. For more on the theft of nuclear material from this site, please see Table II-B.

281. There are five Naval Bases for the Northern Fleet: Zapadnaya Litsa, Vidyaevo, Gadzhievo, Severomorsk, and Gremikha. It is possible that fresh naval fuel is stored at all of these sites. [Thomas Nilson, Igor Kudrik, and Alexander Nikitin, "The Russian Northern Fleet: Radioactive Waste at the Naval Bases," (Chapter 4), *The Northern Fleet*, Bellona Report, Bellona Web Site, http://www.ngo.grida.no/ngo/bellona/ehome/russia/index.htm.]

282. Please see Table II-B for details regarding this theft.

283. Center for Nonproliferation Studies interview with DOE official, July 1997.

284. Center for Nonproliferation Studies interview with DOE official, October 1997.

285. Center for Nonproliferation Studies discussion with Department of Energy official, January 1998.

286. "MPC&A Program Strategic Plan," *op cit.*, p. 16.

287. Sukhoruchkin, paper presented at the INMM meeting, July 28-31, 1996, Naples, Florida, *op cit.*

288. Center for Nonproliferation Studies interview with Russian official, July 1997.

289. Joshua Handler, "Russia Pacific Fleet: Submarine Bases and Facilities," *Jane's Intelligence Review*, April 1994, pp. 169-170.

290. Joshua Handler, Greenpeace Trip Report, October 27, 1994, p. 6.

291. Georgi Kostev, *Nuclear Safety Challenges in the Operation and Dismantlement of Russian Nuclear Submarines*, (Moscow: Committee for Critical Technologies and Non-Proliferation, 1997), Chapter IV ("Naval Ships [sic] Dismantlement: General Issues and Specific Problems with Regard to Nuclear-Powered Submarines"), pp. 76-104.

292. Center for Nonproliferation Studies discussion with DOE official, January 1998.

293. "MPC&A Program Strategic Plan," *op cit.*, p. 16.

294. Center for Nonproliferation Studies discussion with DOE official, October 1997.

295. Murakami, "IAEA Safeguards," *op cit.*, p. 4.

296. I.M. Vishnevsky and V. I. Gavriliuk, "Cooperative Efforts To Improve Accounting, Control, and Physical Protection of Nuclear Material at the Institute for Nuclear Research Scientific Center of the National Academy of Sciences of Ukraine and the State Atomic Energy Commission of Ukraine," *United States/Former Soviet Union: Program of Cooperation on Nuclear Material Protection, Control and Accounting*, December 1996, p. NIS-47.

297. *Ibid.*, p. NIS-48.

298. "A Report on the Partnership for Nuclear Security," U.S. Department of Energy, October 1995, p. 19.

299. Correspondence with Ukrainian nuclear official, January 1998.

300. Center for Nonproliferation Studies discussions with Ukrainian specialists.

301. IAEA safeguards inspections have occurred regularly at KhPTI since February 1995. The configuration of material at this site requires that inspections take place on a monthly basis. See V.F. Zelensky and V. A. Mikhailov, "Cooperative Efforts To Improve Nuclear Material Accounting, Control, and Physical Protection at the National Science Center Kharkiv Institute of Physics and Technology," *United States/Former Soviet Union: Program of Cooperation on Nuclear Material Protection, Control and Accounting*,

December 1996, p. NIS-2.

302. Correspondence with Ukrainian nuclear official, January 1998.

303. Zelensky and Mikhailov, "Cooperative Efforts to Improve Nuclear Material Accounting," *op cit.*, p. NIS-3.

304. *Ibid.*

305. Jessica Stern, "Nunn-Lugar Activities to Improve Fissile Material Protection, Control, and Accountability in the Former Soviet Union," in John Shields and William Potter, eds., *op cit.*

306. Correspondence with Ukrainian nuclear official, January 1998.

307. This reactor was used previously to train Soviet sailors to operate nuclear submarines. As Ukraine no longer has need of such a training facility, the reactor will be licensed as a scientific research and training reactor. It will be used to train reactor operators for Ukraine's five nuclear power facilities. Emily Ewell, "Trip Report: Uzbekistan, Kazakhstan, Ukraine," June 1995; and correspondence with Ukrainian nuclear official, January 1998.

308. U.S. General Accounting Office, *Nuclear Safety: Concerns in the Former Soviet Union*, *op cit.*, pp. 23-25.

309. Correspondence with Ukrainian nuclear official, January 1998; Emily Ewell, "Trip Report: Uzbekistan, Kazakhstan, and Ukraine," June 1995; and "Ukraine: Research Facilities," NIS Nuclear Profiles Database, Center for Nonproliferation Studies Monterey Institute of International Studies August 1997.

310. Correspondence with Ukrainian nuclear official, January 1998.

311. Andrey Glukhov, Project Manager, Batelle PNL, Statement before the Senate Subcommittee on Governmental Affairs, March 13, 1996.

312. Correspondence with Ukrainian nuclear official, January 1998.

313. "A Report on the Partnership for Nuclear Security," U.S. Department of Energy, October 1995, p. 19.

314. "MPC&A Program Strategic Plan," *op cit.*, p. 17.

Table I-F Status of Disarmament Assistance and Threat Reduction Programs

1. U.S. Department of Defense Cooperative Threat Reduction and Department of Energy MPC&A Programs

The U.S. Congress initiated the Cooperative Threat Reduction (CTR), or "Nunn-Lugar,"[1] program in Fiscal Year 1992 (FY92) to provide material assistance to Belarus, Kazakhstan, Russia, and Ukraine with the goals of denuclearization, demilitarization, and reducing the threat of weapons and fissile material proliferation. The CTR program has focused primarily on strategic offensive arms and weapons of mass destruction (WMD) infrastructure elimination; nuclear weapons protection, control and accounting; and chemical weapons destruction. The material protection, control, and accounting (MPC&A) program was initially funded by the Department of Defense (DOD) and managed by the Department of Energy (DOE). Beginning in FY96, however, DOE assumed funding responsibility for all future MPC&A activities through a separate and growing budget authority. The Department of Defense continues to administer FY92-95 CTR funds for export control assistance, which should be exhausted by the end of 1998. As of FY96, however, funding responsibility for these programs shifted to the Department of State under the Non-Proliferation and Disarmament Fund.

Cooperative Threat Reduction. CTR program funds directly support activities to destroy weapons of mass destruction; to transport, store, disable, and safeguard weapons and the fissile components of nuclear weapons in connection with their destruction; and to establish verifiable safeguards against the proliferation of such weapons. Examples of CTR activities include deactivation and dismantlement of ICBMs, SLBMs, and strategic bombers in the Newly Independent States (NIS); supporting individual defense and military contacts and exchanges with the NIS; providing equipment for dismantlement assistance; strengthening defense and military cooperation ties; and assisting with the conversion of defense industries to commercial enterprises.

Broadly speaking, DOD's CTR activities funded during FY95-FY96 concentrated on the dismantling and securing of nuclear weapons in Belarus, Kazakhstan, Russia, and Ukraine. By the end of 1996, the last nuclear weapons in Belarus, Kazakhstan, and Ukraine had been transferred to Russia. Remaining FY96 funding for Kazakhstan and Belarus will be used in projects aimed at dismantling other WMD infrastructure, such as missile launch pads, liquid rocket fuel, and heavy bombers. Although Ukraine no longer has nuclear weapons, it still maintains ballistic missiles and launch capabilities. The CTR program has requested continued funding through FY99 for the dismantling of these missiles and related infrastructure.

The curtailment of human rights and freedom of speech by Belarusian President Aleksandr Lukashenko led President Clinton to revoke CTR certification for Belarus in March 1997. CTR projects for which funds had been obligated before the decertification will be completed, but funding in excess of $25 million for agreed projects has been frozen. This funding would have contributed to the continued dismantling of the strategic offensive weapons infrastructure and other projects in Belarus. (All nuclear weapons have been returned to Russia.)

DOD also began discussions on potential CTR projects with Georgia, Moldova, and Uzbekistan. Although none of these states had nuclear weapons on its territory at the time of the dissolution of the Soviet Union, Georgia and Uzbekistan possess small quantities of weapons-grade HEU, and all three of these states would profit from improved non-proliferation export controls. The umbrella agreement signed with Georgia in July 1997 will allow for an Export Control Implementing Agreement to be signed, under which the CTR program will provide 2 patrol boats in 1998 to the Georgian Border Guard to assist them in controlling their maritime borders. In October 1997 the United States purchased 21 MiG-29 aircraft from Moldova using CTR funds rumored at $40 million plus military equipment; the aircraft, 14 of which are nuclear-capable aircraft, were potentially bound for Iran, but are now in the possession of the U.S. Air Force.[2] No projects beyond military and defense contacts have been specified for Uzbekistan.

As some projects have been completed or shifted to other agencies, DOD has consolidated its funding to several core CTR programs listed in the annual appropriations chart below. The progression of funding from FY94-98 indicates a gradual shift in program priorities. For example, DOD will provide over $100 million in FY97-98 to help Russia build a chemical destruction facility at Shchuche to launch its effort to eliminate some 40,000 metric tons of stockpiled chemical weapons as required by the Chemical Weapons Convention.[3] In addition, continued funding for fissile material storage and fissile material containers will be used for the Mayak storage facility construction project.

Several of the originally funded CTR projects have been finished or are nearing completion. Projects for emergency response training and equipment in the NIS that totaled $30 million in notified funding were largely completed in FY96, as was the Arctic nuclear waste project in Russia. Projects associated with security enhancements for weapons transportation, such as armored blankets and rail car upgrades, have mostly been completed as the emphasis has shifted from transportation to storage and dismantlement. Physical security upgrades, guard force training, and computer tracking systems will be provided as part of the dismantlement effort.

Included in the FY97 Defense Authorization Act was a measure called the Defense Against Weapons of Mass Destruction Act, also known as the "Nunn-Lugar-Domenici" program after its Senate sponsors. This act appropriated an additional $116.4 million for projects beyond the scope of the original CTR programs that focus on domestic and international terrorism prevention, preparedness, and response. Of this funding, $23 million was allocated for traditional CTR projects on reactor core conversion, dismantlement of chemical and biological weapons production facilities, and increased military-to-military contacts. The core conversion project, which will halt the production of weapons-grade plutonium at Seversk (Tomsk-7) and Zheleznogorsk (Krasnoyarsk-26), while still allowing the use of these reactors for heat and electricity, is currently being implemented. (See Table I-D for details on core conversion.)

Material Protection, Control, and Accounting. Activities to enhance fissile material protection, control, and accounting have been gradually shifted to the Department of Energy, which operates under separate budget authority from the DOD CTR program. The DOE program initially included a "government-to-government" component and a "lab-to-lab" component. Although these two components were originally administered separately, DOE consolidated them into a unified program in February 1997.

Cooperative efforts between the United States, Russia, the other NIS countries, and the Baltic nations are aimed at improving the security of approximately 650 metric tons of highly enriched uranium and plutonium that is in non-weapon forms, such as oxides and metals. The sectors targeted by DOE for MPC&A programs are as follows: Russian defense related sites, including uranium and plutonium cities, nuclear weapons complex sites, and maritime fuel sites; Russian civil and regulatory sites, including large fuel facilities, reactor-type facilities, national regulatory agencies, and training centers; and NIS and Baltic civilian nuclear facilities.[4] (Individual projects are detailed in Table I-E.)

In 1997, many new facilities, including the Russian Research Institute of Instruments at Lytkarino and all the sites associated with the Russian Navy, were added to the MPC&A program. By the end of 1997, DOE had cooperative MPC&A projects underway at all facilities in the NIS known to contain fissile material.

The expenditures for MPC&A projects, listed below, show that DOE now has complete funding responsibility for MPC&A programs. In addition to DOE budget appropriations, funding for MPC&A was appropriated for DOE activities under the Defense Against Weapons of Mass Destruction Act. These funds are for MPC&A and dismantlement verification projects, as well as for projects on smuggling and plutonium disposition.

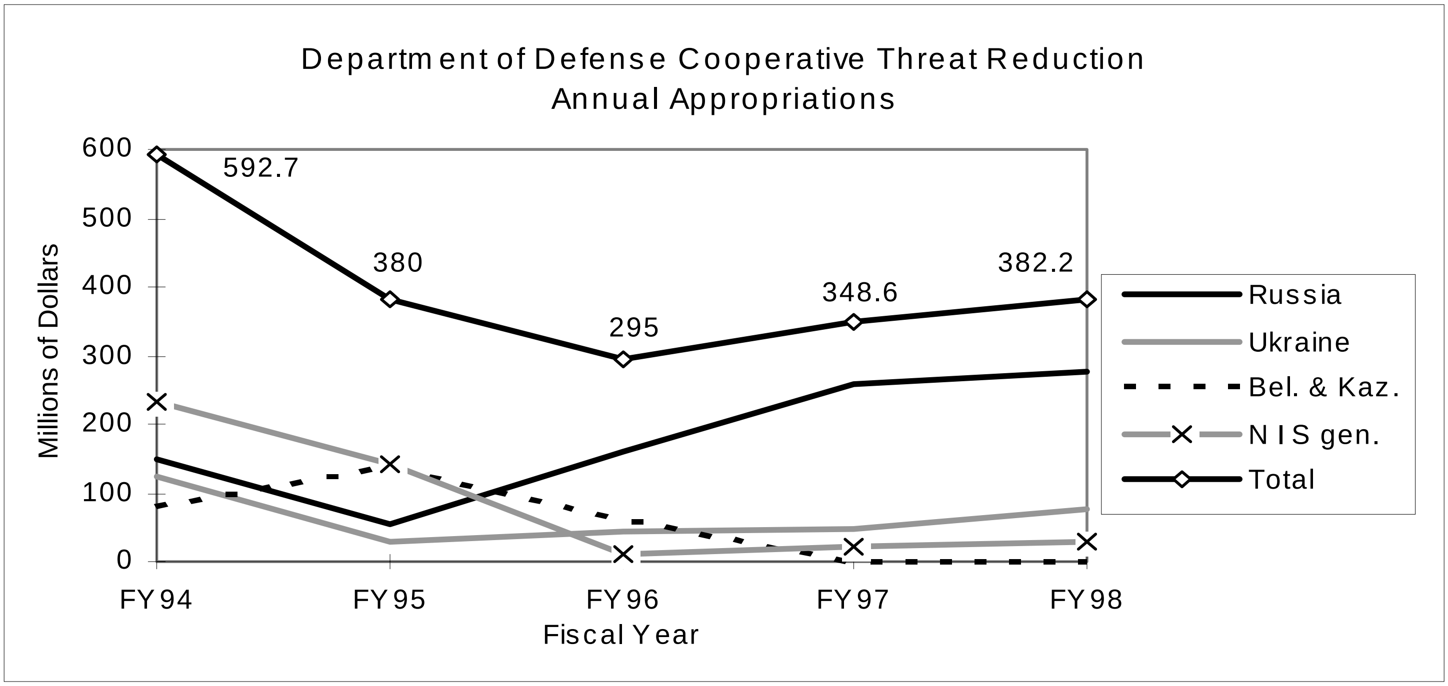


Chart Notes: Figures based on CTR appropriations shown in the chart below. Decreases in the total appropriations from FY94 to FY95 are due in part to the transfer of the Materials Protection, Control, and Accounting program to the Department of Energy, which is now responsible for both the funding and management of that program.

