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NUCLEAR NONPROLIFERATION

Status of U.S. Efforts to Improve Nuclear Material Controls in Newly Independent States

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National Security and
International Affairs Division

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The Honorable Sam Nunn
Ranking Minority Member
Permanent Subcommittee
on Investigations
Committee on Governmental Affairs
United States Senate

The Honorable Floyd D. Spence
Chairman
The Honorable Ronald V. Dellums
Ranking Minority Member
Committee on National Security
House of Representatives

This report responds to your request that we review U.S. efforts to strengthen controls over nuclear material in the newly independent states of the former Soviet Union. As requested, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after its issue date. At that time, we will send copies to the Secretaries of State, Defense, and Energy; and the Chairman of the Nuclear Regulatory Commission. We will also make copies available to other interested parties on request.

If you have any questions concerning this report, we can be reached at (202) 512-4128 and (202) 512-3841, respectively. Major contributors to this report are listed in appendix III.

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Executive Summary

Purpose

Safeguarding nuclear material that can be used directly in nuclear explosives has become a primary national security concern for the United States and the newly independent states of the former Soviet Union. Terrorists and countries seeking nuclear weapons could use as little as 25 kilograms of highly enriched uranium (HEU) or 8 kilograms of plutonium to build a nuclear explosive. The seizure of HEU and plutonium in Europe and Russia has prompted concerns about how the newly independent states control their direct-use materials. The Ranking Minority Member of the Permanent Subcommittee on Investigations, Senate Governmental Affairs Committee, and the Chairman and Ranking Minority Member of the House Committee on National Security requested that GAO review U.S. efforts to help the newly independent states strengthen their nuclear material controls.

GAO's report addresses (1) the nature and extent of problems with controlling direct-use nuclear materials in the newly independent states; (2) the status and future prospects of U.S. efforts to help strengthen controls in Russia, Ukraine, Kazakstan, and Belarus; and (3) the executive branch's consolidation of U.S. efforts in the Department of Energy (DOE). The scope of GAO's review included direct-use nuclear material controlled by civilian authorities in the newly independent states and direct-use material used for naval nuclear propulsion purposes. GAO did not review the protection, control, and accounting systems used for nuclear weapons in the possession of the Ministry of Defense in Russia. U.S. officials believe there to be relatively better controls over weapons in the custody of the Ministry of Defense than over material outside of weapons.[1] GAO recently issued a report that addressed the safety of nuclear facilities in the newly independent states.[2]

Background

"Direct-use nuclear material" consists of HEU and plutonium that is relatively easy to handle because it has not been exposed to radiation or has been separated from highly radioactive materials.[3] Direct-use material presents a high proliferation risk because it can be used to manufacture a nuclear weapon without further enrichment or irradiation in a reactor.

[1]The Department of Defense (DOD) has an ongoing program with the Russian Ministry of Defense to enhance the security of nuclear weapons in Ministry of Defense custody during transportation and storage.

[2]See Nuclear Safety: Concerns With Nuclear Facilities and Other Sources of Radiation in the Former Soviet Union (GAO/RCED-96-4 Nov. 7, 1995).

[3]HEU is uranium enriched above 20 percent in the isotope uranium 235. An isotope is a variation of a chemical element.

Many types of nuclear facilities routinely handle, process, or store such direct-use materials. Direct-use material can be found at research reactors, reactor fuel fabrication facilities, uranium enrichment plants, spent fuel reprocessing facilities, and nuclear material storage sites, as well as nuclear weapons production facilities. Material protection, control, and accounting (MPC&A) systems are used at such facilities to deter, detect, and respond to attempted thefts.

The United States is pursuing two different, but complementary strategies to achieve its goals of rapidly improving nuclear material controls over direct-use material in the newly independent states: a government-to-government program, and an initiative known as the lab-to-lab program.[4] Under the government-to-government program, initially sponsored and funded by the Department of Defense Cooperative Threat Reduction (CTR) program,[5] the United States agreed in 1993 to work directly with the governments of Russia, Ukraine, and Kazakstan to develop national MPC&A systems and improve controls over civilian nuclear material. The United States extended such assistance to Belarus in 1995. Although CTR funds were used, DOE was responsible for implementing the program. In April 1994, DOE initiated the lab-to-lab program to work directly with Russian nuclear facilities in improving their MPC&A systems. The program is limited to Russia and intended to rapidly improve controls at civilian research, naval nuclear propulsion, and civilian-controlled, nuclear weapons-related facilities. This program is funded jointly by DOE and the CTR program.[6]

Results in Brief

The Soviet Union produced approximately 1,200 metric tons of HEU and 200 metric tons of plutonium. Much of this material is outside of nuclear weapons, is highly attractive to theft, and the newly independent states may not have accurate and complete inventories of the material they inherited. Social and economic changes in the newly independent states have increased the threat of theft and diversion of nuclear material, and

[4]The government-to-government program is implemented through formal agreements that establish, among other things, rights to audit and examination by U.S. officials. The lab-to-lab program works directly with Russian nuclear facilities and is not bound by the formal agreements. To the maximum extent feasible, the government-to-government programs are required to use U.S. goods and services, while the lab-to-lab program can purchase goods and services from other suppliers as needed.

[5]Congress established the CTR program in 1991 to help Russia, Ukraine, Kazakstan, and Belarus safely store, transport, and destroy weapons of mass destruction and prevent their proliferation. See Weapons of Mass Destruction: Helping the Former Soviet Union Reduce the Threat: An Update (GAO/NSIAD-95-165, June 9, 1995).

[6]DOE is also providing assistance to upgrade four facilities that are not included in the lab-to-lab program. These facilities are located in Georgia, Latvia, Lithuania, and Uzbekistan.

with the breakdown of Soviet-era MPC&A systems, the newly independent states may not be as able to counter the increased threat. Nuclear facilities rely on antiquated accounting systems that cannot quickly detect and localize nuclear material losses. Many facilities lack modern equipment that can detect unauthorized attempts to remove nuclear material from facilities. While as yet there is no direct evidence that a black market for stolen or diverted nuclear material exists in the newly independent states, the seizures of direct-use material in Russia and Europe have increased concerns about theft and diversion.

U.S. efforts to help the newly independent states improve their MPC&A systems for direct-use material had a slow start, but are now gaining momentum. DOD's government-to-government CTR program obligated $59 million and spent about $4 million from fiscal years 1991 to 1995 for MPC&A improvements in Russia, Ukraine, Kazakstan, and Belarus. The program has provided working group meetings, site surveys, physical protection equipment, computers, and training for projects in Russia, Ukraine, Kazakstan, and Belarus. Initially, the program was slow because (1) until January 1995, the Russian Ministry of Atomic Energy (MINATOM) had refused access to Russian direct-use facilities and (2) CTR-sponsored projects at facilities with direct-use materials in Ukraine, Kazakstan, and Belarus were just getting underway. According to DOD officials, program requirements for using U.S. goods and services and for audits and examinations also delayed implementation. The program began to gain momentum in January 1995 when CTR program and MINATOM officials agreed to upgrade nuclear material controls at five high-priority facilities handling direct-use material.[6] DOE and Russia's nuclear regulatory agency have also agreed to cooperate on the development of a national MPC&A regulatory infrastructure.

DOE's lab-to-lab program obligated $17 million and spent $14 million in fiscal years 1994 and 1995. This program has improved controls at two "zero-power" research reactors, and begun providing nuclear material monitors to several MINATOM defense facilities to help them detect unauthorized attempts to remove direct-use material.[7] In fiscal year 1996, the program is implementing additional projects in MINATOM's nuclear defense complex.

[6]Subsequent to the conclusion of GAO's review, DOE and MINATOM agreed to add four additional sites to the government-to-government program and two additional sites to the lab-to-lab program.

[7]A zero-power research reactor is a type of research reactor using fuel that is not very radioactive.

In fiscal year 1996, the United States expanded the MPC&A assistance program to include all known facilities with direct-use material outside of weapons in the newly independent states. Management and funding for the expanded program were consolidated within DOE. DOE plans to request from Congress $400 million over 7 years for the program. However, the expanded program faces several inherent uncertainties involving its overall costs and U.S. ability to verify that assistance is being used as intended. DOE is responding to these uncertainties by developing a long-term plan and a centralized cost reporting system and by implementing a flexible audit and examination program.

Principal Findings

Nature and Extent of the Problem

Much of the 1,200 metric tons of highly enriched uranium and 200 metric tons of plutonium produced by the Soviet Union is outside of nuclear weapons; this stockpile of material is expected to grow rapidly as Russia proceeds to dismantle its nuclear weapons. According to DOE, this material is located at 80 to 100 civilian research, naval nuclear propulsion, and civilian controlled nuclear weapons-related facilities. It is considered to be highly attractive to theft because it is (1) not very radioactive and is therefore relatively safe to handle and (2) in forms that make it readily accessible to theft, such as items stored in containers that can easily be carried by one or two persons, or in components from dismantled weapons.