Table I-F Status of Disarmament Assistance Programs

Department of Defense Cooperative Threat Reduction Program - Annual Appropriations

(Figures are in millions of dollars)

Country	Project	FY94	FY95	FY96	FY97	FY98
Russia	**Strategic Offensive Arms Elimination**: Elimination of nuclear delivery vehicles and infrastructure such as heavy bombers, SLBMs, ICBMs, solid rocket motors, and propellant.	$51.3	$32.0	$74.0	$59.8	$77.9
	Chemical Weapons Destruction: Creation of a chemical weapons destruction facility at Shchuche and provision of three mobile chemical weapons destruction labs.	$34.3	$18.2	$13.0	$70.7	$35.4
	Fissile Material Storage: Design and construction of a facility at Mayak to store 50,000 containers of fissile material from dismantled nuclear weapons.	$55.0		$29.0	$66.0	$57.7
	Fissile Material Containers: Provision of containers for transport and storage of fissile materials from dismantled weapons.	$7.7			$38.5	$7.0
	Reactor Core Conversion: **See Table I-D for details.**				$10.0*	$41.0
	Weapons Storage Security: Computer hardware and training for the Ministry of Defense to enhance storage security of nuclear weapons awaiting destruction.		$5.0	$42.5	$15.0	$36.0
Ukraine	**Strategic Nuclear Arms Elimination:** Elimination of SS-19 and SS-24 missiles and silos, and storage of rocket fuel.	$124.8	$30.0	$43.1	$47.0	$76.7
Belarus & Kazakhstan	Strategic Offensive Arms Elimination, Export Controls, Environmental Restoration, and WMD Infrastructure Elimination, for example.	$79.4	$137.4	$62.9		
NIS - General	**Defense and Military Contacts:** Promote better understanding and cooperation between U.S. and NIS military establishments through visits, meetings, and exchanges.	$13.6	$8.0	$10.0	$12.0*	$10.0
	Dismantlement of Biological and Chemical Weapons Production Facilities.				$9.0*	$20.0
	Prior Year and Completed Projects: Arctic nuclear waste disposal, armored blanket provision, and communications links, for example.	$217.6	$133.0			
TOTAL CTR		$592.7	$380.0	$295.0	$348.6	$382.2

Chart Notes: Data represents actual appropriations from Congress for FY94-98. Data is from DOD Budget Submission and CTR Appropriations summaries.

* Indicates funding from the Defense Against Weapons of Mass Destruction Act.

Table I-F Status of Disarmament Assistance Programs

Cooperative Threat Reduction - Cumulative Notifications to Congress
(Figures are in millions of dollars)

COUNTRY	STRATEGIC OFFENSIVE ARMS ELIMINATION	FISSILE MATERIAL PROTECTION	MILITARY REDUCTIONS AND REFORM
Belarus	$56 for destruction of SS-25 launchers and rocket fuel, and nuclear infrastructure elimination.	$27 for initial MPC&A, emergency response training and equipment, and export controls.	$34 for defense conversion and military contacts; includes $5 for ISTC projects.
Kazakhstan	$104 for destruction of SS-18 ICBMs and silos, heavy bombers, and a biological weapons facility.	$35 for Project Sapphire,[5] initial MPC&A, export controls, and emergency response training and equipment.	$33 for defense conversion and military contacts; includes $9 for ISTC projects.
Russia	$296 for ICBM, SLBM, heavy bomber, and rocket fuel elimination; an additional $139 for chemical weapons storage and destruction of a CW production facility.	material $402 for the Mayak fissile storage facility project, initial MPC&A, plutonium production elimination, export controls, and emergency response training and equipment.	$108 for defense conversion and military contacts; includes $35 for ISTC projects.
Ukraine	$318 for elimination of SS-24s, SS-19s, launch facilities, heavy bombers, and rocket fuel.	$50 for initial MPC&A, emergency response training and equipment, and export controls.	$78 for defense conversion, military contacts, and STCU projects.

Chart Notes: In order to disburse CTR funds for specific weapons destruction, demilitarization, and other cooperative projects in a former Soviet republic (such as SLBM dismantlement, defense industrial conversion, or chemical weapons destruction), a series of milestones must be achieved. First, that state must sign an “umbrella” agreement with the United States to set out legally the privileges and immunities for U.S. personnel working on projects there and to establish the legal and customs framework for the provision of aid. Then, for each individual project the following steps are taken:

1) DOD first ***notifies*** Congress of its intention to fund a specific project and the amount it intends to spend; this notification is required by the CTR enabling legislation;

2) DOD and the recipient nation enter consultations on the technical details of a particular CTR project and ***agree*** to a maximum amount of support that will be provided for that project;

3) Funds are set aside, or ***obligated***, for each project by DOD; these funds include contractor fees, equipment costs, and transfers to other U.S. CTR participant agencies, such as DOE and the Army Corps of Engineers; and finally,

4) Funds are ***disbursed*** to contractors to provide materials, equipment, and technical support for specific CTR projects.

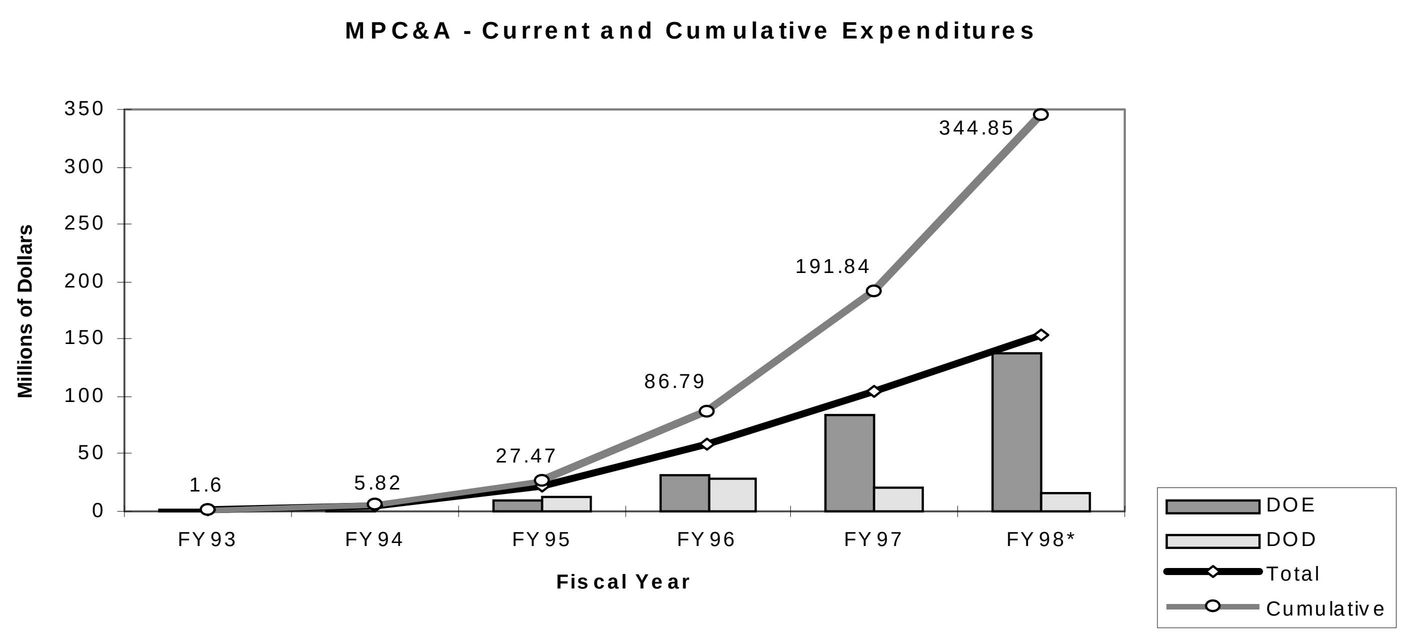
The notifications made to Congress for the broad categories of activities listed in the chart give a more accurate picture of the amount actually spent on projects, whereas the amount appropriated tends to be significantly larger due to CTR program administration costs. Information for this chart was generated from “Cooperative Threat Reduction,” U.S. Department of Defense, August 1997.

Department of Energy Materials Protection, Control, and Accounting
Actual Expenditures by Fiscal Year

(Figures are in millions of dollars)

Country	FY93	FY94	FY95	FY96	FY97	FY98 budget	TOTAL
NIS Total	$1.6 ($1.6 - DOE)	$4.22 ($4.15 - DOE) ($.07 - DOD)	$21.65 ($9.13 - DOE) ($12.52 - DOD)	$59.32 ($31.37 - DOE) ($27.95 - DOD)	$105.05 ($83.83 - DOE) ($21.22 - DOD)	$137.01 all DOE	$328.85 ($267.09 - DOE) ($61.76 - DOD)
Russia	$1.6 ($1.6 - DOE)	$4.08 ($4.01 - DOE) ($.07 - DOD)	$16.92 ($7.28 - DOE) ($9.64 - DOD)	$44.71 ($24.91 - DOE) ($19.80 - DOD)	$87.48 ($78.10 - DOE) ($9.38 - DOD)	$133.61	$288.40 ($249.51 - DOE) ($38.89 - DOD)
Kazakhstan	$0	$.06 ($.06 - DOE)	$1.47 ($1.11 - DOE) ($.36 - DOD)	$7.35 ($4.97 - DOE) ($2.38 - DOD)	$11.62 ($5.20 - DOE) ($6.42 - DOD)	$2.47	$22.97 ($13.81 - DOE) ($9.16 - DOD)
Ukraine	$0	$.08 ($.08 - DOE)	$2.8 ($.28 - DOE) ($2.52 - DOD)	$4.62 ($.36 - DOE) ($4.26 - DOD)	$4.49 ($.11 - DOE) ($4.38 - DOD)	$.50	$12.49 ($1.33 - DOE) ($11.16 - DOD)
Belarus	$0	$0	$.23 ($.23 - DOE)	$1.67 ($.16 - DOE) ($1.51 - DOD)	$1.08 ($.04 - DOE) ($1.04 - DOD)	$.19	$3.17 ($.62 - DOE) ($2.55 - DOD)
Georgia and Uzbekistan	$0	$0	$.23 ($.23 - DOE)	$.97 ($.97 - DOE)	$.38 ($.38 - DOE)	$.24	$1.82 ($1.82 - DOE)

Chart Notes: Data is from a DOE Material Protection Control and Accountability Program Summary, January 23, 1998. DOD figures for Russia do not include CTR funds for the Mayak storage facility construction project that is detailed in the CTR core appropriations chart above.



* Congress appropriated $137 million for MPC&A in FY98, which will be divided up among projects in the NIS at a later date; no new DOD CTR funds were requested for MPC&A projects in FY98, but DOE expects that approximately $16 million in CTR funding obligated for MPC&A in previous fiscal years will be spent, primarily on projects in Kazakhstan and Ukraine.

Table I-F Status of Disarmament Assistance Programs

2. Initiatives for Proliferation Prevention (IPP)[6]

The Newly Independent States Initiatives for Proliferation Prevention (NIS-IPP), formerly the Industrial Partnering Program, was established in June 1994 to redirect the activities of NIS weapon scientists and engineers into projects with non-military applications that have commercial value and are of mutual benefit to both the United States and the Newly Independent States. The IPP program is managed and funded by the U.S. Department of Energy (DOE).

The projects consist of three phases. The “Thrust I” phase is designed to coordinate lab-to-lab contacts through an Inter-Laboratory Board (ILAB), comprised of the ten DOE National Laboratories. ILAB helps to identify and evaluate technologies at NIS facilities that may have commercial applications and potential.

The “Thrust II” phase involves the participation of members of the United States Industry Coalition (USIC, a group of more than 80 companies, universities, and consortia) in efforts to begin commercialization of the technologies selected during the Thrust I phase. The Department of Energy tries to concentrate IPP resources into Thrust II activities as USIC member-companies match DOE funding on a more than 1-to-1 basis. USIC also includes academic institutions in its membership that provide management training and assistance to participants’ IPP projects.

In addition, IPP may incorporate a third and longer-range phase to the program, in which private investment funds would finance the full commercialization of the technologies; this phase has not yet begun.

IPP initially received $35 million through the FY94 Foreign Operations Appropriations Act which carried over to fund 193 initial projects in FY95. These projects involved more than 60 NIS institutes and 2,000 scientists, engineers, and technicians in WMD-related fields. Of the original Thrust I projects, 82% were in Russia, 11% in Ukraine, 4% in Kazakhstan, and 2% in Belarus.

In FY96, Congress appropriated $10 million (DOE originally requested $55 million[7]) for IPP, and an additional $20 million was provided by the Department of Defense Cooperative Threat Reduction program. In FY97, IPP received $30 million, which funded approximately 78 projects; an additional $30 million in FY98 will fund approximately 100 new projects. Additional CTR funding comparable to that in FY96 could increase this number by approximately 60 projects. The focus of programs for FY98 will generally shift from Thrust I to Thrust II; some new Thrust I projects will focus specifically on chemical and biological weapons facilities in the NIS.

FISCAL YEAR	PROJECT	AMOUNT OBLIGATED	PROJECTS APPROVED
FY95 Funding originated in FY94.	Thrust I: Technology identification (ILAB)	$20 million	159
	Thrust II: Cost-Sharing Partnerships (USIC)	$12 million	34
	Academic Support Element (USIC)	$3 million	
FY96	Thrust I: Technology identification (ILAB)	$6 million	40
	Thrust II: Cost-Sharing Partnerships (USIC)	$12 million	24
	Additional projects	$2 million	
FY97	Thrust I: Technology identification (ILAB)	$30 million	68
	Thrust II: Cost-Sharing Partnerships (USIC)		10
	Additional projects		
FY98	Thrust I: Technology identification (ILAB)	$30 million	60
	Thrust II: Cost-Sharing Partnerships (USIC)		40
	Additional projects		
Total		$115 million	435

3. Science and Technology Centers

The International Science and Technology Center (ISTC) is a multilateral non-proliferation program designed to deter the spread of weapons of mass destruction and missile technology expertise by providing peaceful employment opportunities to scientists and engineers in the former Soviet Union who were previously involved in work in these fields. The ISTC was founded in 1992 by the European Union (EU), Japan, the Russian Federation, and the United States. In addition to these initial parties to the agreement, Armenia, Belarus, Finland, Georgia, Kazakhstan, the Kyrgyz Republic, and Sweden also have joined the ISTC. (Since joining the European Union in 1994, Sweden and Finland have been participating through the EU.) Most recently, Norway has acceded to the ISTC as a funding party, and South Korea is finalizing its accession.

The ISTC, whose Secretariat is permanently headquartered in Moscow, has funded 450 projects for a total of approximately $145 million since its inception. Proposals are submitted to the ISTC Secretariat for review and are then approved by the ISTC Governing Board, currently chaired by Ambassador Ronald F. Lehman II, of Lawrence Livermore National Laboratory.

Thus far, ISTC projects have engaged more than 17,000 scientists and engineers and cover a wide range of non-proliferation and civilian-use science and technology research. Recent project areas include improved nuclear safety and nuclear waste management; chemical weapons destruction; treaty verification; materials protection, control, and accounting; environmental protection; and bio-medical research. In addition to the international scientific collaboration that these projects generate, the ISTC seminar program further integrates former Soviet research institutes into the global scientific community.

In order to ensure the full participation of all interested countries in the NIS, branch offices of the ISTC were established in Almaty, Kazakhstan, and Minsk, Belarus.[8] A second center, the Science and Technology Center in Ukraine (STCU), commenced operations in Kiev in July 1995. The current parties to the STCU are the United States, Canada, Sweden, Ukraine, and Uzbekistan, which finalized its accession on December 27, 1997. The European Union has announced its intention to join and should complete accession procedures by the end of 1997. Uzbekistan and Georgia have also expressed their interest in participation. The STCU Governing Board, which is chaired by Dr. John Boright of the U.S. National Academy of Sciences, has approved a total of 122 projects valued at $14.3 million and engaging more than 2200 scientists.[9]

CENTER LOCATION	FUNDING PARTIES	TOTAL CONTRIBUTION	COMMENTS
ISTC: **HQ - Moscow** **Branch Offices - Almaty, Minsk**	European Union	$50.6	The Russian Federation supports the ISTC with an in-kind contribution of a head-quarters facility and related expenses.
	Finland[10]	$1.2	
	Japan	$25.1	
	Norway[11]	$.3	
	Sweden[12]	$3.7	
	United States[13]	$62.3	
	Other Sources	$1.7	
	SUBTOTAL	**$144.9**	
STCU: **HQ - Kiev**	Canada	$2.0	Ukraine supports the STCU with and in-kind contribution of a headquarters facility and related expenses.
	Sweden	$1.5	
	United States	$14.0	
	SUBTOTAL	**$17.5**	
TOTAL		**$162.4**	

Chart Notes: Data from “Joint Statement of the 13th Governing Board of the International Science and Technology Center,” June 30 - July 1, 1997, and information provided by the U.S. Department of State, Office of Regional Nonproliferation. Figures are in millions of dollars.