Nuclear materials in the newly independent states are more vulnerable to theft and diversion than in the past. Soviet-era control systems relied heavily on (1) keeping nuclear material in secret cities and facilities, (2) closely monitoring nuclear industry personnel, and (3) severely punishing control violations. Closed borders and the absence of a black market for nuclear material also lessened the threat of diversion. Without the secrecy and heavy security of the Soviet system, facilities in the newly independent states must now rely to a greater degree on other control systems such as manual, paper-based tracking systems—which cannot quickly locate and assess material losses—and on labor-intensive physical protection systems that lack monitors for detecting attempts to steal nuclear material from a facility. In addition, the newly independent states may not have complete and accurate inventories of their nuclear materials because the Soviet Union did not conduct complete and comprehensive

physical inventories at their nuclear facilities. Some of the facilities GAO visited in March 1995 did not have a comprehensive inventory of their nuclear materials on hand.

Initial Efforts to Improve Control Systems in the Newly Independent States Had a Slow Start

Until January 1995, MINATOM refused to grant CTR technical experts access to direct-use facilities, limiting the program's efforts to a low-enriched uranium fuel fabrication line. This obstacle was removed in January 1995 when MINATOM agreed to allow access to five facilities with direct-use material. In July 1995, the CTR-sponsored program made progress in controlling direct-use material by installing physical protection equipment and providing training at a MINATOM facility that includes an HEU fuel fabrication line. The Kazakstani, Ukrainian, and Belarussian governments have been more willing to allow the United States to help upgrade MPC&A systems at their direct-use material facilities. However, CTR-sponsored projects in these countries are just beginning, and improvements to controls over their direct-use materials will not be completed until the middle of 1996 at the earliest.

Working directly with institutes and operating facilities, DOE's lab-to-lab program has completed the first phase of an MPC&A project at a MINATOM zero-power research reactor that will eventually computerize its inventory system for thousands of kilograms of direct-use material and upgrade its MPC&A systems. DOE's program has also upgraded controls at a zero-power research reactor in Moscow containing about 80 kilograms of direct-use material by (1) increasing physical protection for the reactor building, (2) implementing a computerized material accounting system, and (3) installing access control equipment. The lab-to-lab program has also deployed nuclear material monitors at three MINATOM nuclear weapons facilities and two civilian research facilities. Additional monitors were being shipped as GAO concluded its review.

United States Expands MPC&A Assistance

The executive branch has decided to consolidate MPC&A assistance in DOE. In September 1995, the President directed DOE to develop a long-range plan to improve MPC&A systems at all facilities in the newly independent states handling direct-use material by the year 2002. The President also transferred funding and management responsibilities for the CTR MPC&A program from DOD to DOE in fiscal year 1996. However, DOE faces several inherent uncertainties in managing an expanded assistance program over the next 7 years. For example, while DOE estimates that the program will require $400 million to upgrade 80 facilities with direct-use material, it

faces uncertainties in both the number of facilities to be covered (which could range to more than 100) and the cost per facility (ranging from $5 million to $10 million per facility). Because of these uncertainties, program costs could range from $400 million to over $1 billion. In addition, DOE's ability to directly assess program progress and confirm that U.S. assistance is used for its intended purposes may be limited because the Russians may limit the measures that can be used for these purposes at highly sensitive facilities.

DOE Is Responding to Program Uncertainties

DOE is taking steps to ensure that the program is successful and that U.S. funds are well spent.

- DOE is developing a long-term plan for the expanded program that consolidates the program plans for the government-to-government and lab-to-lab programs. According to DOE, the plan establishes objectives, priorities, and timetables for implementing projects at the 80 to 100 facilities in the newly independent states. DOE has drafted the plan; however, the plan had not been issued at the time GAO concluded its review in January 1996.
- DOE is developing a consolidated centralized program cost-reporting system intended to provide DOE with current financial status for government-to-government and lab-to-lab projects. The information should be useful in responding to changing budgetary requirements for the program.
- DOE is implementing a flexible audit and program evaluation approach to provide some assurances that assistance is used only for its intended purposes. Under the approach, the United States will pay Russian laboratories for services and equipment upon completion of clearly defined delivered products and will use a series of direct and indirect measures to evaluate program progress and effectiveness. DOE expects to issue a report on assurances obtained by the lab-to-lab program in March 1996.

Recommendations

GAO is making no recommendations in this report.

Agency Comments

In commenting on this report, the Departments of Energy and State generally agreed with GAO's assessment of the U.S. effort to improve nuclear material controls in the newly independent states. The Department of State offered additional editorial comments that have been incorporated

into the report where appropriate. DOD officials also agreed with the facts as presented in this report, but expressed concern about how the report portrays the relative success of the government-to-government and lab-to-lab programs. These officials stated that the programs are complementary approaches to achieving the goal of improving controls and accountability over direct-use nuclear material in the newly independent states. GAO agrees and has modified the report accordingly.

Contents

Figures

Abbreviations

CTR	Cooperative Threat Reduction
DOD	Department of Defense
DOE	Department of Energy
GAN	Gosatomnadzor
HEU	highly enriched uranium
KGB	Komityet Gosudarstvyennoj Byezopasnosti
MPC&A	material protection control and accounting
MINATOM	Russian Ministry of Atomic Energy
NIS	newly independent states

Introduction

Direct-use nuclear material is essential for building nuclear weapons. The diversion or theft of such material can enable terrorists or countries to build nuclear weapons without investing in expensive nuclear technologies and facilities. One way of deterring and detecting theft is by instituting nuclear material control systems on a national level and at facilities handling direct-use material.

What Is Direct-Use Material?

"Direct-use nuclear material" consists of highly enriched uranium (HEU) and plutonium that is relatively easy to handle because it has not been exposed to radiation or has been separated from highly radioactive materials.[1] Direct-use material presents a high proliferation risk because it can be used to manufacture a nuclear weapon without further enrichment or irradiation in a reactor. According to the International Atomic Energy Agency, approximately 25 kilograms of HEU or 8 kilograms of plutonium is needed to manufacture a nuclear explosive, although the Department of Energy (DOE) suggests the amounts needed to build a weapon may be smaller.

Many types of nuclear facilities routinely handle, process, or store direct-use material. Besides nuclear weapon production facilities, direct-use material can also be found at research reactors, reactor fuel fabrication facilities, uranium enrichment plants, spent fuel reprocessing facilities, and nuclear material storage sites. Most civilian nuclear power facilities are of less concern because they use low-enriched or natural uranium as fuel, which would require additional enrichment before the fuel would be suitable for nuclear weapons. While these reactors produce plutonium in spent reactor fuel, such fuel is dangerous to handle because it is highly radioactive. Spent reactor fuel also requires reprocessing before it is suitable for nuclear weapons.

How Is Nuclear Material Controlled?

Nuclear materials are controlled to prevent and detect their theft. Nuclear material can be stolen or diverted by (1) outside individuals or groups, such as terrorists attempting to break in and steal nuclear material; (2) inside individuals or groups, such as one or more employees that have access to nuclear material; and (3) combinations of insiders and outsiders.

A nuclear material control system consists of three overlapping components—material protection, material control, and material

[1]HEU is uranium enriched above 20 percent in the isotope uranium 235. An isotope is a variation of a chemical element.

accounting. Together they compose a set of procedures, personnel, and equipment that address both insider and outsider threats.

Material protection systems are designed to limit access to nuclear material by outside individuals and prevent the unauthorized removal of material from a facility by inside individuals. Nuclear facilities protect their material by (1) installing fences with sensors and television cameras to delay, detect, and assess unauthorized intrusions; (2) posting armed guards at entry and exit points; (3) establishing a protective response force that can react to unauthorized intrusions; and (4) installing nuclear material monitors to detect attempts to remove material from a facility. Nuclear facilities also assess the reliability of personnel with access to nuclear material by conducting background checks and continuously monitoring their behavior.

Material control systems contain, monitor, and establish custody over nuclear material. Nuclear facilities control material by (1) storing material in containers and vaults equipped with seals that can indicate when tampering may have occurred, (2) controlling access to and exit from nuclear material areas using badge and personnel identification equipment, and (3) establishing procedures to closely monitor nuclear materials.[2] Nuclear facilities also designate custodians to be responsible for nuclear material in their possession.