Table I-F Status of Disarmament Assistance Programs

4. Other Disarmament Assistance Programs

COUNTRY[14]	DISARMAMENT ASSISTANCE TO BELARUS
Germany	Germany will assist with the destruction of rocket fuel, once the political situation there is judged to be satisfactory. In 1996, Germany provided financial assistance to Belarus for the transfer of 18 nuclear-armed SS-25 ICBMs to Russia.[15]
Japan	Since 1993, Japan has pledged $4.7 million to Belarus through the Cooperation for the Elimination of Nuclear Weapons Program.[16] Japan has provided material accounting software, measuring instruments, computer communications equipment, and a nuclear material protection system to the Sosny Institute. Japan will also provide equipment for a professional retraining center in Lida to help ex-military personnel obtain jobs in the private sector.[17] In a February 1995 Belarusian-Japanese agreement, Japan also offered equipment worth $2.5 million to set up a system for registering and controlling fissile material.[18]
Sweden	Sweden plans to assist with the maintenance and control systems associated with the Japanese-provided software and equipment at the Sosny Institute.[19]
	DISARMAMENT ASSISTANCE TO KAZAKHSTAN
Japan	Pursuant to a September 1994 agreement, Japan has supplied equipment and instituted an exchange of experts in order to establish a better control and monitoring system for nuclear materials in Kazakhstan. With the $9.36 million disbursed by a joint committee, Japan has aided in the dismantling of nuclear weapons and helped Kazakhstan meet IAEA safeguards obligations.[20] In 1996-97, Japan agreed to provide the BN-350 fast breeder reactor at Aktau with communication systems equipment and a physical protection system. Japan also plans to conduct medical surveys at the Semipalatinsk nuclear test site to assess the effects of nuclear exposure on local residents.
	DISARMAMENT ASSISTANCE TO RUSSIA
Canada	Under the auspices of the Canadian Nuclear Safety Initiative (CNS), Canada has provided aid for programs on technical assistance, technical improvements to the RBMK reactor design, safety procedures, and regulatory training. The CNS, signed in September 1994, provided $10 million for the creation of a Nuclear Safety and Engineering Program, which has allowed Canadian personnel to advise Russian counterparts at the Sosnovy Bor, Kursk, and Smolensk nuclear power plants. Canada also administers an internship program for senior officials of the Russian regulatory agencies to study nuclear safety issues at the Atomic Energy Control Board in Canada.[21]
France	Since 1994, members of the French Institute for Nuclear Protection and Safety have been working with Minatom counterparts to decrease the threat of fissile material smuggling from Russian nuclear installations.[22]
Germany	In cooperation with the United States, Germany is helping Russia to dispose of fissile material from dismantled nuclear warheads. As part of this effort, Germany will help Russia build a plant to process Russian plutonium into MOX fuel.[23] In other areas, Germany has provided emergency equipment for use in the event of a nuclear accident, and it has given about $17 million towards the multilateral project to construct a chemical weapons destruction plant.[24]
Japan	Japan has pledged about $70 million for Russian disarmament assistance. Once the Mayak storage facility is completed, Japan plans to use a portion of these funds to purchase transportation and storage containers for the site.[25] A second project is the construction of a liquid radioactive waste treatment facility in Vladivostok in hopes of preventing further Russian dumping of radioactive waste in Far East seas. A third project will send mobile treatment plants to Russia for the disposal of liquid rocket fuel from dismantled SLBMs.[26] Another project involves the provision of emergency equipment in preparation for any potential accident associated with the transport of dismantled nuclear weapons.[27]
Netherlands	In December 1996, the Netherlands announced it would provide $12.5 million between 1997 and 2002 for the elimination of Russian chemical weapons. Further assistance was also offered for the dismantling of Russian nuclear weapons systems.[28]
Norway	Norway allocated $42 million for projects in northwestern Russia on nuclear safety, radioactive waste disposal, pollution, and arms-related environmental hazards.[29]
Sweden	Sweden contributed $4 million to the ISTC. As part of a $5 million aid package, Sweden is also helping with the repatriation of Russian military personnel from Latvia.[30] Additionally, Sweden has promised a total of $450,000 in aid toward the destruction of the chemical weapons storage facility in Kambarka, the largest facility of its kind in Russia.

Table I-F Status of Disarmament Assistance Programs

COUNTRY	DISARMAMENT ASSISTANCE TO RUSSIA (cont.)
United Kingdom	The U.K. contributes about 16% of the EU's disarmament budget, including $29.9 million to the Nuclear Safety Account. British industry also has several "twinning" arrangements with nuclear power plants, estimated to cost $82,000-$164,000 per year, which involve personnel interchange and exchange of operational knowledge. The British company Magnox is also in the process of reworking a protocol with Rosenergoatom which will include the exchange of information on emergency preparedness, public relations and waste management.[31] The Department of Trade and Industry has also supported a Magnox project to provide training equipment to the Smolensk nuclear power plant training center ($410,000) and a collaboration between AEA Technology and the Russian Design Institute for Power Engineering (RBMK-Chernobyl type reactors).
European Union	The EU provides research financial aid through the TACIS Program (Technical Assistance to the Commonwealth of Independent States) and the Nuclear Safety Account (NSA). Through TACIS, the EU has coordinated "On-Site Assistance" programs at the Balakova, Smolensk, and Leningrad power plants.[32] The Nuclear Safety Account (NSA), established in 1993 and managed by the European Bank for Reconstruction and Development, signed an agreement with Russia in June 1995 worth $81.75 million. This agreement calls for safety upgrades for the Kola, Novovoronezh and Leningrad nuclear power plants and requires Russia to carry out Western-style, in-depth safety assessments for those units, and for the Kursk 1 and 2 units, before issuing longer-term operating licenses. While the deadline for the project completion has been extended to 1998, little progress has been made since the initiation of the agreement due to lack of Russian cooperation. Over the last three years, the EU has also contributed $41 million to the ISTC, has provided aid for the decommissioning of Russian nuclear submarines, and for managing and disposing of the resulting spent fuel and radioactive waste.[33]
	DISARMAMENT ASSISTANCE TO UKRAINE
Canada	In 1994, Canada allocated $15 million for the dismantlement of nuclear weapons and assistance for the civilian nuclear sector, and at the 1994 Naples Economic Summit, it pledged $34 million for the aid package to Ukraine.[34]
Germany	Since 1995, Germany has assisted Ukraine with developing techniques for missile silo elimination. Six silos have thus far been destroyed and the elimination of another six is projected by the end of 1997.
Japan	In 1996, Japan provided $6 million for two projects in Ukraine: the establishment of an MPC&A system at the Kharkiv Institute, which is on-going, and the provision of medical equipment and pharmaceutical supplies for military personnel engaged in dismantling nuclear weapons, which was completed in December 1996. At the request of the Ukrainian Defense Ministry, Japan is considering an additional shipment of medical equipment.[35] Further assistance has been provided for the decommissioning of the Chernobyl nuclear power plant.[36]
Poland	Poland pledged $10 million for the repair of the Chernobyl reactor tomb.[37]
Sweden	Sweden provided $2 million of the EU contribution to the STCU.
European Union	In September 1997, the EU approved a $93.46 million grant to rebuild the sarcophagus constructed around the damaged Chernobyl nuclear reactor in 1986. The financial aid is part of a $300 million rescue package provided by the G-7 to Ukraine.[38] At the 1994 Naples Economic Summit, the EU offered a $400 million loan to complete three partially constructed nuclear power plants that will replace Chernobyl and $100 million to finance technical assistance.[39] The EU has been providing general Chernobyl-related assistance to Ukraine since 1994.[40]
	GENERAL DISARMAMENT ASSISTANCE TO THE NIS
France	From 1992-95, France contributed $73 million for NIS disarmament programs. France also assisted with an evaluation of processing mixed-oxide fuel using fissile material from dismantled warheads.[41]
Germany	In 1996, Germany appropriated $12 million for nuclear and chemical disarmament projects in Belarus, Russia and Ukraine.[42] $8.4 million was allocated to the NIS for FY97 projects, including the joint Russo-German research program on the treatment of plutonium .[43]
Italy	Italy expects to contribute $5.6 million from 1996-98 for technical cooperation and the provision of equipment.[44]
Japan	Since 1994, Japan has provided $100 million for the destruction of nuclear weapons in the NIS.[45] In addition to bilateral disarmament aid, Japan contributed $19.28 million to the ISTC.[46]
Sweden	In general, Sweden is funding technology transfer to nuclear authorities and facilities in the NIS, including programs on export/import control.
European Union	EURATOM provided $3.4 million in assistance to the NIS in 1996.[47] In 1994, the European Commission committed $73.5 million to the Nuclear Safety Program, the largest single TACIS program, which includes design safety studies, on-site assistance (particularly in Russia and Ukraine), and assistance to safety authorities.[48]

NOTES

1. From "Cooperative Threat Reduction Program: Summary of Obligations and Disbursements by Country/Project," Department of Defense, Assistant to the Secretary of Defense (Atomic Energy), Office of Cooperative Threat Reduction, May 15, 1995; "U.S. Assistance and Related Programs for the New Independent States of the Former Soviet Union: 1994 Annual Report," Department of Defense, Office of Cooperative Threat Reduction, January 1995; "Semi-Annual Report on Program Activities to Facilitate Weapons Destruction and Nonproliferation in the Former Soviet Union," Department of Defense, Office of Cooperative Threat Reduction, October 30, 1994; "Weapons of Mass Destruction: Status of Cooperative Threat Reduction Program," U.S. General Accounting Office, Report to Congress, September 1996; "CTR - Russia," U.S. Department of Defense, Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs - Cooperative Threat Reduction, November 1996; "Cooperative Threat Reduction: Status of Defense Conversion Efforts in the Former Soviet Union," U.S. General Accounting Office, Report to the House Committee on National Security, April 1997; and “Cooperative Threat Reduction,” U.S. Department of Defense, August 1997. See also William Potter and John Shields, eds., *Dismantling the Cold War: NIS Perspectives on The Nunn-Lugar Cooperative Threat Reduction Program* (Cambridge, MA: MIT Press, 1997); and Jason Ellis and Todd Perry, "Nunn-Lugar’s Unfinished Agenda," *Arms Control Today*, October 1997, pp. 14-22.

2. See Wade Boese, "U.S. buys Moldovan Aircraft to Prevent Acquisition by Iran," *Arms Control Today*, October 1997, p. 28.

3. "Weapons of Mass Destruction: Status of Cooperative Threat Reduction Program," U.S. General Accounting Office, Report to Congress, September 1996, pp. 18-21.

4. MPC&A programs operated by DOE in the NIS outside Russia include projects at: the Sosny Institute of Nuclear Power in Belarus; the Tbilisi Institute of Physics in Georgia; the Aktau BN-350 Breeder Reactor, the Almaty Research Reactor, the Kurchatov Institute of Atomic Energy in Semipalatinsk, and the Ulba Fuel Fabrication Plant in Kazakhstan; the Salaspils Institute of Nuclear Physics in Latvia; the Ignalia Nuclear Power Plant in Lithuania.; the Kharkiv Institute of Physics and Technology, the Kiev Institute for Nuclear Research, the Sevastopol Naval Institute, and the South Ukraine Nuclear Power Plant in Ukraine; and the Institute of Nuclear Physics in Tashkent, Uzbekistan. From Office of Nonproliferation and National Security, U.S. Department of Energy, "MPC&A Program Strategic Plan," January 1998.

5. For more information on Project Sapphire, see Table I-E, note 51.

6. Information from "NIS IPP Progress Report," Office of Nonproliferation and National Security, US Department of Energy, March 7, 1996; Testimony by Joan Rohlfing before the House Committee on International Relations, June 13, 1996; Interviews with John Hnatio and Mike Lawson, IPP office, July 1997.

7. "New Independent States Industrial Partnering Program: First Quarter Report (FY1995)," Office of Defense Programs, Department of Energy, January 1995.

8. Due to the decertification of Belarus, the U.S. is not funding any new projects there, although Belarus is still party to the ISTC.

9. All ISTC and STCU data from consultations with Ann Harrington, Jim Noble, and Sharon Poulson, U.S. Department of State, Office of Regional Nonproliferation, July 1997.

10. Contributions after 1994 made as a member state of the European Union.

11. Contribution made since acceding to the ISTC in Spring 1997.

12. Contributions after 1994 made as a member state of the European Union.

13. The figures for the United States represent funds committed to the Science Centers during fiscal years 1994-1997. In FY94 and FY95, U.S. support for the Science Centers came from the Department of Defense Cooperative Threat Reduction program. In FY96 and FY97, funding was authorized under the Freedom Support Act administered by the Department of State.

14. The authors have attempted to make this list as complete as possible, but it is not necessarily a comprehensive catalog of all international assistance in this area. Much of the material for this report was provided by the Defense and Military Attaches at the relevant embassies in Washington DC. Telephone conversations with German officials took place on July 10 and September 3, 1997, with Japanese officials on August 15, 1997, Swedish officials on July 28, 1997, and British officials on July 10, 1997.

15. "Bonn to Assist Belarusian Disarmament Program," *Reuters*, June 28, 1996.

16. Takekazu Kawamura, "Japan’s Role in Dismantling Russian N-Weapons," *Plutonium*, Spring 1997, p. 7.

17. *Ibid.*

18. "Belarus: Foreign Ministry Official Tallies Achievements," *Minsk Vo Slavu Rodiny*; January 19, 1996, p. 1, translated in *FBIS-TAC-96-002*, January 19, 1996.

19. Kawamura, *op. cit.*

20. "Disarmament Assistance to Kazakhstan," *Kyodo*, September 6, 1994, translated in *JPRS-TAC-94-012-2*, September 6, 1994.

21. "Canada-Russia Nuclear Co-operation," Department of Foreign Affairs and International Trade, Canada, December 1996, http://www.dfait-maeci.gc.ca/english/geo/europe/rus-nucl.html.

22. Francois Labrouillere, "France, Russia to Cooperate in Nuclear Smuggling Prevention," *Paris Match*, September 1, 1994, p. 72, translated in *JPRS-TND-94-018*, September 1, 1994.

23. Wolfgang Pollack, "Russia to Process Plutonium Using Siemens' MOX Method," *Welt am Sonntag*, February 5, 1995, p. 7, translated in *JPRS-TEN-95-004*, February 5, 1995.

24. Anatoliy Yurkin, "Russia: General Says Financial Aid Needed To Eliminate Chemical Arms," Moscow *ITAR-TASS*, November 11, 1996, translated in *FBIS-TAC-96-010*, November 11, 1996; U.S. General Accounting Office, *Weapons of Mass Destruction*, September 1996, p. 21f.

25. Kawamura, *op. cit.*; Andrey Varlamov and Andrey Kirillov, "Japan To Help Russia Build Nuclear Storage Facilities," *ITAR-TASS*, April 20, 1996, translated in *FBIS-SOV-96-078*, April 20, 1996.

26. Kawamura, *op. cit.*, p. 6.

27. *Ibid.*, p. 6.

28. Bram Versteegt, "Netherlands: Government Offers Russia Aid for Nuclear Arms Destruction," *Algemeen Dagblad*, December 18, 1996, p. 7, translated in *FBIS-WEU-96-245*, December 18, 1996.

29. "Nuclear Safety and the Environment: Plan of Action," Norwegian Ministry of Foreign Affairs, February 1997.

30. “Government to Discuss Disposal of Russian Plutonium,” *Welt Am Sonntag*, Hamburg, June 25, 1995, p.4, translated in *FBIS-WEU*, November 8, 1995.

31. Telephone interview with Richard Griffin, British Nuclear Industries Directorate, London. January 22, 1998.

32. *TACIS Annual Report 1994*, p. 57.

33. Kawamura, *op. cit.*, p. 8.

34. *Ibid.*

35. Kawamura, *op. cit.*, p. 7.

36. "Japan Promises Help in Shutting Down Chernobyl," *Agence France Presse*, July 1, 1996.

37. "Poland Give $10 mln for Chernobyl Reactor Tomb" *Reuters*, January 25, 1998.

38. "EU To Release 100 Million Ecus for Chernobyl," *Reuters*, September 2, 1997.

39. "Canada-Russia Nuclear Co-operation," *op. cit.*

40. *TACIS Annual Report 1994*, p. 58.

41. Kawamura, *op. cit.*, p. 7.

42. "Bonn to Assist Belarusian Disarmament Program," *op. cit.*

43. Kawamura, *op. cit.*

44. *Ibid.*, pp. 7-8.

45. *Ibid.*, p. 5.

46. *Ibid.*, p. 8.

47. Hartmut Kistenfeger, "Germany: Russian Experts Warn of ‘Deficient’ Nuclear Control," *Focus*, May 5, 1997, pp. 80-82, translated in *FBIS-TAC-97-125*, May 5, 1997.

48. *TACIS Annual Report 1994*, pp. 44-45.

Part II:

Export Controls and Illicit Exports

Table II-A Status of Export Controls[1]

BELARUS	
CONTROL MECHANISM	**STATUS/COMMENTS**
Nuclear Non-Proliferation Treaty (NPT)	Belarus acceded to the NPT on July 22, 1993, as a non-nuclear-weapon state party. The treaty requires that all exports of nuclear facilities, materials, and nuclear-unique components be subject to IAEA safeguards in the recipient country.[2] At the May 1995 NPT Review and Extension Conference, Belarus was a co-sponsor of the resolution endorsing indefinite extension of the Treaty.
Nuclear Suppliers Group (NSG)	Belarus is not a member of the NSG. The Belarusian government reportedly is considering joining the NSG, but does not yet formally adhere to NSG export control guidelines.[3]
Other Pledge to Ensure Nuclear Exports Are Placed Under IAEA Inspection by Recipient	On April 14, 1995, Belarus signed a Safeguards Agreement with the IAEA in accordance with Article III of the NPT.[4] The agreement entered into force on August 2, 1995.[5]
Missile Technology Control Regime (MTCR)	Belarus is not a member of the MTCR or an adherent to MTCR standards. Belarus has shown little interest in joining the MTCR.[6]
Domestic Export Controls	The legal basis for export controls in Belarus consists of two governmental decrees and a comprehensive new Law on Export Controls, which was passed by the National Assembly (Parliament) on December 19, 1997 and signed by President Lukashenko on January 6, 1998. ***Council of Ministers Resolution No. 218*** (March 18, 1997) “On Establishing Prohibitions and Limitations on the Transference of Commodities across the Customs Border of the Republic of Belarus.” This decree includes a list of items whose export and import is forbidden, and a list of items whose export and import can be carried out only in accordance with certain procedures. The following goods are included in the list of items whose export and import can be carried out only in accordance with certain procedures: nuclear, chemical, biological, and other types of weapons of mass destruction, and their components; arms and military technology, ammunition, and explosives meant for military use; raw materials, materials, equipment, technology, and scientific and technical information that could be used to create weapons and military technology; materials, equipment, and technology that could be used to create weapons of mass destruction and their delivery vehicles; and sources of radiation, nuclear substances, and materials.[7] ***Law on Export Controls*** (January 6, 1998). This law provides a legislative basis for export controls that defines a set of general principles, basic terms, and the responsibilities of various governmental bodies in the sphere of export controls. The law provides for export controls on materials and technologies that could be used in the production of nuclear, chemical, and biological weapons; materials and technologies that could be used in the production of weapons of mass destruction; military items; dual-use items; and results of any scientific-technical work that could be used for military purposes.[8] ***Council of Ministers Resolution No. 27*** (January 10, 1998) “On Improving State Control Over the Transfer of Specific Commodities (Goods, Services) Across the Customs Border of the Republic of Belarus.” This decree introduces a unified procedure for issuing licenses for the export and import of specific commodities (goods, services).[9] In addition, according to a Belarusian policy analyst, there are seven detailed export control lists currently in effect. These lists cover: 1) nuclear weapons, materials, and technologies; 2) chemical weapons and facilities for their production; 3) biological weapons and facilities for their production; 4) missiles for delivering nuclear, chemical, or biological weapons; 5) conventional weapons; 6) raw materials, equipment, inventions, technologies, services, expertise, results of scientific research and

BELARUS (cont.)	
CONTROL MECHANISM	**STATUS/COMMENTS**
Domestic Export Controls (cont.)	design development used for weapons and military production; and 7) dual-use technologies. The lists are based on Russian control lists, and were adopted in March 1997.[10] Revised export control lists were supposed to be developed by March 10, 1998.[11] An Interdepartmental Commission on Control of Imports and Exports within the Belarusian Security Council and the Ministry of Foreign Economic Relations (MFER) are the government bodies with primary responsibility for export controls. The Interdepartmental Commission includes representatives from the MFER, the Ministry of Defense, the National Security Council, the Committee for State Security, the Ministry of Foreign Affairs, as well as the State Secretary. The MFER takes the lead in developing and implementing the policy and procedural aspects of the Belarusian export control system. [12] Under the current system, when a Belarusian company wishes to export a controlled item, it must submit a license application to the MFER. Based on consultations with other relevant ministries and agencies, the MFER may or may not issue an export license. The Interdepartmental Commission on Control of Imports and Exports is the final authority for all controversial export decisions.[13] Belarus is a party to the "Agreement on Coordination Regarding Issues of Export Control of Raw Materials, Materials, Equipment, Technology, and Services Which Could be Used in the Production of Weapons of Mass Destruction and their Delivery Systems" (Minsk Accord) of June 26, 1992, between CIS member states. According to this agreement, the parties will create national export control systems, coordinate their efforts to control exports of materials used in the production of weapons of mass destruction, and create uniform control lists based on existing international export control regimes.[14] In addition, on February 9, 1993, Belarus reached an agreement with five other CIS states to cooperate in controlling exports of raw materials, equipment, technology, and services used to produce weapons of mass destruction.[15] Like many multilateral agreements between CIS countries, however, very little has been done to implement these early attempts to coordinate CIS export control policy. The most recent meeting on CIS export control coordination took place on October 29, 1997. Representatives from CIS states discussed the importance of harmonizing national export control legislation, and proposed the creation of an export control working group under the aegis of the Council of Foreign Ministers of CIS states.[16] Belarus, Kazakhstan, and Russia signed an agreement to establish a Customs Union on January 6, 1995. The goal of the Customs Union was to harmonize their foreign economic policies, remove tariffs and duties on trade among the three countries, and to lift customs controls along their common borders.[17] (Kyrgyzstan joined this Customs Union on March 29, 1996.) In accordance with the Customs Union, Belarus and Russia announced their intention to fully integrate their Customs and Border Guards authorities. By the end of 1996 all checkpoints had been abolished along the Belarusian-Russian border. Until the legal and logistical aspects of this integration are worked out, however, the illegal transshipment of controlled items across the Belarusian-Russian border may become an issue of serious concern. In early 1997, for example, Russia reintroduced checkpoints on the Russian side of the border, claiming that transit goods were being smuggled into Russia in violation of its customs regulations.[18] However, by late 1997 the Russia-Belarus border had become fully transparent.[19]

KAZAKHSTAN	
CONTROL MECHANISM	**STATUS/COMMENTS**
Nuclear Non-Proliferation Treaty (NPT)	Kazakhstan acceded to the NPT as a non-nuclear weapon state party on February 14, 1994.[20] The treaty requires that all exports of nuclear facilities, materials, and nuclear-unique components be subject to IAEA safeguards in the recipient country. At the May 1995 NPT Review and Extension Conference, Kazakhstan co-sponsored a resolution endorsing indefinite extension of the treaty.
Nuclear Suppliers Group (NSG)	Kazakhstan is not a member of the NSG, but its export control list of nuclear materials, equipment, and technology is based on the NSG lists. Kazakhstan has expressed interest in joining the NSG.[21]
Other Pledge to Ensure Nuclear Exports are Placed Under IAEA Inspection by Recipient	On July 26, 1994, Kazakhstan signed a safeguards agreement with the IAEA, in accordance with Article III of the NPT.[22] The agreement entered into force on August 11, 1995.[23]
Missile Technology Control Regime (MTCR)	Kazakhstan is not a member of the MTCR or an adherent to its standards.
Domestic Export Controls (Nuclear)	Given Kazakhstan's well-developed nuclear industry, it is particularly important for Kazakhstan to create a strong nuclear export control system. Although the system is still evolving, Kazakhstan has taken a number of key steps towards the development of such a non-proliferation export control system. The legal basis for Kazakhstani nuclear export controls consists of a series of executive branch decrees and regulations, as well as two national laws. In fact, Kazakhstan was the first country in the former Soviet Union to pass comprehensive legislation on non-proliferation export controls. The following list represents the key legislative acts and executive decrees pertaining to nuclear export controls: ***Government Resolution No. 183*** (March 9, 1993) “On the Export and Import of Nuclear Materials, Technologies, Equipment, Facilities; Special Non-Nuclear Materials; Dual-Use Equipment, Materials, and Technologies; Radioactive Materials; and Isotope Products.” This resolution sets forth the requirements for nuclear exports and outlines the responsibilities of the Kazakhstan Atomic Energy Agency in the sphere of nuclear export control. Although this resolution was enacted before Kazakhstan officially acceded to the NPT, Article IV specifically requires that nuclear exports be carried out in accordance with the provisions of the NPT. Lists of controlled nuclear and dual-use nuclear materials, which are consistent with Nuclear Supplier's Group lists, are set forth in Appendices One and Two. The resolution requires that licenses be issued for these materials only if they will be placed under IAEA control in the importing country, if physical protection will be provided for the materials at levels not less than those recommended by the IAEA, and if the importing country agrees not to re-export the materials without the written permission from the Government of Kazakhstan.[24] ***Government Resolution No. 1037*** (June 30, 1997) “On the Export and Import of Goods (Works, Services) in the Republic of Kazakhstan.” This resolution is the seventh and final in a series of resolutions, each superseding the next, outlining the procedures for exporting controlled goods in Kazakhstan. The resolution explains the export licensing procedures, as well as includes control lists for all goods requiring either special permission from the Government and/or an export license before they can be exported. The list of goods requiring special permission from the Government includes military equipment and technologies, nuclear materials and technologies, radioactive materials, and radioactive waste. The list of goods requiring an export license includes all materials and dual-use materials that could be used in the production of a weapon of mass destruction.[25]

KAZAKHSTAN (cont.)	
CONTROL MECHANISM	**STATUS/COMMENTS**
Domestic Export Controls (Nuclear) (cont.)	***Law on the Export Control of Arms, Military Technology, and Dual-Use Products*** (7/18/96). The law provides a broad legal basis for export controls. It states that export controls in Kazakhstan are established in the interests of national and international security and in order to strengthen the non-proliferation regime. The law gives the Government of Kazakhstan the authority to create and develop an export control system, and to define the authority of other executive organs in the sphere of export controls. It broadly defines the items subject to export control, including weapons and military technology, nuclear and dual-use nuclear materials, chemical and biological agents that could be used in the creation of chemical or biological weapons, missile technologies, military scientific and technical information, as well as any other products determined by the Government of Kazakhstan. The law specifically states that nuclear exports must be placed under IAEA safeguards, as well as addresses issues of re-export and transit.[26] The first draft of the law was written during a U.S.-funded seminar on export control issues for Kazakhstani officials, held in Washington, D.C. in April 1995. A subsequent version of the law was passed by the Mazhlis (lower house of Parliament) on May 5, 1996 and by the Senate (upper house of Parliament) on June 3, 1996. The law entered into force on June 18, 1996.[27] ***Law on Use of Atomic Energy*** (April 1997). This law codified the legal basis and regulatory principles regarding the use of atomic energy in Kazakhstan. Chapter 4 specifically addresses export and import questions in two articles: Article 19 states that export and import of goods and services in the sphere of use of atomic energy is controlled by relevant state organs in accordance with the national legislation and international obligations of the Republic of Kazakhstan; Article 20 states that the procedures for exporting and importing nuclear materials, technologies, equipment and facilities, special non-nuclear materials, sources of ionizing radiation, radioactive materials, and radioactive waste is set forth in the legislation of the Republic of Kazakhstan.[28] ***Criminal Code of the Republic of Kazakhstan*** (January 1, 1998). The new criminal code provides penalties for violations of export control. Article 243 provides penalties for the illegal export of technologies, scientific and technical information, and services that could be used in the creation of weapons of mass destruction and other arms. Articles 158 and 159 define the production, proliferation, and use of weapons of mass destruction as a crime against the peace and security of mankind. Other articles provide penalties for customs violations.[29] All nuclear export decisions require the issuance of a formal resolution from the Government, after which the Ministry of Energy, Industry and Trade can issue an export license. Both of these steps can take place only with the agreement of the Kazakhstan Atomic Energy Agency. The Ministry of the Interior and the Customs Committee are responsible for preventing illegal exports.[30] Kazakhstan is a party to the “Agreement on Coordination Regarding Issues of Export Control of Raw Materials, Materials, Equipment, Technology, and Services Which Could be Used in the Production of Weapons of Mass Destruction and their Delivery Systems” (Minsk Accord) of June 26, 1992, between CIS member states. According to this agreement, the parties will create national export control systems, coordinate their efforts to control exports of materials used in the production of weapons of mass destruction, and create uniform control lists based on existing international export control regimes.[31] In addition, on February 9, 1993, Kazakhstan reached an another agreement with five other CIS states to cooperate in controlling exports relevant to manufacturing weapons of mass destruction. [32] Like many multilateral agreements between CIS countries, however, very little has been done to implement these early attempts to coordinate CIS export control policy. The most recent meeting at which CIS export control coordination was considered took place on October 29, 1997. Representatives from CIS states discussed the importance of harmonizing national export control

KAZAKHSTAN (cont.)	
CONTROL MECHANISM	**STATUS/COMMENTS**
Domestic Export Controls (Nuclear) (cont.)	legislation, and proposed the creation of an export control working group under the aegis of the Council of Foreign Ministers of CIS states.[33] One factor that has complicated efforts to control the export of sensitive technologies from former Soviet states is the reduction or elimination of border controls along internal FSU borders. On January 6, 1995, Kazakhstan, Belarus, and Russia signed an agreement to establish a Customs Union, whereby tariffs and customs controls along their common borders would be abolished. (Kyrgyzstan joined this Customs Union on March 29, 1996.) Kazakhstani ***Resolution No. 367*** and ***Resolution No. 381***, passed on September 6, 1995, and September 19, 1995, respectively, established the legal basis in Kazakhstan for the Customs Union. Russia and Kazakhstan have eliminated tariffs and trade volume restrictions, and no longer operate most major customs checkpoints along their common border.[34] However, as of early 1998, the Customs Union had not yet been fully implemented on the Russia-Kazakhstan border.[35]

RUSSIA	
CONTROL MECHANISM	**STATUS/COMMENTS**
Nuclear Non-Proliferation Treaty (NPT)	Russia is a nuclear-weapon state party to the NPT. The Treaty prohibits transferring nuclear weapons to non-nuclear-weapon states or otherwise assisting them to acquire such weapons and also requires that exports of nuclear facilities, materials, and nuclear-unique components be subject to IAEA inspections in the recipient country. At the May 1995 NPT Review and Extension Conference, Russia was a co-sponsor of the resolution endorsing indefinite extension of the Treaty.
Nuclear Suppliers Group (NSG)	Russia is a member of the NSG. The NSG requires IAEA safeguards as a condition of supply; national control laws and procedures; physical protection against theft for sensitive parts of the nuclear fuel cycle; restraint of enrichment and reprocessing plant assistance to countries of proliferation concern; common control list; export restraint to regions of conflict and instability; and information-sharing among members. Russian has adopted detailed export control lists of nuclear and dual-use nuclear-related items.[36]
Missile Technology Control Regime	Russia was formally admitted into the MTCR in October 1995.[37] The MTCR prohibits or restricts transfers of missiles, components, and related production technology with respect to missiles able to carry nuclear, chemical, or biological warheads to a distance of 300 kilometers or more. Russia has adopted a detailed export control list of missile components and technologies.
Domestic Export Controls (Nuclear)	The legal basis for export controls in Russia consists of both laws and executive branch decrees. A comprehensive Law on Export Controls was drafted by the Federal Service for Currency and Export Controls, and circulated among relevant agencies in the fall of 1997.[38] The draft law has been sharply criticized by some government agencies, including Minatom, and analysts believe this draft will have to be drastically revised before submission to the Duma for consideration and approval.[39] Despite the fact Russia does not have a specific law on export control, two federal laws were passed in late 1995 that provide a broad legal basis for Russian non-proliferation export controls: ***Federal Law No. 153-FZ*** (May 13, 1995) “On State Regulation of Foreign Trade Activity.” This law includes three articles that are relevant to export controls: Article Two of Chapter One provides a list of the specific concepts or terms underlying export controls; Article Six of Chapter Two provides for federal jurisdiction in determining policy and procedures for export control of fissionable material and raw goods, materials, equipment, technologies, scientific-technical information, and services which can be used to develop arms and military equipment or nuclear chemical and other types of weapons of mass destruction and their missile delivery systems; Article Sixteen of Chapter Four provides basic principles for export control regulations, stating that the export control system in Russia has been instituted to protect national interests and to fulfill international obligations regarding the non-proliferation of weapons of mass destruction.[40] ***Federal Law No. 170-FZ*** (November 21, 1995) “On Use of Atomic Energy.” This law codified the legal basis and regulatory principles regarding the use of atomic energy in Russia. The law includes two articles that are relevant to nuclear export control: Article 63, Chapter Fourteen states that the export and import of nuclear installations, equipment, technology, nuclear materials, radioactive substances, special non-nuclear substances, and services in the sphere of atomic energy are carried out in accordance with international obligations for the non-proliferation of nuclear weapons and international agreements in the sphere of nuclear energy; Article 64, Chapter Fourteen states that the export and import of the above items are carried out under procedures established by the legislative and other legal acts of the Russian Federation, and in accordance with legislation regarding export controls on the basis of permits issued for the right to conduct work in the sphere of atomic energy.[41]