Material accounting systems maintain information on the quantity of nuclear materials within specified areas and on transfers in and out of those areas. They employ periodic inventories to count and measure nuclear material by element and isotopic content. Nuclear facilities use the inventory and transfer data to establish nuclear material balances, which track materials on hand and the flow of material within a specified area. The material balances are closed periodically by reconciling physical inventory with recorded inventories, correcting errors, calculating inventory differences and evaluating their statistical differences, and performing trend analysis to detect protracted theft of nuclear material. Nuclear facilities in the United States are capable of updating material accounting data within 24-hour periods. Some U.S. facilities with more modern nuclear accounting systems are capable of updating material accounting data within 4 hours.

[2]One such procedure is to require two or more authorized persons to be present when nuclear material is accessed. Another procedure is to use closely monitored television cameras to maintain surveillance over nuclear material.

In addition to facility systems, the United States and most other countries have established national material protection, control, and accounting (MPC&A) systems. These systems include regulations governing procedures for nuclear material protection control and accounting, inspection requirements to ensure that the systems are implemented properly, and tracking systems to provide information on the location and disposition of nuclear material nationally. In the United States, the Nuclear Regulatory Commission and DOE have promulgated regulations on controlling nuclear material.

How Is the United States Assisting the Newly Independent States to Improve Their Nuclear Material Controls?

The United States is pursuing two different, but complementary strategies to achieve its goals of rapidly improving nuclear material controls over direct-use material in the newly independent states (NIS).[3] Under the Cooperative Threat Reduction (CTR) program,the U.S. Department of Defense (DOD) entered into agreements with the governments of Russia, Ukraine, and Kazakstan in 1993 to rapidly improve nuclear material controls over civilian nuclear material and develop national MPC&A systems in these countries. On June 23, 1995, DOD entered into an agreement with the Ministry of Defense in Belarus to improve controls over its civilian nuclear material. DOE implements the programs under these agreements.[4]

As a complementing strategy, DOE initiated a program in April 1994 of MPC&A cooperation with Russia's nuclear institutes, operating facilities, and enterprises. This initiative, known as the lab-to-lab program, brings U.S. and Russian laboratory personnel directly together to work cooperatively on implementing MPC&A upgrades at Russian nuclear facilities. The purpose of the lab-to-lab program is to rapidly improve MPC&A at civilian, naval nuclear, and nuclear weapons-related facilities handling direct-use material in Russia. The program is jointly funded by DOE and the CTR program.

[3]Other related U.S. efforts include the International Science and Technology Center's Project 40, the Cooperative Threat Reduction program sponsored Russian storage facility and Project Sapphire. Project 40 will develop an upgraded approach for safeguarding complex sensitive nuclear fuel cycle facilities. The storage facility will incorporate MPC&A elements into its design. Under Project Sapphire, the United States transferred approximately 600 kilograms of weapons grade HEU from Kazakstan to the United States.

[4]The CTR program was established by Congress in 1991 to help the newly independent states safely secure, transport, store, and destroy weapons and weapons material and prevent weapons proliferation. The program is conducted with the four states that inherited nuclear weapons when the Soviet Union dissolved: Belarus, Kazakstan, Russia, and Ukraine. See Weapons of Mass Destruction: Helping the Former Soviet Union Reduce the Threat: An Update (GAO/NSIAD-95-165, June 9, 1995).

Objectives, Scope, and Methodology

Our objectives were to (1) review the nature and extent of problems with controlling nuclear materials in the NIS; (2) determine the status and future prospects of U.S. efforts to help strengthen controls over direct-use nuclear material in Russia, Ukraine, Kazakstan, and Belarus; and (3) assess plans for consolidating these efforts in DOE. While seven NIS inherited direct-use nuclear material, we focused on the four countries that have been the primary recipients of U.S. assistance—Russia, Ukraine, Kazakstan, and Belarus.

The scope of our review included direct-use nuclear material controlled by civilian authorities in the NIS and direct-use material used for naval nuclear propulsion purposes. We did not review the protection, control, and accounting systems used for nuclear weapons in the possession of the Ministry of Defense in Russia. U.S. officials believe there to be relatively better controls over weapons in the custody of the Ministry of Defense than over material outside of weapons.[5] We also did not include in our review the upgrades at four sites funded by DOE that were not part of the lab-to-lab program. We recently issued a report that addressed the safety of facilities in the NIS.[6]

To meet our objectives, we reviewed U.S. assessments of the nature and extent of nuclear material control problems in the NIS; pertinent program documents, including agreements between DOD and the Russian Ministry of Atomic Energy (MINATOM), the Ukrainian State Committee on Nuclear and Radiation Safety, the Ministry of Defense of Kazakstan, the Ministry of Defense of Belarus, and between DOE and Gosatomnadzor (GAN); program plans; trip reports; quarterly progress reviews and State Department cables; and program budget, obligation, and expenditure data for the CTR-sponsored government-to-government program and for DOE's lab-to-lab program. We also discussed with DOE plans to consolidate U.S. MPC&A assistance in DOE.

We interviewed officials from DOD, DOE, the Department of State, the Nuclear Regulatory Commission, the National Laboratories (including Los Alamos, Sandia, and Lawrence Livermore), the Pacific Northwest Laboratory, the National Security Council, and the National Academy of Sciences. We also interviewed nonproliferation specialists from the

[5]As part of the CTR program, DOD has an ongoing program with the Russian Ministry of Defense to enhance the security of nuclear weapons in Ministry of Defense custody during transportation and storage.

[6]See Nuclear Safety: Concerns With Nuclear Facilities and Other Sources of Radiation in the Former Soviet Union (GAO/RCED-96-4 Nov. 7, 1995).

Monterey Institute of International Studies. In Russia, we interviewed officials from MINATOM, Gosatomnadzor (the Russian nuclear regulatory agency), the Kurchatov Institute, the Institute of Physics and Power Engineering, the Elektrostal Machine Building Plant, the MINATOM nuclear weapons laboratories Arzamas-16 and Chelyabinsk-70, and the Kazakstan Atomic Energy Agency.

In addition, we toured facilities at the Kurchatov Institute and the Institute of Physics and Power Engineering, located in the Russian Federation, to obtain information on current MPC&A systems implemented at these facilities. We visited sites in Russia that have been the recipients of U.S. assistance efforts, including the Elektrostal Machine Building Plant, the Kurchatov Institute, and the Institute of Physics and Power Engineering. We also witnessed the demonstration of a model MPC&A system at Arzamas-16.

Our review was conducted between November 1994 and January 1996 in accordance with generally accepted government auditing standards.

Nature and Extent of Nuclear Material Control Problems in the NIS

With the dissolution of the Soviet Union, Russia and six other NIS inherited hundreds of tons of direct-use nuclear material. Much of this material is thought to be located at 80 to 100 civilian, naval nuclear, and nuclear weapons-related facilities, mostly in Russia. However, U.S. and NIS officials do not know the exact amounts and locations of this material. Much of it is highly attractive to theft because it is relatively safe to handle and is not in weapons. U.S. officials are concerned that social and economic changes in the NIS have increased the threat of theft and diversion of nuclear material, and with the breakdown of Soviet-era MPC&A systems, the NIS may not be as able to counter the increased threat. While as yet there is no direct evidence that a nuclear black market for stolen or diverted nuclear material exists in the NIS, the seizures of gram and kilogram quantities of direct-use material have increased these concerns.

Nature and Extent of the Problem

The Soviet Union produced up to 1,200 metric tons of HEU and 200 metric tons of plutonium. Much of this material is outside of nuclear weapons, and the stockpile of material outside of weapons is expected to grow rapidly as Russia proceeds to dismantle its weapons. The material is considered to be highly attractive to theft because it is (1) not very radioactive and therefore relatively safe to handle and (2) in forms that make it readily accessible to theft, for example, in containers that can easily be carried by one or two persons or as components from dismantled weapons. This material can be directly used to make a nuclear weapon without further enrichment or reprocessing.

Most of the material is located in Russia. Los Alamos National Laboratory has identified five sectors in the Russian nuclear complex that handle direct-use material.

- Nuclear materials in weapons. (This material is largely in the custody of the Ministry of Defense.[1])
- The MINATOM defense complex, which contains large amounts of nuclear material removed from dismantled nuclear weapons and stockpiles of HEU and plutonium produced for the nuclear weapons program.
- The MINATOM civilian sector, which includes a number of reactor development institutes such as the Institute of Physics and Power

[1]A U.S.-Russian government-to-government agreement concerning technical exchanges on warhead safety and security was signed in December 1994. Also, in 1995 a CTR-sponsored DOD and Ministry of Defense Nuclear Weapons Security Group was formed to coordinate assistance and cooperation to enhance the security of nuclear weapons in the custody of the Ministry of Defense during transportation and storage and to facilitate discussion and information sharing on this and related issues under the Cooperative Nuclear Weapons Security Program. Nuclear material in the custody of the Ministry of Defense was outside the scope of our review.

Engineering at Obninsk, as well as organizations, such as the Elektrostal Machine Building Factory, that produce nuclear fuels and materials for civilian applications. (Some of these institutes and enterprises do both civilian and defense work.)