RUSSIA (cont.)	
CONTROL MECHANISM	**STATUS/COMMENTS**
Domestic Export Controls (Nuclear) (cont.)	In addition, a new Criminal Code was passed in mid-1996, and entered into force on January 1, 1997, providing a legislative basis for criminal prosecution of export control violations:[42] ***Federal Law No. 63-FZ*** (June 13, 1996) "Criminal Code of the Russian Federation." This law contains a number of articles that address violations of export controls and illegal handling of nuclear and radioactive materials. In particular, Article 188 provides criminal penalties for smuggling of illicit materials, including materials or equipment that could be used in the development of a weapon of mass destruction, and Article 189 provides criminal penalties for the illegal export of technologies, scientific-technical information, and services which could be used to develop weapons of mass destruction.[43] Article 355 makes the production, acquisition or selling of weapons of mass destruction punishable by up to 10 years imprisonment.[44] There are also a series of executive branch regulations, including Presidential Decrees (*ykazi*), Presidential Directives (*rasporyazhenyi*), and Governmental Resolutions (*postanovleniya*), which specifically address export controls. The key regulations in the sphere of nuclear export controls are as follows:[45] ***Presidential Decree No. 312*** (March 27, 1992) "On Control Over Export of Nuclear Materials, Equipment, and Technologies from the Russian Federation." This decree stipulated Russian adherence to the policy of full-scope safeguards – the application of safeguards to all nuclear facilities in recipient non-nuclear weapon state nations – as a condition of export. ***Presidential Decree No. 388*** (April 11, 1992) "On Measures to Establish an Export Control System in Russia." This degree provided the initial legal basis for creating a system of non-proliferation export controls in the Russian federation. With reference to both Russian national interests and international non-proliferation obligations, the decree resolved to establish export controls for materials, equipment, and technologies which can be used in the development of military equipment, or of missile, nuclear, chemical, and other types of weapons of mass destruction. ***Governmental Resolution No. 1030*** (October 11, 1993) "On Controlling the Fulfillment of the Obligations to Guarantee the Use of Imported and Exported Dual-Use Goods and Services for Declared Purposes." This resolution approved the procedures for monitoring the fulfillment of obligations regarding the end-use of dual-use imports and exports. The statute covers both measures to prevent unauthorized re-export of dual-use items from Russia, and measures to prevent unauthorized re-export from a foreign country of dual-use items imported from Russia. ***Presidential Decree No. 202*** (February 14, 1996) "On Approval of the List of Nuclear Materials, Equipment, Special Non-Nuclear Materials and Related Technologies, Falling Under Export Control." This decree approved a new export control list for nuclear material, equipment, and technology. ***Presidential Decree No. 228*** (February 21, 1996) "On Control of Export from the Russian Federation of Dual-Use Equipment and Materials and Appropriate Technology Used for Nuclear Purposes, Export of Which Is Controlled." In accordance with Article 16 of the Federal Law on State Regulation of Foreign Trade Activity, this decree approved a revised control list of dual-use nuclear-related items, and charged the Government to approve new procedures for the control of export of these commodities. This list is consistent with the list of nuclear dual-use items identified in the Annex to the Nuclear Suppliers Group Guidelines.[46]

RUSSIA (cont.)

CONTROL MECHANISM	STATUS/COMMENTS
Domestic Export Controls (Nuclear) (cont.)	***Government Resolution No. 574*** (May 8, 1996) "On Approval of the Statute Regulating Exports and Imports of Nuclear Materials, Equipment, Special Non-Nuclear Materials, and Related Technologies." In accordance with the Federal Law on Use of Atomic Energy, this regulation approved new procedures for exporting nuclear materials contained in the control list approved by Presidential Decree No. 202. The resolution also instructed the Foreign Ministry to notify the IAEA of Russia's compliance with changes introduced to Nuclear Suppliers Group Guidelines at the meeting in Helsinki in April 1995. The regulation also introduced significant changes into the export process for critical nuclear exports.[47] ***Government Resolution No. 575*** (May 8, 1996) "On Approval of the Statute Regulating Exports from the Russian Federation of Dual-Use Equipment, Materials, and Related Technologies Applied for Nuclear Purposes." This regulation approved new procedures for exporting dual-use nuclear material contained in the control list approved by Presidential Decree No. 228. The resolution also instructed the Foreign Ministry to notify the IAEA of Russia's compliance with changes introduced to Nuclear Suppliers Group Guidelines at the meeting in Helsinki in April 1995.[48] ***Government Resolution No. 1403*** (November 7, 1997) "On Control Over the Export to Iraq of Goods, Dual-Use Technologies, and Other Materials Subject to International Mechanisms for Permanent Oversight and Control." This resolution defines the rules and procedures for export of controlled goods and technologies to Iraq in accordance with UN Security Council resolutions that either restrict or forbid the export of sensitive goods and technologies to Iraq. In accordance with this resolution, it is forbidden to export any items to Iraq that are intended for use in activities that are forbidden by the UN Security Council.[49] The Export Control Commission (*Eksportkontrol*), the Ministry of Atomic Energy (Minatom), the Ministry of Foreign Affairs (MFA), and the Ministry of Foreign Economic Relations and Trade (MFERT) are the key governmental bodies whose approval is required in order to export "critical nuclear items." (*Eksportkontrol* is an interagency commission for coordination of state non-proliferation export control policy. Critical nuclear items are items that could be used directly in the production of a nuclear weapon.[50]) According to Resolution No. 574, there are four stages regulating the export of critical nuclear items. During the first stage, a Russian exporter must reach agreement with *Eksportkontrol*, Minatom, the MFA, and the MFERT on the desirability of a proposed draft agreement to export a critical nuclear item to a foreign partner. Then, a formal Government Decision must be issued, giving permission for the negotiation of the final contract. After a contract has been negotiated, it must be evaluated by Eksportkontrol. If the contract does not violate the international non-proliferation obligations of the Russian Federation, and does not violate Russia's domestic regulations and requirements, then *Eksportkontrol* issues a formal conclusion allowing the contract to proceed. During the forth and final stage, the exporter must apply for an export license at the MFERT. The MFERT then consults with Minatom. If Minatom does not have any objections, the MFERT will issue the export license. The third stage, approval of contracts by *Eksportkontrol,* was introduced in Resolution No. 574 (above), and thus is a relatively new step in the export control process. Because *Eksportkontrol* has the power to cancel any contract at that stage, this step significantly diminishes the authority of Minatom.[51] The export control procedures for dual-use nuclear items essentially skip stages two and three. That is, nuclear dual-use exports do not require a formal decision by the Government for contract negotiation, nor do they require a formal conclusion on the contract by Eksportkontrol. Instead, after initial agreement has been reached on the desirability of the draft export agreement, the exporter immediately applies for an export license. MFERT will issue a license only after Eksportkontrol has approved the application.[52]

RUSSIA (cont.)	
CONTROL MECHANISM	**STATUS/COMMENTS**
Domestic Export Controls (Nuclear) (cont.)	Russia is a party to the "Agreement on Coordination Regarding Issues of Export Control of Raw Materials, Materials, Equipment, Technology and Services Which Could Be Used in the Production of Weapons of Mass Destruction and Their Delivery Systems" (Minsk Accord) of June 26, 1992, between CIS member states. According to this agreement, the parties will create national export control systems, coordinate their efforts to control exports of materials used in the production of weapons of mass destruction, and create uniform control lists based on existing international export control regimes.[53] In addition, on February 9, 1993, Russia reached another agreement with five other CIS states to cooperate in controlling exports relevant to manufacturing weapons of mass destruction.[54] Like many multilateral agreements between CIS countries, very little has been done to implement these early attempts to coordinate CIS export control policy. The most recent meeting at which CIS export control coordination was considered took place on October 29, 1997. Representatives from CIS states discussed the importance of harmonizing national export control legislation, and proposed the creation of an export control working group under the aegis of the Council of Foreign Ministers of CIS states.[55] On January 6, 1995, the Russian Federation, Belarus, and Kazakhstan concluded a joint Customs Union. Kyrgyzstan joined this Customs Union on March 29, 1996. The primary result of the Customs Union is that it abolishes tariffs on trade between the four countries and abolishes customs checkpoints on common borders. The Customs Union agreement has yet to be fully implemented on the Russia-Kazakhstan border, but the Russia-Belarus border is now fully transparent. Although the Customs Union should not affect the political aspects of non-proliferation export controls, in practice the already weak border controls between the countries are likely to decrease even further.[56]
Domestic Export Controls (Missile)	In addition to the above-mentioned Law on State Regulation of Foreign Trade Activity, the following executive branch decrees and regulations provide the legal and procedural basis for the control of exports of missile-related technology from the Russian Federation:[57] ***Government Resolution No. 70*** (January 27, 1993), "On Approval of the Statute Regulating Control of Exports from the Russian Federation of Equipment, Materials and Technology Employed to Develop Missile Weapons." This resolution approves the export licensing procedures for equipment, materials, and technologies used to produce missiles capable of delivering payloads of at least 500 kg to a range of at least 300 km. The resolution also defines the export licensing authority and guidelines for missile exports. ***Presidential Decree No. 1194*** (August 16, 1996), "On Control of Exports from the Russian Federation of Equipment, Materials, and Technology Used to Develop Missile Weapons." This decree approves a new control list for exports of equipment, materials, and technologies used to produce missiles, in accordance with Russia's accession to the MTCR in 1995. The decree also instructs the Cabinet of Ministers to draw up a new statute of procedures to control the export of equipment, materials, and technologies used in the production of missiles. This decree replaced the earlier control list approved by Presidential Directive No. 193 from April 25, 1995. ***Government Resolution No. 1100*** (September 13, 1996), "On Amending the Statute Regulating Exports from the Russian Federation of Equipment, Materials, and Technology Used to Develop Missile Weapons." This resolution approves the most recent statute regulating export of missile technologies. Previous versions of the statute were approved by Government Resolution No. 1178 (November 19, 1993) and Government Resolution No. 521 (May 24, 1995). This resolution reflects the new control list for missile technologies, approved by Decree No. 1194 (above).

Table II-A Status of Export Controls

UKRAINE	
CONTROL MECHANISM	**STATUS/COMMENTS**
Nuclear Non-Proliferation Treaty	Ukraine acceded to the NPT on December 5, 1994, as a non-nuclear-weapon state party. At the May 1995 NPT Review and Extension Conference, Ukraine was a co-sponsor of the resolution endorsing indefinite extension of the treaty.[58]
Nuclear Suppliers Group	Ukraine was formally admitted to the Nuclear Suppliers Group (NSG) on April 20,1996, at the NSG Plenary meeting in Buenos Aires. Ukraine previously had attended NSG meetings as an observer.[59]
Other Pledge to Ensure Nuclear Exports are Placed Under IAEA Inspection by Recipient	A full-scope *sui generis* safeguards agreement, allowing IAEA inspection of all Ukrainian nuclear activities (excluding nuclear weapons still on its territory), was signed on September 28, 1994, and entered into force on January 13, 1995.[60] However, because Ukraine had not yet acceded to the NPT when it signed the above agreement in September 1994, it was required to sign a second safeguards agreement in accordance with its obligations as a non-nuclear-weapon state party to the NPT (INFCIRC/153). This agreement was signed on September 21, 1995, and ratified by the Ukrainian Verkhovna Rada on December 17, 1997. This safeguards agreement supersedes the agreement from 1995.[61]
Missile Technology Control Regime	Ukraine signed a Memorandum of Understanding (MOU) with the United States on May 13, 1994, in which it pledged to respect the guidelines of the MTCR,[62] and it has established MTCR-conforming rules and procedures for missile technology transfers. Ukraine has been attempting to join the MTCR for several years, but has been blocked from joining by the United States. The U.S. position is that new MTCR members must be willing to give up their offensive missiles before joining the regime. Ukraine, however, refuses to give up its inventory of Scud-B missiles.[63] Ukraine has put forward three conditions for its membership in the MTCR. First, Ukraine insists on maintaining the right to manufacture (not export) any missile system which is able to carry a 500 kg payload at least 300 km. Second, the MTCR must not be used to protect special status for a particular group of countries or to extend privileges to national corporations. Finally, Ukraine should be allowed to participate in international programs of space exploration for peaceful purposes and should be allowed continued access to the world market in space services.[64]
Domestic Export Controls	The export control system in Ukraine has undergone major changes since its inception in 1992. In addition, the administrative structure for export controls has undergone significant changes within the last year. The legal basis for non-proliferation export controls in Ukraine is a series of executive branch decrees and resolutions, the most important of which are: ***Cabinet of Ministers Resolution No. 563*** (July 27, 1995), “On the Rules and Procedures for Control of the Export, Import and Transit of Missile Technologies, Related Equipment, Materials, and Technologies.” This resolution establishes new export procedures and a new export control list for Ukraine in the sphere of missile technologies, which are consistent with the guidelines of the Missile Technology Control Regime.[65] ***Cabinet of Ministers Resolution No. 302*** (March 12, 1996), “On the Rules and Procedures for the Control of the Export, Import, and Transit of Goods Which Relate to Nuclear Activities and Can Be Utilized in the Construction of Nuclear Weapons.” This resolution establishes new export procedures and a new export control list for Ukraine in the sphere of nuclear materials and technologies, which is consistent with the guidelines of the Nuclear Suppliers group.[66]

UKRAINE (cont.)