- Civilian research institutes outside of MINATOM, which include the Kurchatov Institute and facilities run by the Academy of Sciences, the Ministry of Science, and the Commission on Defense Industry. (Most of these institutes possess only small quantities of materials, although some, such as the Kurchatov Institute, possesses several tons of direct-use material.)
- The naval propulsion sector, which includes the Navy and the Ministry of Shipbuilding. (This sector comprises stockpiles of HEU used in submarines and icebreakers.)

Other NIS with facilities that handle direct-use material include Belarus, Georgia, Kazakstan, Latvia, Ukraine, and Uzbekistan. Generally, the nuclear facilities in these countries are operated by their respective atomic energy ministries or academies of science and involve nuclear research centers, research reactors, and, in the case of Kazakstan, a plutonium breeder reactor.

Soviet-Era Nuclear Material Controls

The Soviet Union controlled nuclear materials since the beginning of its nuclear program in the 1940s. The Soviet approach to controlling nuclear materials placed a heavy emphasis on internal security, which corresponded to the political and economic conditions within the Soviet Union. It placed less emphasis on accounting procedures, which were used to monitor production, rather than to detect diversion or ensure the absence of diversion.

The Soviet Union located its nuclear weapons complex in closed secret cities. The cities were separated from other urban areas, self-contained, and protected by fences and guard forces. Personnel working in the Soviet nuclear complex were under heavy surveillance by the KGB. Personnel went through an intensive screening process, and their activities were closely monitored. In general, facilities would control access to nuclear material using a three-person rule, requiring two facility staff members and at least one person from the security services to be present when material was handled. The Soviet-era control system enforced severe penalties for violations of control procedures.

According to U.S. national laboratory officials, the Soviet system accounted for nuclear material, although it was not complete, timely, or accurate. Facilities paid close attention to end-products to meet production quotas and paid less attention to the use of completely measured material balances to track net gains and losses of materials as they were processed or handled. The Soviet system relied on manual, paper-based systems that made tracking material time-consuming. They also used standard estimates of rates of loss for materials that could be held up in processing equipment, such as pipes, rather then measuring actual losses. According to DOE, in these respects, the Soviet system of accounting was similar to that used in the early days of the U.S. nuclear program.

According to Russian officials, traditional Soviet approaches to nuclear material controls were generally effective because (1) the Soviet Union was a closed society (separated by a robust iron curtain) with strict controls over foreign travel by its citizens, (2) internal security within the Soviet Union was quite rigid and strict discipline was carried out when controls were violated, and (3) there was no black market in nuclear materials within the country.

Social and Economic Changes May Increase the Threat of Theft and Diversion of Nuclear Material

Social and economic changes in the NIS have increased the threat of theft and diversion of nuclear material, and Soviet-era MPC&A systems may not be able to adequately counter the increased threat. The major nuclear facilities in the MINATOM weapons complex are no longer secret, and access to these facilities, along with the other nuclear facilities in the NIS, has increased. According to a U.S. government assessment, (1) the difficult economic situation has led to a loss of prestige for nuclear workers, (2) inflation and late payment of wages have eroded the value of salaries, and (3) pervasive corruption in society and the increasing potency of a strong criminal element have weakened the insider protection program based on personnel surveillance.

With these changes, Russian and U.S. officials have become increasingly concerned about growing insider and outsider threats of nuclear theft. According to an official from one of MINATOM's major facilities in its nuclear weapons complex, the insider threat at the facility has increased due to the frustrations of the institute's workers who had not been paid in months. According to this official, this causes changes in their attitudes toward their work and places pressures on their families. The outsider threat has also increased at this facility because the closed city is now

open to businesspeople and outside workers who visit for short periods of time. According to this official, the institutes do not have background information on the visitors. Consequently, they have a lower level of trust in the visitors than in the employees who have been working at the facility. According to this official, while no nuclear material has been stolen from this facility, other precious metals such as platinum and gold have been.

Current Status of Nuclear Material Controls at NIS Facilities

With the erosion of traditional nuclear controls, current nuclear control systems in the NIS have weaknesses that could result in the theft of direct-use materials. The NIS may not have complete and accurate inventories of their nuclear materials, and some material may have been withheld from facility accounting systems. Nuclear facilities rely on antiquated accounting systems and practices that cannot quickly detect and localize nuclear material losses. Many NIS facilities also lack certain types of modern equipment that can detect unauthorized attempts to remove nuclear material from facilities.

The NIS May Not Have Accurate and Complete Inventories

The NIS may not have accurate and complete inventories of the direct-use material they inherited from the former Soviet Union. According to a GAN official, the nuclear safeguard system inherited from the former Soviet Union was not a comprehensive system. The Soviet Union did not have a national material control and accounting system and according to a Russian laboratory official, the Soviet Union did not conduct comprehensive physical inventories of nuclear material at its nuclear facilities. Some of the facilities we visited, such as the Kurchatov Institute, were in the process of conducting such a comprehensive inventory, but it was not completed at the time of our visit. At the Institute of Physics and Power Engineering, officials were conducting an inventory of 70,000 to 80,000 small disk-shaped fuel elements containing direct-use uranium and plutonium at one reactor. When we visited the facility, they did not have an exact count of the elements. Figure 2.1 shows examples of the small disk-shaped fuel elements we observed at this facility that could be attractive to theft.

Figure 2.1: Examples of Small, Disk-Shaped Fuel Elements to Be Inventoried

Source: GAO.

U.S. and Russian officials are also concerned that some direct-use nuclear material has not yet been discovered at NIS nuclear facilities. According to U.S. national laboratory officials, some nuclear material may have been withheld from facility accounting systems so that plant managers could make up shortfalls in meeting their production quotas. According to another national laboratory official, organizations do not always share information with one another on the location and availability of specific nuclear products. Russian officials are concerned that they have no real

information on the amounts or presence of some nuclear material and that this material has yet to be discovered. According to a DOD official, HEU for a Soviet navy reactor program that was terminated years earlier was discovered by Kazakstani officials after the Soviet Union dissolved. This HEU, enough for over two dozen nuclear weapons, was transferred from Kazakstan to the United States under Project Sapphire.

U.S. officials are uncertain as to whether they have identified all facilities within the NIS where direct-use material is located. The United States has identified 80 to 100 facilities that handle direct-use material in the NIS. However, according to a DOE official, there may be as many as 35 additional facilities where such material is handled.

Material Accounting and Control Systems Would Have Difficulty Quickly Detecting Diversion or Theft

Many nuclear facilities in the NIS rely on manual, paper-based material accounting systems that cannot quickly locate and assess material losses, rather than computer-based systems. Nuclear facility operators have to manually check hundreds of paper records to determine if material is missing. In contrast, U.S. nuclear facilities use computers extensively to maintain current information on the presence and quantity of all material. U.S. facilities are capable of updating nuclear material accounting information within 24 hours, and some can update material accounting information within 4 hours.

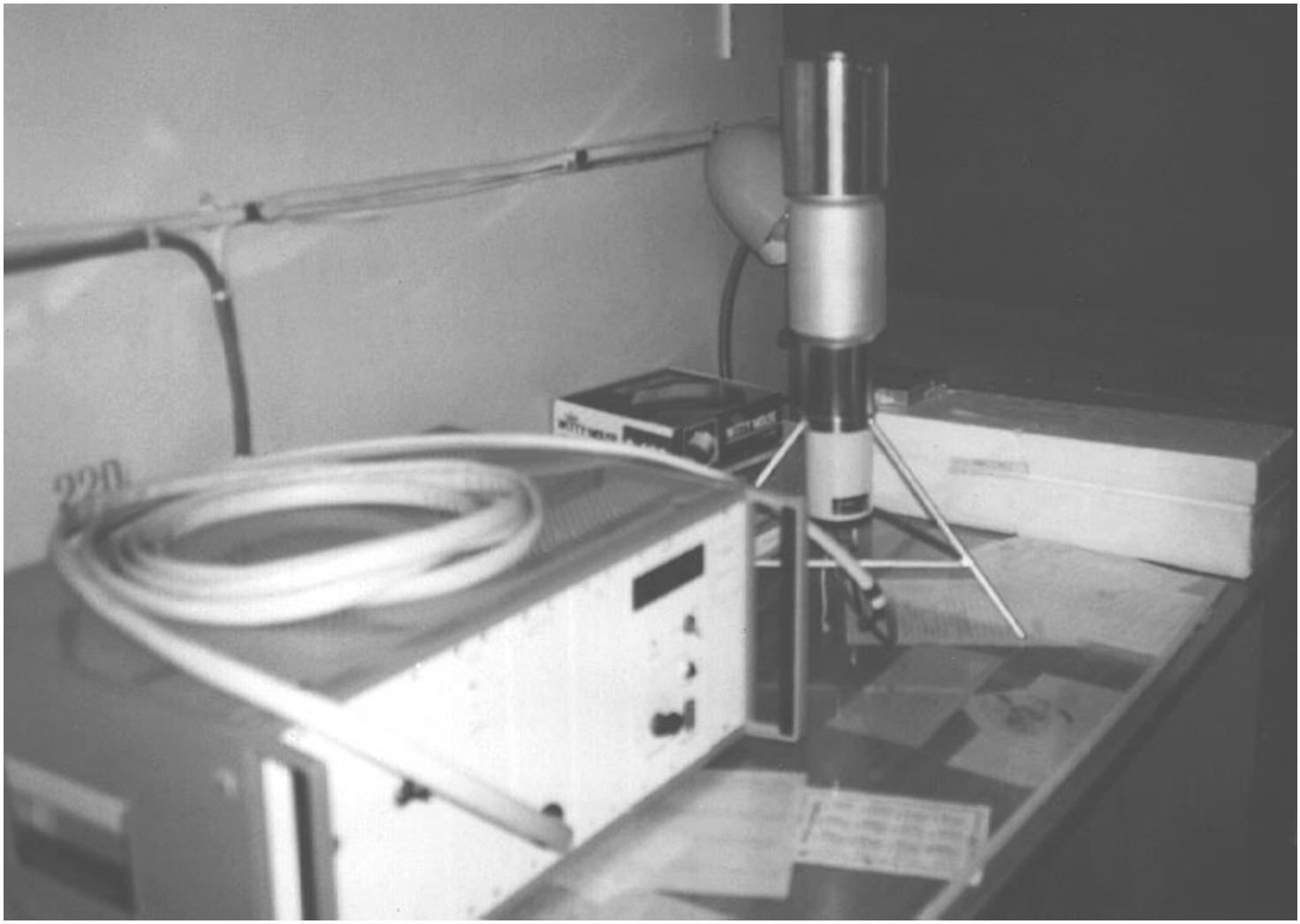
Russian accounting systems do not provide systematic coverage of materials through all phases of the nuclear fuel cycle.[2] According to U.S. national laboratory officials, these systems do not adequately measure or inventory material held up in processing equipment and pipes or material disposed of as waste.

In addition, NIS facilities do not make full use of measured nuclear material balances, which makes it difficult to detect thefts occurring over a long period of time. According to a Los Alamos National Laboratory official, these facilities typically weigh material at certain points in production and generally measure radiation emitted from the material. These procedures, while useful in identifying the types of material present, are less rigorous than required in the United States because they do not measure the quantity of material. Diversions of small amounts of nuclear material could go undetected over time without more accurate measurements. Figure 2.2 shows a Russian radiation measuring instrument we observed being used

[2]The nuclear fuel cycle refers to a sequence of operations involving supplying nuclear fuel for reactors, irradiating fuel in reactors, and handling or storing nuclear fuel.

at a facility to identify the types of material present in reactor fuel elements.

Figure 2.2: A Russian Radiation Measuring Instrument Used to Identify the Uranium and Plutonium Content of Fuel Elements



Source: GAO.

Nuclear facilities in the NIS also use material control equipment that could be made more resistant to tampering by insiders. For example, nuclear material containers and vaults are sealed with a wire and wax seal system that could be removed and replaced without detection. In contrast, in the United States, material is sealed using numbered copper seals that are controlled and crimped, making them much more resistant to tampering.

Material Protection Systems Lack Modern Equipment

Material protection systems at NIS nuclear facilities have weaknesses that could result in the inability to detect insiders or outsiders trying to steal nuclear material. In the United States, sites handling direct-use material are protected by two fences; various sensors designed to delay and detect intruders as they approach a facility; and television cameras, which allow facility personnel to assess the nature of the threat. The nuclear facilities we visited in Russia for the most part did not have such equipment. For example, during our visit to the Kurchatov Institute, we noticed that a concrete fence protecting the main facility was crumbling. The fence appeared to lack television monitors or other sensors. A fence used to protect another site at the institute with large quantities of direct-use material did not appear to have any sensors or television cameras to detect intrusion and had vegetation that could obscure intruders or those leaving the facility.

We toured another site at the Kurchatov Institute where several hundred kilograms of direct-use material were present. Although the site was within the walled portion of the institute, there was no fencing or other intrusion delay and assessment system around the site. Although we were accompanied by an institute official who had cleared our visit with security personnel, we were able to gain access without showing identification. One unarmed security guard was posted within the building. In contrast, during a visit to a Sandia National Laboratory facility in New Mexico, we were required to show identification and display security badges while we visited a facility with large amounts of direct-use material. This facility had numerous armed guards inside and outside the site.

Reports of Diversion of Direct-Use Material

According to U.S. officials, there is no direct evidence that a nuclear black market linking buyers, sellers, and end-users exists for stolen or diverted nuclear material in the NIS. However, the seizure of gram and kilogram quantities of direct-use material in Russia, Germany, and the Czech

Republic have increased concerns about the effectiveness of MPC&A systems in the NIS.

The first case involving the theft or diversion of direct-use material appeared in Russia in 1992. According to U.S. officials, the more significant cases included the following:

- From May to September 1992, 1.5 kilograms of weapons grade HEU were diverted from the Luch Scientific Production Association in Russia by a Luch employee. According to a nonproliferation analyst, the material was diverted in small quantities about 20 to 25 times during the period. The employee was apprehended en route to Moscow.
- In March 1994, three men were arrested in St. Petersburg trying to sell 3.05 kilograms of weapons-usable HEU. According to U.S. officials, Russian media articles claim that the material was smuggled out of a MINATOM facility located near Moscow in an oversized glove.
- On May 10, 1994, 5.6 grams of nearly pure plutonium-239 were seized by German officials.
- On August 10, 1994, 560 grams of a mixed-oxide uranium plutonium mixture were seized at Munich Airport from a flight originating from Moscow.
- On December 14, 1994, 2.72 kilograms of weapons-grade uranium were seized by police in Prague.

U.S. officials stated that they have not uncovered any direct links between buyers of direct-use materials and end-users that would use the material for weapons purposes. However, the cases are troubling for several reasons.

- The cases are the first to involve gram and kilogram quantities of direct-use material.
- They show that individuals are willing to take high risks to traffic in smuggled direct-use material.
- While scientific analysis cannot pinpoint which facilities the material seized in Europe originated from, the criminal investigations suggest that the material may have come from the NIS.
- The detection of nuclear smuggling so far has been by chance, rather than by reliance on physical protection control and accounting systems, or customs checks at the borders of the NIS.

Current Status and Future Prospects for U.S. Assistance to the NIS

The United States is pursuing two different, but complementary strategies to achieve its goals of rapidly improving nuclear material controls over direct-use material in the NIS. The CTR-sponsored government-to-government program, which works directly with the NIS, is only now beginning to improve controls over direct-use material because (1) until January 1995, Russia's MINATOM was reluctant to cooperate with the U.S. program because of security concerns and (2) work at non-Russian facilities with direct-use material is in the early stages of implementation. The DOE lab-to-lab program, which works directly with Russian nuclear facilities, has improved controls over direct-use material at five facilities during its first full year of implementation.[1]

Despite the slow start, the prospects for U.S. efforts to enhance MPC&A in the NIS are improving. Russia and the United States agreed in June 1995 to add five high-priority sites that have large amounts of direct-use material to the CTR-sponsored government-to-government program. In Kazakstan and Ukraine, the CTR-sponsored MPC&A program is progressing steadily with improvements at several sites with direct-use nuclear material. DOE also signed an agreement with GAN, the Russian nuclear regulatory agency, in June 1995 to cooperate on the establishment of a national nuclear materials control and accounting system in Russia. DOE's lab-to-lab program is also expanding to cover MINATOM nuclear weapons facilities.

U.S. MPC&A Assistance Programs in the NIS

Both DOD's CTR-sponsored government-to-government program and DOE's lab-to-lab program were designed to demonstrate MPC&A technology at model facilities and facilitate the transfer of MPC&A improvements to other nuclear facilities in the NIS. The CTR-sponsored program works with the governments of Russia, Ukraine, Kazakstan, and Belarus to upgrade civilian MPC&A at selected facilities and develop regulations, enforcement procedures, and national material tracking systems. DOE's lab-to-lab program works directly with Russian nuclear facilities to upgrade their MPC&A controls.