CONTROL MECHANISM	STATUS/COMMENTS
Domestic Export Controls (cont.)	***Cabinet of Ministers Resolution No. 1005*** (August 14, 1996) “On the Rules and Procedures for the Control of Goods Which May Have Military Applications (Dual-Use Goods and Technologies).” This resolution establishes new export procedures and a new export control list for dual-use goods and technologies, in accordance with the requirements of the Wassenaar Arrangement.[67] ***Cabinet of Ministers Resolution No. 1247*** (October 9, 1996), “On Issues Related to the State Company for Export/Import and the Rendering of Military and Special Services.” This resolution gave the state company *Ukrspetseksport* the sole authorization to export and import armaments and military goods.[68] ***Presidential Decree No. 1279*** (December 28, 1996), “On Further Improving State Export Controls.” This decree transformed the Government Commission on Export Controls and the State Expert-Technical Committee, previously the two primary export control bodies in Ukraine, into the Government Commission for Export Control Policy and the State Service for Export Controls. The Government Commission on Export Control Policy is an interagency group made up representatives from the Ministry of Foreign Affairs, the Ministry of Foreign Economic Relations and Trade, the Ministry of Defense, the Ministry of Economics, the Ministry of Machine-Building, the Military-Industrial Complex and Conversion, the Ministry of Internal Affairs, the Ministry of Environmental Protection and Nuclear Safety, the State Security Service, the Center for Strategic Planning and Analysis of the National Security and Defense Council, the National Security and Defense Council, the Cabinet of Ministers, the State Export Control Service, the State Customs Service, the State Border Guards, the State Committee for the Protection of Information, and the National Space Agency. The Commission is responsible for ensuring interagency coordination on export control issues and for resolving any difficult export licensing issues. The State Service for Export Controls is responsible for developing and implementing export control procedures.[69] ***Presidential Decree No. 433*** (May 14, 1997) “On the Provision of the State Export Control Service of Ukraine.”[70] ***Cabinet of Ministers Resolution No. 384*** (April 22, 1997) “On the Procedures for Controlling Exports, Imports, and Transport of Products Which May Be Used in the Production of Chemical, Biological (Biochemical), and Toxic Weapons.”[71] ***Cabinet of Ministers Resolution No. 1217*** (November 10, 1997) “On the Government Commission for Export Control Policy.” This resolution defines the responsibilities of the Government Commission for Export Control Policy. Its primary responsibilities are introducing restrictions and bans on the export, import, and transit of goods; granting permits for international trade of military equipment, missile technology, and materials that could be used in the creation of a nuclear or chemical weapon; ensuring compliance with international export control obligations; and to analyze tendencies in the trade of military and dual-use goods.[72] In addition, the former Expert-Technical Committee (now State Service for Export Controls) led an interagency effort to draft a “Temporary Provision on Export Control in Ukraine.” This document contains a comprehensive set of export control regulations, and will be the primary acting export control regulation until a comprehensive export control law is passed. The text also will be used as the basis for that future law. The “Temporary Provision” represents a considerable step forward in terms of defining responsibilities, terms and definitions, and procedures. However, as such, the document more resembles a detailed set of regulations and lacks the underlying legal principles that generally characterize laws.[73] This document has been submitted to the Cabinet of Ministers, and is awaiting ratification by a Decree of the President of Ukraine.[74] Ukrainian enterprises wishing to export controlled commodities are required to apply to the State Service for Export Controls (SSEC) for an export license. The application is then evaluated by the SSEC's various technical and legal departments in consultation with other relevant ministries. An exporter may also send a license application directly to the appropriate ministry for a preliminary analysis and decision, after which the request is forwarded to the SSEC.

UKRAINE (cont.)	
CONTROL MECHANISM	**STATUS/COMMENTS**
Domestic Export Controls (cont.)	When making a licensing decision, the ministries and the SSEC consider several political, technical, economic, and military issues, such as whether the exporter has demonstrated that the commodity will only be used for peaceful purposes, whether adequate physical protection is required or will be provided, and whether international safeguards apply. If ministries differ in their evaluations, as has been the case in several instances, the SSEC acts as a referee. The SSEC regularly issues export licenses in routine cases. However, when a case is sensitive for political or economic reasons, the license will be forwarded to the Government Commission on Export Control Policy for a final decision[75] The SSEC generally issues one of two types of license: a general license or an individual license. A general license allows an exporter to export a specified commodity freely for a specified period (usually one year) at the end of which the exporter must re-apply for a license. An individual license grants an exporter permission to export a specific quantity of controlled goods being exported under the terms of a single contract. Additional or separate contracts require separate licenses. [76] Ukraine is a party to the "Agreement on Coordination Regarding Issues of Export Control of Raw Materials, Materials, Equipment, Technology and Services Which Could Be Used in the Production of Weapons of Mass Destruction and Their Delivery Systems" (Minsk Accord) of June 26, 1992, between CIS member states. According to this agreement, the parties will create national export control systems, coordinate their efforts to control exports of materials used in the production of weapons of mass destruction, and create uniform control lists based on existing international export control regimes.[77] Like many multilateral agreements between CIS countries, very little has been done to implement this early attempt to coordinate CIS export control policy. The most recent meeting at which CIS export control coordination was considered took place on October 29, 1997. Representatives from CIS states discussed the importance of harmonizing national export control legislation, and proposed the creation of an export control working group under the aegis of the Council of Foreign Ministers of CIS states.[78]

NOTES

1. The principal sources for this table are the NIS Nuclear Profiles Database, Center for Nonproliferation Studies, Monterey, CA, November 1997; Emily Ewell and John Parachini, "Belarusian Export Controls: A Status Report," Center for Nonproliferation Studies, Monterey Institute of International Studies, prepared for the Office of Nonproliferation and Arms Control of the U.S. Department of Energy, May 1997; Emily Ewell and Holly Tomasik, "Nuclear Export Controls of the Russian Federation: A Status Report," Center for Nonproliferation Studies, Monterey Institute of International Studies, prepared for the Office of Arms Control and Nonproliferation at the U.S. Department of Energy, December 1996; Emily Ewell, John Parachini and William Potter, "Ukrainian Nuclear Export Controls: A Status Report," Center for Nonproliferation Studies, Monterey Institute of International Studies, prepared for the Office of Arms Control and Nonproliferation at the U.S. Department of Energy, December 1996; original Russian- and Ukrainian-language texts of laws and decrees; and interviews with NIS officials.

2. "Belarus: Nuclear Disarmament Treaties and Agreements," NIS Nuclear Profiles Database, Center for Nonproliferation Studies, Monterey Institute of International Studies, October 1997.

3. Ural Latypov, "Export Control In Belarus: Trends of Evolution," Development and Security Institute of Belarus and the Monterey Institute of International Studies, Minsk, 1994, p. 8; Communication with U.S. Department of Energy official, June 21, 1995.

4. *Agreement of 14 April 1995 Between the Republic of Belarus and the IAEA for the Application of Safeguards in Connection With the Treaty on the Non-Proliferation of Nuclear Weapons*, International Atomic Energy Agency, Information Circular No. 495 (INFCIRC/495), January 1996.

5. *Ibid.*

6. Ewell and Parachini, "Belarusian Export Controls," *op. cit.*, p. 18.

7. From the Russian-language text of the decree, published in *Respublika Dzelavaya: Dakumenty Kamentaryi,* No. 10 (114).

8. From the Russian-language text of the law.

9. Center for Nonproliferation Studies correspondence with Belarusian analyst, February 1998.

10. Andrei Mavchuk, International Security and Arms Control Department, Ministry of Foreign Affairs, Republic of Belarus, "Belarus' Export Control Developments and Participation in Multilateral Nonproliferation Regimes," January 1998.

11. Center for Nonproliferation Studies, correspondence with Belarusian analyst, February 1998.

12. Ewell and Parachini, “Belarusian Export Controls,” *op. cit.*, p. 10.

13. *Ibid.*

14. From the Russian-language text of the Minsk Accord, *Soglasheniye o koordinatsii rabot po voprosom eksportnogo kontrolya*, June 26, 1992.

15. "Six CIS States Join Forces to Enforce Export Control," *ITAR-TASS (Moscow)*, February 9, 1993, in *FBIS-SOV-93-026*, February 10, 1993.

16. Sergei Ryabikin, "Representatives of CIS States Discuss Export Control Over Products Used for the Creation of Mass Destruction Weapons," *RIA Novosti Hotline*, October 29, 1997.

17. "Russia, Belarus, Kazakhstan Sign Customs Union Agreement," *Rossiiskaya Gazeta,* January 28, 1995, in *FBIS-SOV-95-0227-S* February 9, 1995.

18. Ewell and Parachini, “Belarusian Export Controls,” *op. cit.*, p. 2.

19. Correspondence with Alexander Pikayev, Director, Center for Critical Technologies and Nonproliferation, January 1998.

20. "Signatories and Parties to the Treaty on the Non-Proliferation of Nuclear Weapons," Arms Control and Disarmament Agency Web Site: Treaties and Agreements, http://www.acda.gov/treaties/npt3.txt.

21. Center for Nonproliferation Studies discussion with Kazakhstani nuclear official, summer 1997.

22. "Kazakhstan: International Organizations and Treaties," NIS Nuclear Profiles Database, Center for Nonproliferation Studies, Monterey Institute of International Studies, October 1997.

23. "Situation on 31 December 1996 With Respect to the Conclusion of Safeguards Agreements between the Agency and Non-Nuclear-Weapons States in Connection with NPT," International Atomic Energy Agency Web Site, http://www.iaea.org.

24. From the Russian-language text of the decree.

25. Correspondence with Kazakhstani export control specialist, January, 1998.

26. From the Russian-language text of the law, published in *Kazakhstanskaya Pravda*, June 25, 1996, p. 2.

27. Center for Nonproliferation Studies, discussion with Kazakhstani official, summer 1996.

28. From the Russian-language text of the law, published in *Problemy Nerasprostraneniya*, No. 1, November 1997, pp. 17-26.

29. Dastan Eleukenov, "Kazakhstan Export Control System," unpublished paper prepared for the Monterey Institute, January 1998.

30. Timur Zhantikin, "Kontrol Eksporta Yadernykh Materialov," *Problemy Nerasprostraneniya*, No. 1, November 1997, p. 7.

31. From the Russian-language text of the Minsk Accord, *Soglasheniye o koordinatsii rabot po voprosom eksportnogo kontrolya*, June 26, 1992.

32. "Six CIS States Join Forces to Enforce Export Control," *op. cit.*

33. Ryabikin, “CIS States Discuss Export Control,” *op. cit.*

34. "Derbisov on Customs Affairs, Security," *Kazakhstanskaya Pravda,* August 30, 1995, in *FBIS-SOV-95-173*, August 30, 1995.

35. Correspondence with Alexander Pikayev, January 1998.

36. Recognizing the unusual circumstances of the break-up of the Soviet Union, the Nuclear Suppliers Group agreed that on-going supply commitments between Russia and a number of former Soviet republics would be exempted from the rule that recipient states must have all of their nuclear facilities under IAEA safeguards.

37. "Russia: International Organizations and Treaties," NIS Nuclear Profiles Database, Center for Nonproliferation Studies, November

1997.

38. Center for Nonproliferation Studies discussion with Russian export control specialist, October 1997.

39. Center for Nonproliferation Studies discussion with Vladimir Orlov, Russian non-proliferation analyst, November 1997.

40. This law was adopted by the State Duma (lower house of Parliament) on July 7, 1995; approved by the Federation Council (upper house of Parliament) on July 21, 1995; and signed by President Boris Yeltsin on October 13, 1995. An earlier draft of the law was adopted by the Duma in May 1995, but vetoed by President Yeltsin because it required that export control lists be approved by federal law. In the final version of the law, that provision was removed. See Ewell and Tomasik, “Nuclear Export Controls,” *op. cit.*, p. 41.

41. This law was adopted by the State Duma on October 20, 1995 and signed by President Yeltsin on November 21, 1995. The text of the law appears in *Rossiiskaya Gazeta*, November 28, 1995. An earlier draft of the law had been passed by the Duma on June 2, 1995, but was vetoed by the President on June 25, 1995. See *Ibid.*, p. 42.

42. Correspondence with Gary Bertsch, Director, Center for International Trade and Security, University of Georgia, January 1998.

43. "Excerpts from the Criminal Code of the Russian Federation," *The Monitor*, Vol. 2, No. 4, University of Georgia, pp. 33-5.

44. Correspondence with Gary Bertsch, January 1998.

45. A complete list of Russian legislative acts and executive decrees, including the summaries of the decrees in this chart, can be found in Ewell and Tomasik, “Nuclear Export Controls,” *op. cit.*, pp. 41-63.

46. This decree replaced Presidential Directive No. 827 rp from December 28, 1992.

47. This regulation replaced Government Regulations No. 1005 from December 21, 1992; No. 1136 from October 6, 1994; and No. 388 from March 22, 1995.

48. This regulation replaced Government Regulation No. 68 from January 27, 1993, and the portion of Government Regulation No. 556 from June 3, 1995, that amended No. 68.

49. From the Russian-language text of the decree, published in *Rossiiskaya Gazeta*, November 18, 1997, p. 4.

50. Critical nuclear items are defined as uranium enriched to 20% or higher, plutonium, reprocessing equipment, equipment for uranium isotope separation, equipment for heavy water production, equipment for the conversion of enriched uranium and plutonium, and technologies related to these items.

51. Center for Nonproliferation Studies discussion with Russian export control specialist, October 1997.

52. *Ibid.*

53. From the Russian-language text of the Minsk Accord, *Soglasheniye o koordinatsii rabot po voprosom eksportnogo kontrolya*, June 26, 1992.

54. "Six CIS States Join Forces to Enforce Export Control," *op. cit.*

55. Ryabikin, “CIS States Discuss Export Control,” *op. cit.*

56. Ewell and Tomasik, “Nuclear Export Controls,” *op. cit.*, p. 29.

57. *Ibid.,* pp. 41-63.

58. "Ukraine: Nuclear Disarmament Treaties and Agreements," NIS Nuclear Profiles Database, Center for Nonproliferation Studies, Monterey Institute of International Studies, November 1997.

59. Ewell, Parachini, and Potter, “Ukrainian Export Controls,” *op. cit.*

60. "Ukraine: International Organizations and Treaties," NIS Nuclear Profiles Database, Center for Nonproliferation Studies, Monterey Institute of International Studies, November 1997.

61. Center for Nonproliferation Studies correspondence with Ukrainian official from Ministry of Environmental Protection and Nuclear Safety, January 1998.

62. Undersecretary of State for Arms Control and International Security Lynn E. Davis, "Progress on Denuclearization in Ukraine," *U.S. Department of State Dispatch*, August 15, 1994, Vol. 5, No. 33, p. 557.

63. Jeff Erlich, "Scud Missile Cache Stymies Ukraine Effort to Join MTCR," *Defense News*, September 30 – October 6, 1996, p. 46.

64. "Ukraine: International Organizations and Treaties," *op. cit.*

65. From the Ukrainian-language text of the decree.

66. *Ibid.*

67. Center for Nonproliferation Studies discussion with Ukrainian Foreign Ministry official, May 1997; and "List of Existing Normative Documents on Export Control Issues," distributed at the conference: *Cooperation Between Enterprises and State Export Control Organs*, organized by the Scientific and Technical Center for the Export and Import of Special Technologies, Equipment, and Materials, Kiev, Ukraine, November 1997.

68. Victor Vaschilin, "State Export Controls in Ukraine," *The Monitor*, Vol. 3, No. 3, University of Georgia, pp. 12-14; and "List of Existing Normative Documents on Export Control Issues," *op. cit*.

69. From an English-language translation of the decree: "Edict of the President of Ukraine on Further Improving State Export Controls," *Uryadovyy Kuryer*, January 11, 1997, p. 7, in *FBIS-SOV-97-026*, January 11, 1997.

70. "List of Existing Normative Documents on Export Control Issues," *op. cit*.

71. *Ibid.*

72. "HSN: On the Books," *Eastern Economist,* November 17, 1997, p. 27.

73. Ewell, Parachini, and Potter, “Ukrainian Export Controls, *op. cit*.

74. "List of Existing Normative Documents on Export Control Issues," *op. cit*.

75. Center for Nonproliferation Studies discussion with Ukrainian Foreign Ministry official, May 1997; and correspondence with Gary Bertsch, January 1998.

76. Center for Nonproliferation Studies discussions with Ukrainian officials, June, August, and November 1995; and Adam M. Scheinman, "Managing Export Controls in Latvia and Ukraine," A Trip Report of the LAWS/WCNP NIS Export Control Project, August 8-12, 1994, p. 7f.

77. From the Russian-language text of the Minsk Accord, *Soglasheniye o koordinatsii rabot po voprosom eksportnogo kontrolya*, June 26, 1992.

78. Ryabikin, “CIS States Discuss Export Control,” *op. cit*.

Table II-B Highlights of Significant Fissile Material Smuggling Cases

Information from this chart has been compiled from the "*Illicit Nuclear Transfers Chronology Database*" *and the* "*Profiles of Significant Nuclear Smuggling Cases Database*" *(under development), which are maintained by the Center for Nonproliferation Studies at the Monterey Institute of International Studies.*

Hundreds of incidents of nuclear material diversion have been reported in the years following the collapse of the Soviet Union. The vast majority of these cases has involved the diversion or attempted sale of radioactive isotopes, low-enriched uranium (LEU) and natural uranium—materials that pose little to no proliferation threat. However, the seven cases outlined below are generally considered to be of major proliferation significance, as they involve more than minuscule quantities of weapons-grade nuclear material.

The December 1994 confiscation of highly-enriched uranium (HEU) in Prague was the last known case involving a significant quantity of material that could be confirmed by unambiguous corroborating sources. However, it would be dangerous to assume, as many analysts have, that the lack of such incidents in recent years signifies that nuclear smuggling is no longer a significant threat. Despite the United States' and Russia's pledge, at the April 1996 Moscow Nuclear Safety and Security Summit, to enhance intelligence cooperation regarding nuclear diversion, it is doubtful if Moscow has provided Washington with any new meaningful information on nuclear diversions. Although it is not widely known, Russian and Ukrainian officials have acknowledged a number of potentially significant cases of nuclear diversion in the past few years.[1] Such cases include the seizure of 6 kg of 20% enriched HEU in Kiev in March 1995 and the loss of 145 g of 90% enriched HEU from Tomsk Polytechnical University.[2] Because there is limited information available on these cases, they have not been included in the chart below. Also omitted from the chart because of the lack of unambiguous evidence is the reported seizure of 3.05 kg of weapons-usable uranium in St. Petersburg in March 1994.[3] There also have been a number of cases in which hundreds of kilograms of LEU nuclear reactor fuel and dual-use materials were diverted from sites throughout the Newly Independent States (NIS). Most of these materials have never been recovered. While such materials are not weapons-grade, the diversions may be indicative of the ease with which large quantities of sensitive materials can be stolen and exported, particularly if middle- to high-level facility insiders are involved.

Lastly, it is important to note that all seven incidents outlined below involve nuclear material of Russian origin that was recovered in Russia or in Europe. Given that several countries of proliferation concern are located in regions to the immediate south of the former Soviet Union, it is possible to imagine a sophisticated operation in which material was smuggled directly to these countries without a European detour. Border guards and customs authorities in the "southern tier" countries of the NIS may be less able to intercept illicit goods due to technical and financial constraints. Indeed, highly sophisticated smugglers would be more likely to use routes where the chances of escaping detection were greatest. Thus, while the seven cases outlined below offer concrete evidence of proliferation-significant nuclear materials trafficking, it is essential to keep in mind the potential for cases that remain undiscovered.

Table II-B Highlights of Significant Fissile Material Smuggling Cases

OVERVIEW OF CASES			
CASE NAME & DATE OF DIVERSION	**MATERIAL DIVERTED**	**ORIGIN OF MATERIAL**	**RECOVERY OF MATERIAL**
Podolsk 5/92-9/92	1.5 kg of 90% HEU	Luch Scientific Production Association, Podolsk	10/9/92; Russian police operation intercepted the smugglers in the Podolsk train station.
Andreeva Guba 7/29/93	1.8 kg of 36% HEU	Naval base storage facility, Andreeva Guba	7/29/93; Russian security forces arrested the thieves before they could smuggle the material out of Russia.
Tengen Unknown	6.15 g of Pu-239	Unconfirmed; possibly Arzamas-16	5/10/94; Police in suspect's apartment for another reason, stumbled upon the cache.
Landshut Unknown	800 mg of 87.7% HEU	Unconfirmed; likely Obninsk	6/13/94; Undercover German police acted as potential customers in a sting operation.
Sevmorput 11/27/93	4.5 kg of 20% HEU	Naval Shipyard, Sevmorput	6/94; The brother of a suspect asked a co-worker for help finding a customer. The co-worker notified authorities.
Munich Unknown	560 g MOX fuel; 363 g of Pu-239	Unconfirmed; likely Obninsk	8/10/94; Undercover German police acted as potential customers in a sting operation.
Prague Unknown	2.7 kg of 87.7% HEU	Unconfirmed; likely Obninsk	12/14/94; Anonymous tip to police giving the material's location (a parked car).

PODOLSK	
COMMENTS	
Amount of Material and Date of Diversion	1.5 kg of HEU enriched to 90% was diverted between May and September 1992.[4]
Origin of Material	Luch Scientific Production Association, Podolsk, Russia; fuel processing and nuclear material production plant.[5]
Method of Diversion	Leonid Smirnov, an engineer at Luch, filled thirty, 50 g vials with HEU while his co-workers were on a break. He then sealed the vials, checked them with a Geiger counter to make sure radioactivity was undetectable, and took them home in his bag. He blamed the measurement discrepancies on "irretrievable losses" in the lab and stored the vials on his balcony at home.[6]
Broker and/or Customer	Leonid Smirnov had read an article in the paper about the lucrative uranium market, but he himself had little idea of how to find a customer. He planned to store the material in a locker at the train station until he found a buyer in Moscow. He first claimed to have a customer in the Caucasus, but further investigation revealed that there was no buyer.[7]
Recovery of Material	On October 9, 1992, Smirnov wrapped the containers in lead, put them in plastic bags, and went to the train station to search for a buyer and store the material. At the station, he happened to run into some of his neighbors who were being followed on suspicion of stealing batteries from their factory. The neighbors were arrested, and Smirnov was taken in for questioning as well. Recovery in this case was accidental.[8]
Court Rulings	On March 11, 1993, Smirnov was convicted of stealing and storing radioactive material. The maximum sentence he could have received was ten years, but he was released after the verdict and given three years of probation.[9]

Table II-B Highlights of Significant Fissile Material Smuggling Cases

ANDREEVA GUBA	
COMMENTS	
Amount of Material and Date of Diversion	1.8 kg of HEU enriched to 36% in the form of two fuel rods was diverted on July 29, 1993.[10]
Origin of Material	Naval base storage facility (Northern Fleet), Andreeva Guba, Murmansk region; located 40 km from the Norwegian border.[11]
Method of Diversion	Two naval servicemen, Popov and Antonov (a sailor and a guard), stole two fuel rods from the storage area during Antonov's watch. They broke the padlock on the door to the storage area and removed two fuel rods. With a hacksaw, they then separated the section containing nuclear material from one of the rods.[12]
Broker and/or Customer	Popov and Antonov claimed to be operating under instructions from two naval officers, Captain Bakshanskiy and Lt. Captain Nikonov. These two officers denied any involvement.[13]
Recovery of Material	Russian security officers discovered the missing material and intercepted it before it was taken very far.[14]
Court Rulings	On November 2, 1995, Antonov was sentenced to four years in prison, and Popov was sentenced to five years in prison. The two naval officers implicated in the case were found not guilty due to lack of evidence.[15]

TENGEN	
COMMENTS	
Amount of Material and Date of Diversion	6.15 g of Pu-239 was diverted at an unknown date.[16]
Origin of Material	There are indications that this material came from a Soviet weapons lab at Arzamas-16. It appears to be part of a sample of a few kilograms of very pure plutonium used to standardize fission cross sections.[17]
Method of Diversion	The method of diversion is unknown.
Broker and/or Customer	The broker was a German businessman named Adolf Jaeckle. The plutonium was stored in Jaeckle's garage in Tengen, Germany, in a small lead cylinder with a steel band.[18]
Recovery of Material	Jaeckle was under investigation for counterfeiting, and the police accidentally found the material in his apartment on May 10, 1994.[19]
Court Rulings	On November 23, 1995, Jaeckle was sentenced to 2.5 years in prison for illegal possession of fissile material.[20]

Table II-B Highlights of Significant Fissile Material Smuggling Cases

LANDSHUT	
COMMENTS	
Amount of Material and Date of Diversion	800 mg of HEU enriched to 87.7% was diverted at an unknown date.[21]
Origin of Material	The material appears to be naval reactor or research reactor fuel, possibly from the Institute of Physics and Power Engineering, Obninsk, Russia. It is technically identical to the material recovered from the highly-publicized incident in Prague on December 14, 1994.[22]
Method of Diversion	The method of diversion is unknown. Gustav Illich, a Slovakian trader, obtained the material from contacts who had stored the material in a metal cylinder in a Prague bank.[23]
Broker and/or Customer	There were at least two brokers involved in this case: Illich and Vaclav Havlik, a Czech trader who was Illich's supplier in the given case. German undercover agents presented themselves to Illich as potential customers seeking to purchase HEU for a German nuclear reactor.[24] One of the undercover German policemen also worked the Munich sting operation.[25]
Recovery of Material	On June 13, 1994, Illich gave the undercover agents the 800 mg sample of HEU in Landshut, Germany. The agents chose not to arrest him at that time, as they hoped to set up a later meeting where they could seize a large cache of the material. On July 14, 1994, German agents set up a second meeting with Illich and Havlik. As soon as Havlik handed over a uranium pellet, police moved in and arrested him. Subsequent analysis revealed that the pellet was low-enriched, reactor-grade uranium.[26]
Court Rulings	Havlik was sentenced to 13 months in prison. He served his time and now runs a bar in Prague.[27] Illich was sentenced to 19 months in prison.[28]

SEVMORPUT	
COMMENTS	
Amount of Material and Date of Diversion	4.5 kg of HEU enriched to 20% was diverted on November 27, 1993.[29]
Origin of Material	Sevmorput Shipyard (Northern Fleet), Rosta District, Murmansk; storage facility for submarine reactor fuel.[30]
Method of Diversion	On November 27, 1993, sometime after 1:00 a.m., two naval officers, Aleksei Tikhomirov and Oleg Baranov, drove to Sevmorput shipyard where Tikhomirov climbed through a hole in the fence and made his way to a submarine fuel storage bunker. He then used a hacksaw to remove a padlock from the door to the storage facility and pried the door open. He went inside, removed the uranium from three fuel rods, put it in a bag, and departed. However, he left the door open, and the theft was noticed around 2:00 p.m. the following day. He stored the material in his garage.[31]
Broker and/or Customer	Tikhomirov and Baranov did not have specific buyer.[32]
Recovery of Material	Dmitri Tikhomirov (Aleksei's brother), a naval officer at the same shipyard, asked a fellow officer about potential customers. That officer alerted authorities.[33]
Court Rulings	Aleksei Tikhomirov and Baranov were each sentenced to 3.5 years in prison. Dmitri Tikhomirov was acquitted because he did not actively participate in the diversion.[34]

MUNICH

Table II-B Highlights of Significant Fissile Material Smuggling Cases

COMMENTS	
Amount of Material and Date of Diversion	363 g of Pu-239 was diverted at an unknown date.[35]
Origin of Material	Justiniano Torres Benito, a Colombian national convicted in the case, claimed the material was from the Institute of Physics and Power Engineering (IPPE) in Obninsk, Russia. The Russian Ministry of Atomic Energy (Minatom) asserted that the material could not possibly have originated in Russia. Subsequent analysis by the U.S. CIA, Euratom, and Los Alamos National Laboratory, however, confirmed that the material may have come from Obninsk. In February 1996, it was reported that Russian Foreign Minister Yevgeniy Primakov forwarded to Bonn a report from the Russian Federal Counterintelligence Service confirming that the material in question was from IPPE, thus contradicting Minatom's earlier assertions.[36]
Method of Diversion	The method of diversion is unknown.
Broker and/or Customer	Some reports claim that two Russians, O.V. Asafyev and E.V. Baranov, sold the material in Russia in August 1994 to Torres and Spaniards Julio Oroz and Javier Bengoechea Arratibel. Other reports suggest a network of contacts in Russia involving the two Russians and the three foreigners. The exact connection between them is unclear. There was no evidence of a customer other than German undercover agents.[37]
Recovery of Material	On August 10, 1994, a German police sting operation intercepted the material on a Lufthansa flight from Moscow to Munich. Torres, Oroz, and Bengochea were arrested upon seizure. One of the undercover agents also worked the Landshut sting operation. German intelligence has been sharply criticized for enticing the suspects to obtain the material illegally, then entrapping them.[38]
Court Rulings	Under German law, the suspects could have been sentenced to ten years in prison. Torres received four years, ten months; Bengoechea received three years, nine months; and Oroz received three years. Torres served his time and returned to Bogota, Columbia, on April 24, 1997.[39]

Table II-B Highlights of Significant Fissile Material Smuggling Cases

PRAGUE	
	COMMENTS
Amount of Material and Date of Diversion	2.72 kg of HEU enriched to 87.7% in the form of uranium dioxide was diverted at an unknown date, probably early 1994.[40]
Origin of Material	The material is probably from a naval or research reactor rather than a weapons facility. The Czech police think it may be fuel from a nuclear powered icebreaker in Russia's Northern Fleet. The material is technically identical to the material seized in Landshut, and may therefore be from the Institute of Physics and Power Engineering (IPPE) in Obninsk, Russia.[41] Analysis by the Institute for Transuranium Elements at the European Commission has shown that the material is identical to traces of fuel found in an empty nuclear fuel assembly in a German scrap metal yard. The empty fuel assembly appears to be from a test-version of a BN-600 reactor.[42]
Method of Diversion	The material can be traced back to Eduard Baranov, a resident of Obninsk, Russia, who may have been responsible for its diversion. However, he would not say how or where he obtained the material.[43]
Broker and/or Customer	Alexander Scherbinin, a Russian trader, obtained the material from Baranov. Scherbinin, a Czech physicist named Jaroslav Vagner, and a Belarusian named Kunitsky went to a Prague restaurant to meet with a potential buyer from Austria. The potential customer was probably an undercover police officer.[44]
Recovery of Material	On December 14, 1994, Czech police acted on an anonymous telephone tip and found the material in the backseat of a car parked at the aforementioned Prague restaurant. Police arrested Scherbinin, Vagner, and Kunitsky.[45]
Court Rulings	It was reported in October 1997, that Scherbinin and Vagner were sentenced to eight years each in prison by a Prague city court.[46] A Czech citizen, Zdenek Cech, and a Czech police officer, Zdenek Sindlauer, were sentenced to 2.5 and 1.5 years in prison respectively for their roles in helping to hide and peddle the uranium.[47]

NOTES

1. Discussions with Russian officials, Summer 1997, and Ukrainian officials, August 1995 and March 1996.

2. In March 1995, Ukrainian authorities seized 6 kg of uranium in Kiev. Although some reports claimed the material was LEU reactor fuel pellets, an analysis of the material by the Kiev Institute of Nuclear Research showed that the material was enriched to 20%. The Tomsk case involves the loss of one fuel assembly containing 145 g of 90% enriched U-235 research reactor fuel from Tomsk Polytechnical University. Gosatomnadzor became aware of the loss in mid-1996, although the fuel most likely disappeared in late 1994 or early 1995. [Discussions with Ukrainian and Russian officials, 1996 and 1997; "Doslovno. Gosatomnadzor Rossii: Obnaruzheno Propazha 145 Gramm Urana S Obogashcheniyem 90 Protsentov," *Voprosy Besopasnosti*, #16, October 27, 1997. p. 9.]

3. The St. Petersburg case was widely reported in the Russian press in June 1994, but there has been no subsequent information on the theft, its investigation, or trial (if any took place). U.S. government analysts are divided on the issue of its occurrence.

4. William C. Potter, "Before The Deluge? Assessing The Threat Of Nuclear Leakage From The Post-Soviet States," *Arms Control Today*, October 1995, p. 9.

5. *Ibid.*

6. Frontline Interview with Yuri Smirnov, 1996, http://www.pbs.org/wgbh/pages/fron...shows/nukes/interviews/smirnov.thml.

7. William C. Potter, "Nuclear Leakage From The Post-Soviet States," Statement before the Permanent Subcommittee on Investigations, Committee on Governmental Affairs, U.S. Senate, March 13, 1996.

8. Frontline Interview with Yuri Smirnov, *op. cit.*.

9. Potter, "Before The Deluge? " *op. cit.*, p. 9.

Table II-B Highlights of Significant Fissile Material Smuggling Cases

10. *Ibid.*

11. Potter, “Nuclear Leakage From The Post-Soviet States,” *op. cit.*

12. Mikhail Kulik, “Andreeva Guba: Raskryto Yeshche Odno Yadernoye Khishcheniye,” *Yaderniy Kontrol*, No. 11, November 1995.

13. *Ibid.*

14. Potter, “Before The Deluge? “ *op. cit.*, p. 9.

15. Kulik, “Andreeva Guba: Raskryto Yeshche Odno Yadernoye Khishcheniye,” *op. cit.*

16. John Deutch, Director of Central Intelligence, “The Threat of Nuclear Diversion,” Statement for the Record before the Permanent Subcommittee on Investigations, Committee on Governmental Affairs, U.S. Senate, March 20, 1997.

17. Potter, “Nuclear Leakage From The Post-Soviet States,” *op. cit.*

18. “Seized Plutonium Reportedly Weapons-Grade,” *Deutsche Presse Agentur*, May 27, 1994.

19. Potter, “Nuclear Leakage From The Post-Soviet States,” *op. cit.*

20. Mark Hibbs, “Jaeckle Trial Failed to Trace Pu Sample to Point of Origin,” *Nucleonics Week*, November 30, 1995, pp. 1-2.