The two programs differ in their strategies to improve MPC&A in the NIS. The CTR-sponsored program is implemented by DOE through direct government-to-government agreements between DOD and the respective Ministries responsible for atomic energy in Russia, Ukraine, Kazakstan, and Belarus. The agreements and their amendments specify the total amount of funds available to the programs in each country, identify the

[1]The five facilities where controls over direct-use material have been improved are the Kurchatov Institute, the Institute of Physics and Power Engineering, Chelyabinsk-70, Arzamas –16, and Tomsk-7. All are located in Russia.

types of facilities that will participate, establish the roles and responsibilities of the participating organizations, and establish rights to audit and examination by U.S. officials. To the maximum extent feasible, the CTR-sponsored MPC&A programs use U.S. goods and services.

DOE's lab-to-lab program, in contrast, is implemented directly with Russian nuclear facilities. DOE's national laboratories participating in the program sign contracts directly with their Russian laboratory counterparts, and DOE's national laboratories can purchase goods and services from U.S., Russian, or other suppliers as needed. The program includes complete MPC&A upgrades at specific facilities, or the rapid deployment of a particular MPC&A element, such as portal monitors, as needed.

CTR Government-to-Government Program Status

The CTR-sponsored government-to-government program is funding projects in Russia, Ukraine, Kazakstan, and Belarus for improving civilian nuclear material controls at selected model facilities and developing regulations, enforcement procedures, and national material tracking systems. Figure 3.1 shows the location of current CTR-sponsored government-to-government projects.

Figure 3.1: Current CTR Government-to-Government Projects in Russia, Ukraine, Kazakstan, and Belarus

Sources: DOE and GAO.

In Russia, CTR funds have supported MPC&A upgrades for a low-enriched uranium fuel fabrication facility and a training center. In Ukraine and Kazakstan, the program has funded site surveys at facilities that use direct-use material and lower priority material and assisted national authorities in establishing MPC&A regulations and reporting systems. In Belarus, the program has funded a site survey at a facility using direct-use

material and is assisting the Belarussian government in establishing MPC&A regulations and a reporting system.

Since the beginning of the CTR-sponsored program in 1991, DOD has budgeted $63.5 million for government-to-government MPC&A assistance, obligated $59.2 million, and spent $3.8 million. The government-to-government program has provided working group meetings, site surveys, physical protection equipment, computers, and training for projects in Russia, Ukraine, Kazakstan, and Belarus. As of January 1996, none of the projects have been completed. Table 3.1 shows the distribution of CTR government-to-government program funds among Russia, Ukraine, Kazakstan, and Belarus.

Table 3.1: U.S. Assistance for CTR-Sponsored Government-to-Government Programs (fiscal years 1991-95)

Dollars in millions

Country	Budget	Obligations	Expenditures[a]
Russia[b]	$30.0	$27.5	$2.0
Ukraine	22.5	21.5	0.7
Kazakstan	8.0	7.6	1.1
Belarus	3.0	2.6	0
Total	**$63.5**	**$59.2**	**$3.8**

[a]Our prior work found that DOD's expenditure data can significantly understate the value of work performed to date. Although we were unable to obtain data on the value of work performed for the government-to-government program, our prior report found that the value of work performed for CTR projects was almost double the expenditures reported by the program. See Weapons of Mass Destruction: Reducing the Threat From the Former Soviet Union: An Update (GAO/NSIAD-95-165, June 9, 1995) p.10.

[b]The $30 million budgeted and $27.5 million obligated for Russia does not include $15 million in fiscal year 1995 CTR funds for MPC&A upgrades implemented under DOE's lab-to-lab program.

By July 1995, the CTR-sponsored government-to-government program had started to improve physical protection at a facility with direct-use material. The slow pace of the government-to-government program in Russia can be attributed to two major obstacles. The first obstacle involved difficulties in negotiating agreements with MINATOM to obtain access to sites handling direct-use material. The United States proposed to MINATOM in March 1994 that demonstration projects be initiated at two HEU fuel fabrication facilities. The U.S. position was that including these facilities would support nonproliferation objectives. MINATOM rejected the U.S. proposal saying that the inclusion of direct-use material was a sensitive and delicate issue and that experience in cooperating on low enriched uranium facilities would be needed before expanding to direct-use materials. As a

result, the United States agreed to fund only one project in Russia, the low enriched uranium facility at Elektrostal. Recently, physical protection equipment was installed in the building housing the low enriched uranium fuel line. The same building also houses an HEU fuel fabrication line, which will be protected by this equipment. In the summer of 1994, the United States proposed a quick-fix approach to upgrade MPC&A at Russian facilities with direct-use material. Under this approach, the United States would provide expedited assistance to upgrade nuclear material security at key Russian nuclear facilities. Russian officials were not supportive of the approach citing concerns about providing the United States access to sensitive nuclear facilities.

The second obstacle was MINATOM's resistance in recognizing the role of GAN as a nuclear regulatory entity and GAN's own lack of statutory authority for oversight and enforcement of nuclear regulations. According to State Department officials, GAN was often at odds with MINATOM about the ongoing transition of regulatory authority to GAN. Also, GAN was unable to assert its regulatory role because it lacked legislative authority to regulate facilities with nuclear materials. In addition, despite a decree issued in September 1994 by the Russian President, that named GAN as the lead agency in overseeing the security of nuclear materials in Russia and ordered MINATOM to work with GAN on this issue, there are still disputes over authority between ministries that have not been resolved.

In Ukraine, Kazakstan, and Belarus, the CTR-sponsored government-to-government program is working to improve MPC&A systems at nuclear facilities, develop national MPC&A systems, and help them prepare for International Atomic Energy Agency safeguards pursuant to the Nuclear Nonproliferation Treaty. However, CTR-sponsored projects are just beginning, and improvements to controls at the first facility handling direct-use materials will not be completed until mid-1996 at the earliest.

In Ukraine, the program has completed a site survey for the Kiev Institute of Nuclear Research, which uses direct-use material for fuel in a research reactor and has started delivering access control equipment. The program is also in the process of conducting a site survey at the Kharkiv Institute of Physics and Technology, which also contains direct-use material. The program is also implementing an MPC&A project at the South Ukraine Power Plant, which is a lower priority site because it uses low enriched uranium for fuel. Work at the Kiev Institute is expected to be completed by mid-1996, and work at the other sites is expected to be completed by the end of fiscal year 1997. The program has also established a computer

network for the State Committee for Nuclear and Radiation Safety to facilitate the creation of Ukraine's national nuclear database.

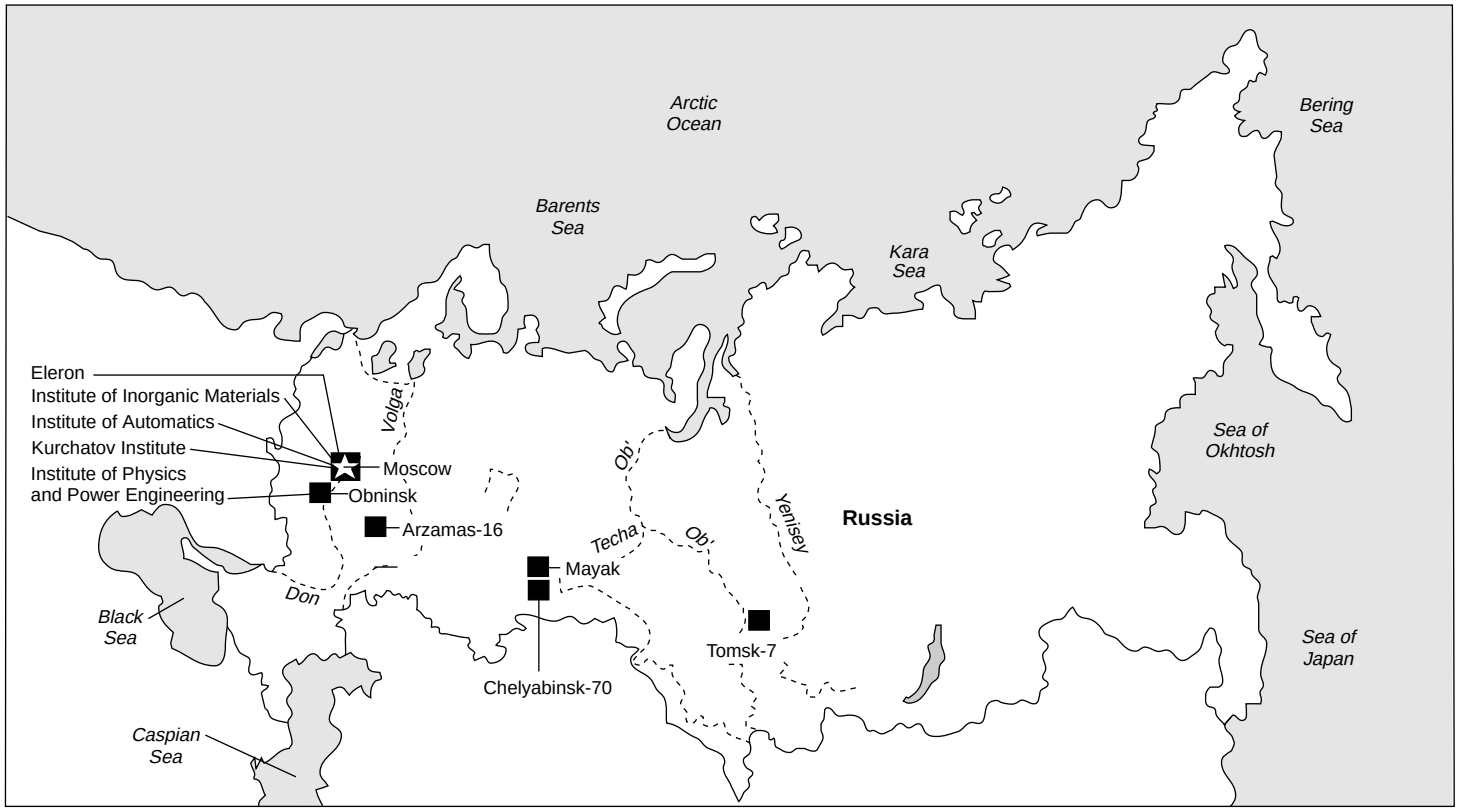
In Kazakstan, the focus of CTR-funded work has been on the Ulba Fuel Fabrication Plant, a low-priority site that produces low enriched uranium fuel elements for power reactors. The program also conducted site surveys for research reactor sites at Semipalatinsk and Almaty and for a breeder reactor at Aktau. DOE expects the program in Kazakstan to be completed by the end of 1997.

In Belarus, the program is upgrading MPC&A systems for direct-use material at the Sosny Research Center in cooperation with Sweden and Japan, helping Belarus develop national regulations, and preparing the government for International Atomic Energy Agency safeguards. The program has completed a site survey and delivered access control equipment and interior sensors to Sosny. DOE expects the program in Belarus to be completed by the end of 1996.

Lab-to-Lab Program Status

The lab-to-lab program is funding projects in Russia to improve MPC&A at sites within nuclear facilities, demonstrate MPC&A technologies, and deploy MPC&A equipment on an as-needed basis. Figure 3.2 shows the location of current lab-to-lab projects.

Figure 3.2: Current Lab-to-Lab Projects



Sources: DOE and GAO.

The lab-to-lab program has completed pilot projects at the Kurchatov Institute in Moscow and the Institute of Physics and Power Engineering and has demonstrated a model material control and accounting system at Arzamas-16, a MINATOM nuclear weapons facility. In addition, the program has deployed nuclear portal monitors around a nuclear site at Chelyabinsk-70, a second MINATOM nuclear weapons facility, the Kurchatov Institute, the Institute of Automatics, the Institute of Physics and Power Engineering, and Arzamas-16. Table 3.2 shows obligations and expenditures for the lab-to-lab program.

Table 3.2: U.S. Assistance for Lab-to-Lab Programs (fiscal years 1994-95)

Dollars in millions

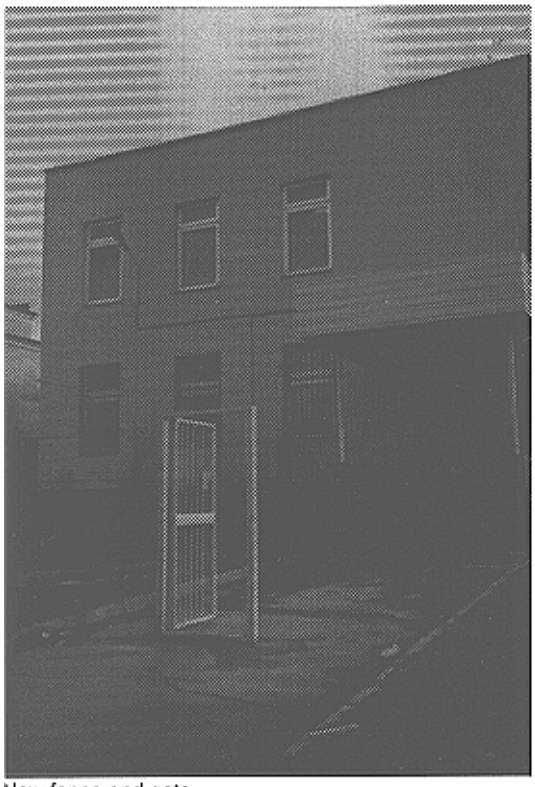
Fiscal year	Budget	Obligations	Expenditures
1994	$2.1	$2.1	$1.6
1995	15.0	15.0	12.7[a]
Total	**$17.1**	**$17.1**	**$14.3**

[a]According to a national laboratory official, in fiscal year 1995, DOE advanced and spent $8.2 million of its own funds for the lab-to-lab program, while waiting for a transfer of $15 million from the CTR program. Of the $15 million transferred from DOD to DOE, DOE spent $4.5 million on the lab-to-lab program in fiscal year 1995 and carried over $10.5 million into fiscal year 1996.

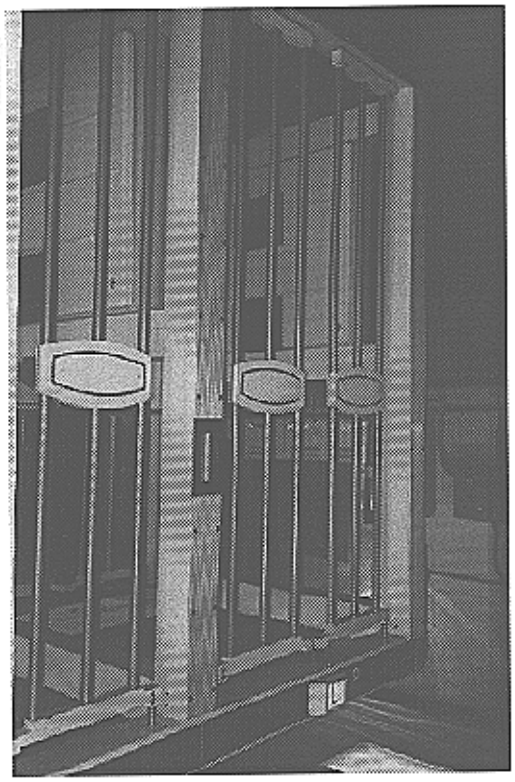
The pilot project at the Kurchatov Institute improved MPC&A for a reactor site containing about 80 kilograms of direct-use material. The improvements included a new fence, sensors, a television surveillance system to detect intruders, a nuclear material portal monitor, a metal detector at the facility entrance, improved lighting, alarm communication and display systems, an intrusion detection and access control system in areas where nuclear material is stored, and a computerized material accounting system.

Figure 3.3 shows the types of improvements we observed during our visit to the Kurchatov Institute reactor site in March 1995.

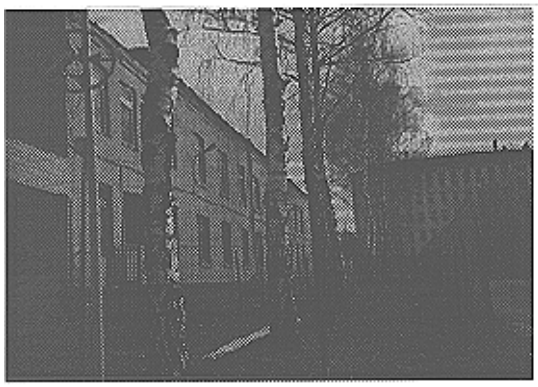
Figure 3.3: Lab-to-Lab Cooperative Efforts at the Kurchatov Institute in Moscow



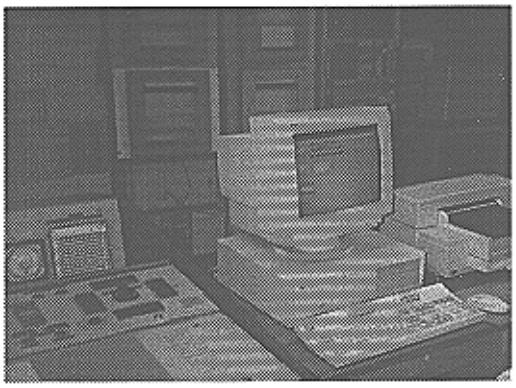
New fence and gate



Russian-manufactured portal monitor used to detect nuclear material



Exterior perimeter surveillance system



New computerized material accounting system

At Obninsk, the program has upgraded MPC&A systems for a research reactor facility that houses several thousand kilograms of direct-use material.[2] The program is providing a computerized material control and accounting system; entry control; portal monitoring systems; a vehicle monitor; and bar codes to be attached to the discs, seals, and video surveillance systems. In addition, the program will assist the facility with taking a physical inventory and performing radiation measurements to quantify the amount of material present. The first phase of this project was completed in September 1995.