21. Potter, “Before The Deluge? “ *op. cit.*, p. 10.

22. Frontline Timeline: Prague, Czech Republic, 1996, http://www.pbs.org/wgbh/pages/frontline/shows/nukes/timeline/t108.html.

23. Frontline Interview with Gustav Illich, 1996, http://www.pbs.org/wgbh/pages/fron...shows/nukes/interviews/illich.html.

24. *Ibid.*

25. “Loose Nukes” transcript from Washington Media Associates, obtained by request on June 6, 1997.

26. Frontline Interview with Vaclav Havlik, 1996, http://www.pbs.org/wgbh/pages/fron…shows/nukes/interviews/havlik.html; Frontline Interview with Gustav Illich, 1996, *op. cit.*, and Potter, “Nuclear Leakage From The Post-Soviet States,” *op. cit.*

27. Frontline Interview with Vaclav Havlik, *op. cit.*

28. “Loose Nukes” transcript, *op. cit.*

29. Potter, “Before The Deluge?” *op. cit.*, p. 9.

30. *Ibid.*

31. Frontline Timeline, Sevmorput, Russia, 1996, http://www.pbs.org/wgbh/pages/frontline/shows/nukes/timeline/t108.html.

32. Potter, “Nuclear Leakage From The Post-Soviet States,” *op. cit.*

33. Potter, “Before The Deluge? “ *op. cit.*, p. 10.

34. Potter, “Nuclear Leakage From The Post-Soviet States,” *op. cit.*

35. Potter, “Before The Deluge? “ *op. cit.* , pp. 10-11.

36. Mark Hibbs, “Smuggler Names Obninsk As Source of Plutonium Flown to Germany,” *Nucleonics Week*, November 9, 1995, pp. 1, 10-11.

37. Mark Hibbs, “Primakov Confirms To Germany: Munich Plutonium From Obninsk,” *Nucleonics Week*, pp. 1, 9-10. *Segodnya* reported that chemist Gennadiy Nikiforov of Moscow set up contacts between the Russian traders and the men in Germany.

38. Potter, “Before The Deluge? “ *op. cit.*, p. 10; and Frontline Interview with Bernd Schmidbauer, 1996, http://www.pbs.org/wgbh/pages/frontline/shows/nukes/interviews/schmidbauer.html.

39. Potter, “Before The Deluge? “ *op. cit.*, p. 11; and “Accused Plutonium Smuggler Returned To Columbia,” *Reuters*, April 24, 1997.

40. Potter, “Before The Deluge? “ *op. cit.*, p. 11.

41. Senate Committee on Governmental Affairs, “Hearings on Global Proliferation Of Weapons Of Mass Destruction: Illicit Trafficking Of Nuclear Materials, *Staff Statement*, March 22, 1996.

42. Presentation by Lothar Koch, Special Fissile Material Workshop #5, Lawrence Livermore National Laboratory, February 3-4, 1998.

43. Frontline Interview with Jan Rathausky, 1996, http://www.pbs.org/wgbh/pages/frontline/shows/nukes/interviews/rathausky.html.

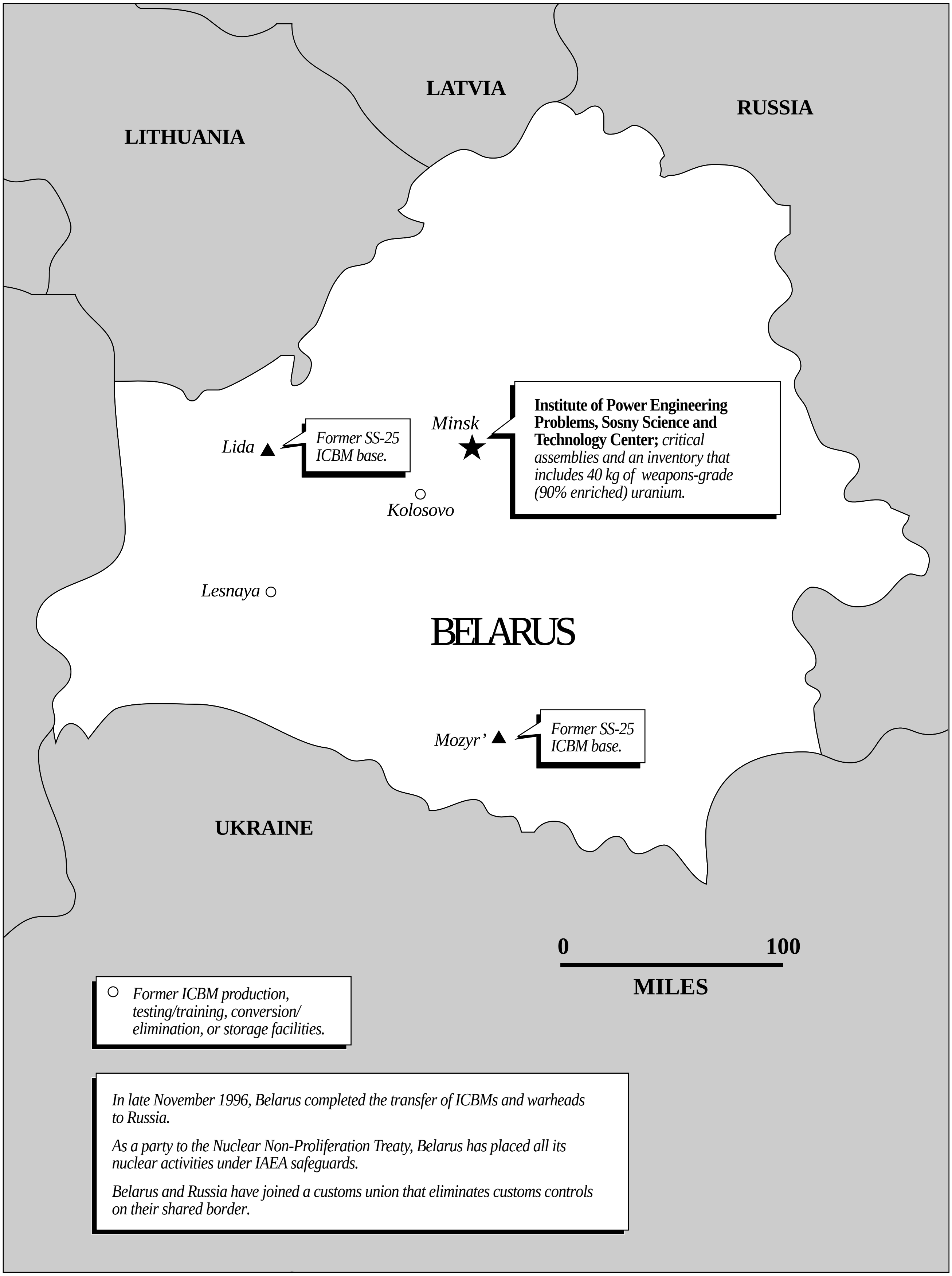
44. Frontline Timeline, Prague, Czech Republic, *op. cit.*

45. *Ibid.*

46. Fedor Ryurikov, "Yadernaya Kontrabanda Grozit Tsepnoy Reaktsiyey," *Obshchaya Gazeta,* October 9-15, 1997, No. 40, p. 8.

47. Ondrej Benda and Ross Larsen, "Uranium Smuggling Case Botched, Judge Tells Cops," *The Prague Post*, September 17-23, 1997.

Appendices



Former SS-25 ICBM base. (Lida)

Institute of Power Engineering Problems, Sosny Science and Technology Center; *critical assemblies and an inventory that includes 40 kg of weapons-grade (90% enriched) uranium.*

Former SS-25 ICBM base. (Mozyr')

○ *Former ICBM production, testing/training, conversion/ elimination, or storage facilities.*

In late November 1996, Belarus completed the transfer of ICBMs and warheads to Russia.

As a party to the Nuclear Non-Proliferation Treaty, Belarus has placed all its nuclear activities under IAEA safeguards.

Belarus and Russia have joined a customs union that eliminates customs controls on their shared border.

SOURCES: NIS Nuclear Profiles Database, Center for Nonproliferation Studies, Monterey Institute of International Studies; START Treaty Memoranda of Understanding (MOU), September 1990 - July 1997.

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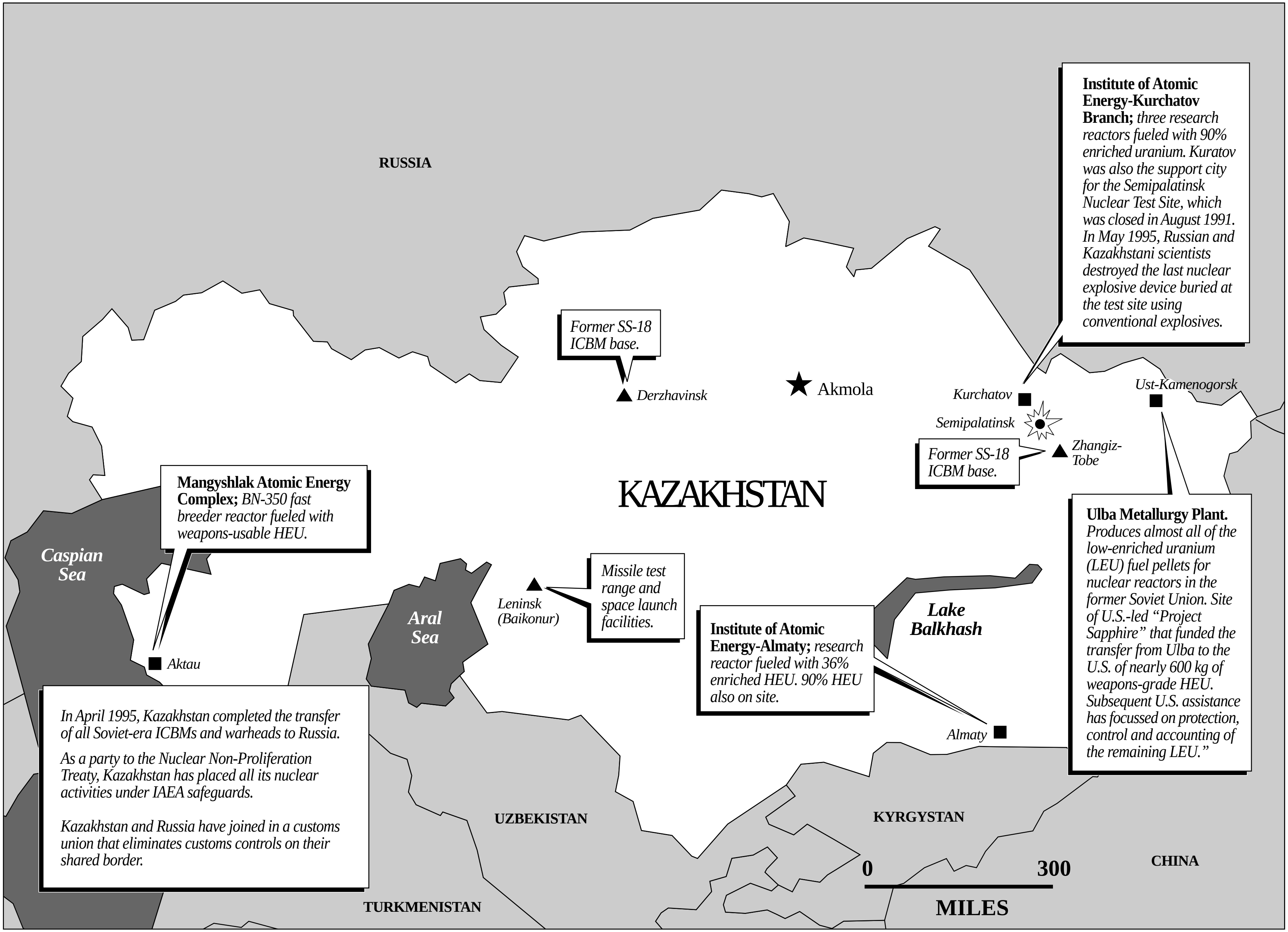

Institute of Atomic Energy-Kurchatov Branch; *three research reactors fueled with 90% enriched uranium. Kuratov was also the support city for the Semipalatinsk Nuclear Test Site, which was closed in August 1991. In May 1995, Russian and Kazakhstani scientists destroyed the last nuclear explosive device buried at the test site using conventional explosives.*

Former SS-18 ICBM base.

Former SS-18 ICBM base.

Mangyshlak Atomic Energy Complex; *BN-350 fast breeder reactor fueled with weapons-usable HEU.*

Missile test range and space launch facilities.

Institute of Atomic Energy-Almaty; *research reactor fueled with 36% enriched HEU. 90% HEU also on site.*

Ulba Metallurgy Plant. *Produces almost all of the low-enriched uranium (LEU) fuel pellets for nuclear reactors in the former Soviet Union. Site of U.S.-led "Project Sapphire" that funded the transfer from Ulba to the U.S. of nearly 600 kg of weapons-grade HEU. Subsequent U.S. assistance has focussed on protection, control and accounting of the remaining LEU."*

In April 1995, Kazakhstan completed the transfer of all Soviet-era ICBMs and warheads to Russia.

As a party to the Nuclear Non-Proliferation Treaty, Kazakhstan has placed all its nuclear activities under IAEA safeguards.

Kazakhstan and Russia have joined in a customs union that eliminates customs controls on their shared border.

SOURCES: NIS Nuclear Profiles Database, Center for Nonproliferation Studies, Monterey Institute of International Studies; START Treaty Memoranda of Understanding (MOU), September 1990 - July 1997.

Russia's Nuclear Weapons Infrastructure

Operational Strategic Nuclear Weapons Facilities

- ■ *Silo-based Inter-Continental Ballistic Missiles (ICBMs)*
- ☒ *Road-mobile ICBMs*
- ⊡ *Rail-mobile ICBMs*
- ✪ *Anti-Ballistic Missiles (ABMs)*
- ⬢ *Submarine Launched Ballistic Missiles (SLBMs)*
- ▲ *Heavy Bombers carrying Air-Launched Cruise Missiles (ALCMs) or Gravity Bombs*

SOURCES: START Memorandum of Understanding (MOU), September 1990, December 1994, July 1995, and December 1995.

Locations with Weapons-Usable Fissile Material for One or More Nuclear Bombs

- ◒ *Plutonium Production*
- ⊗ *Uranium Enrichment/Processing*
- ▬ *Warhead Assembly/Dismantlement*
- ⊙ *Research Institute/Research Reactor*
- ◪ *Fuel Storage*

SOURCE: Monterey Institute of International Studies, Monterey, CA; Natural Resources Defense Council, Washington, DC; U.S. Department of Energy, Washington, DC.

On January 14, 1994, Ukraine agreed to transfer all nuclear warheads on its territory to Russia pursuant to a Trilateral Statement with the United States and Russia. By June 1, 1996, Ukraine had completed the transfer of all warheads, over 1,800 in total, to Russia. In addition, on November 16, 1994, the Ukrainian parliament approved Ukraine's accession to the Nuclear Non-Proliferation Treaty. Ukraine deposited its instrument of accession on December 5, 1994, and IAEA inspections of all its nuclear facilities began in 1995.

Institute of Nuclear Research; *research reactor fueled by 36% and 90% HUE.*

Airbase with Blackjack strategic bombers.

Kharkiv Physics and Technology Institute; *facility stores up to 75 kg of weapons-grade (90% enriched) uranium.*

Airbase with Bear-H strategic bombers.

Former SS-19 ICBM base

Location of several heavy-water production plants giving Ukraine the capability to produce about 250 metric tons of heavy-water per year.

Former SS-19 and SS-24 ICBM base

Center of uranium mining activities in Ukraine.

Sevastopol Institute of Nuclear Energy and Industry; *reseach reactor and two subcritical assemblies fueled with 36% HEU.*

⚛ *Operational nuclear power station(s)*

■ *Nuclear research institute, research reactor, storage facility, or nuclear infrastructure. See Table I-E for details*

▲ *Former ICBM base, production site, or strategic bomber base.*

SOURCES: NIS Nuclear Profiles Database, Center for Nonproliferation Studies, Monterey Institute of International Studies; START Treaty Memoranda of Understanding (MOU), and Department of Energy, "MPC&A Program: Strategic Plan," January 1998