A pilot demonstration project was also completed with Arzamas-16 in March 1995. This project demonstrated MPC&A technologies that could be applied to MINATOM nuclear weapons facilities and the CTR-sponsored fissile material storage facility. Using U.S.- and Russian-supplied equipment, the demonstration consisted of computerized accounting systems; a system to measure nuclear materials in containers; access control systems; a monitored storage facility using cameras, seals, and motion detector equipment; and a system to search for and identify lost or stolen material. Although this project did not have a direct or immediate impact on protecting direct-use material, it has led to greater interest in participation in the lab-to-lab program by MINATOM defense facilities. Figure 3.4 shows U.S.- and Russian-supplied equipment that we observed in use during the March 1995 Arzamas-16 demonstration project.

[2]This material is especially attractive to theft because it is in the form of 70,000 to 80,000 small disks containing HEU and plutonium, along with other material.

Figure 3.4: Lab-to-Lab Cooperative Efforts at Arzamas-16

Cameras used to monitor nuclear material storage containers

Examples of U.S.-supplied seals used on nuclear storage containers

The lab-to-lab program is also rapidly deploying nuclear material portal monitors to Russian institutes, enterprises, and operating facilities. Starting in June 1995, the lab-to-lab program assisted Chelyabinsk-70 in deploying two nuclear material portal monitors and a vehicular portal monitor at the entrances to a key nuclear site. This effort was in response to increased concerns of Chelyabinsk officials about controlling access to the site. Nuclear material portal monitors have also been installed at an engineering test facility at Arzamas-16 and at one of the main entrances to the Institute of Automatics, where the monitors are undergoing testing and evaluation. The lab-to-lab program has also started delivering portal monitors to Tomsk-7. The program officials have signed a contract to install monitors at all portals at Tomsk-7.

Prospects for MPC&A Upgrades Are Improving

While the CTR-sponsored government-to-government program has gotten off to a slow start controlling direct-use material, the U.S. government is making progress in expanding participation in the program to more facilities with direct-use material in the NIS. The lab-to-lab program is also expanding its outreach to additional facilities in Russia that require MPC&A upgrades, and DOE officials have been approached by the Russians to expand their efforts to other facilities.

CTR Government-to-Government Program Expands Its Projects to Direct-Use Sites in Russia

In January 1995, the United States and Russia agreed to expand the CTR-sponsored government-to-government program to facilities using direct-use material. An agreement was signed in June 1995 at the Gore-Chernomyrdin Commission meeting to add five direct-use facilities.[3] These are high-priority facilities because they handle large amounts of direct-use material. They include the HEU fuel fabrication line at the Elektrostal Machine Building Plant, the Scientific Production Association Luch in Podolsk, the Scientific Research Institute for Nuclear Reactors in Dmitrovgrad, the Mayak Production Association, and the Institute of Physics and Power Engineering at Obninsk for a nuclear training laboratory and MPC&A improvements in addition to those underway in the lab-to-lab program.[4]

[3]The Gore-Chernomyrdin Commission was created in 1993 to overcome trade barriers in the energy sector but has expanded into other areas, including business development, space, environment, science and technology, health, and defense diversification.

[4]Subsequent to the conclusion of our review, DOE and MINATOM agreed to add six additional sites to U.S. MPC&A programs.

Lab-to-Lab Program Is Expanding Into MINATOM Facilities

The lab-to-lab program plans to implement MPC&A projects at several MINATOM nuclear weapons complex facilities during fiscal year 1996 and continue work at the Kurchatov Institute and the Institute of Physics and Power Engineering at Obninsk. The lab-to-lab program has signed contracts to upgrade MPC&A systems at Tomsk-7, Chelyabinsk-70, and Arzamas-16. The program at Tomsk-7 includes deployment of nuclear material portal monitors, development of an automated material control and accounting system for an HEU facility, development of an access control system for a sensitive facility on site, and implementation of a rapid inventory system for uranium and plutonium in containers based on the technology demonstrated in fiscal year 1995 at Arzamas-16. At Chelyabinsk-70, the program plans to enhance MPC&A at a reactor facility handling large amounts of direct-use material.

The lab-to-lab program is also pursuing new initiatives with Russian nuclear weapons assembly and disassembly facilities and the Russian navy. In August 1995, representatives of the four Russian nuclear weapons assembly and disassembly facilities (Avangard, Penza-19, Sverdlovsk-45, and Zlatoust-36) met to discuss possible joint work to improve MPC&A at their facilities. U.S. technical experts have also met with officials from the Russian naval fuel sector and the Kurchatov Institute to discuss cooperative work to improve MPC&A at Russian naval facilities. The Russians have proposed a list of eight potential areas of cooperation for improving MPC&A at the naval facilities and have recommended that the joint work be conducted with the participation of the Kurchatov Institute.

DOE Faces Uncertainties in Managing an Expanded U.S. Assistance Program

In fiscal year 1996, the United States substantially increase its MPC&A assistance program to include all facilities in the NIS known to contain direct-use nuclear material. With the increase, the executive branch has consolidated management and funding responsibilities for the DOD-sponsored CTR government-to-government program and the DOE's lab-to-lab program within DOE. The expanded program faces several uncertainties involving the number of facilities to be assisted, costs, and ultimate effectiveness. DOE is developing responses to each of these issues.

The Expanded Program

The executive branch has acted to address the problem of quickly improving MPC&A at NIS facilities by proposing a multiyear program to help the NIS strengthen their controls over direct-use materials. In September 1995, the President directed DOE to prepare a long-range plan to enhance nuclear material controls by the year 2002 at the 80 to 100 facilities in the NIS handling direct-use material. The President also transferred responsibility for funding and supporting new government-to-government projects, which was the responsibility of the CTR program, from DOD to DOE in fiscal year 1996.[1] DOE will also continue to manage the lab-to-lab program.

DOE plans to request from Congress $400 million for the program over 7 years. DOE requested $70 million in fiscal year 1996 and plans to continue requesting $70 million per year through fiscal year 1999, then reducing the request to $50 million a year until 2001, and to $20 million in 2002. DOE plans to work at up to 15 facilities per year. DOE and national laboratory officials estimate that the cost per facility will range from $5 million to $10 million, on the basis of DOD's and DOE's experiences to date working at a limited number of sites at several facilities in the NIS.

Uncertainties Faced by an Expanded Program

As DOE prepares to undertake the much larger task of managing the expanded program, it will face several uncertainties that can affect program implementation.

- As previously stated, DOE does not know how many facilities may ultimately require assistance. Currently, U.S. officials do not know where all the direct-use material is located. According to a DOE official, the United States may need to include as many as 35 additional facilities beyond the

[1]However, financial management responsibilities for CTR-funded projects undertaken in fiscal years 1994 and 1995, including DOD's fiscal year 1995 funding for the lab-to-lab program, will remain with DOD.

80 to 100 facilities currently envisioned to achieve its goal of enhancing controls over all direct-use material.

- DOE is uncertain about the total costs of the program. The cost of the entire program could range from $400 million to over $1 billion based on the estimate that the number of facilities that may require assistance could range from 80 facilities to as many as 135 facilities, and that per project costs could range from $5 million to $10 million.[2] Project estimates could vary as the program expands to different types of facilities, or if the NIS consolidate their stockpiles of direct-use material.
- DOE may have difficulty directly verifying that U.S. assistance is used for its intended purposes because the Russians may limit direct measures that the United States may use at highly sensitive facilities. DOE plans to provide assistance to sensitive MINATOM defense facilities. While DOE is attempting to negotiate the use of direct measures, such as audit and evaluation procedures wherever possible, the Russians may deny the use of such direct measures in certain facilities.

DOE Responses to Program Uncertainties

DOE is currently developing responses that could address these program uncertainties, including developing a long-range plan, a consolidated cost-reporting system, and a flexible strategy for auditing and evaluating program progress. These responses had not been completed at the conclusion of our review.

Long-Term Plan

In September 1995, the President directed DOE to develop a long-term plan. According to a DOE official, the plan will include strategies, priorities, and costs for the work at the 80 to 100 facilities where the U.S. plans to provide assistance. The U.S. strategy is to gain commitments from the Russians for work at facilities where direct-use material is present: the MINATOM defense facilities, MINATOM civilian research facilities, civilian research institutes, and the naval propulsion sector. DOE's priorities are to (1) improve controls at facilities in the NIS handling direct-use material, (2) help the Russians develop and deploy current MPC&A equipment and technology to these facilities, and (3) assist the NIS in developing a national MPC&A regulatory system. DOE estimates that the fiscal year 1996 budget for the lab-to-lab program will be $40 million, the government-to-government program will be $15 million, cooperation with GAN will be $10 million, and cooperation for securing Russian naval nuclear fuel will be $5 million.

[2]According to a national laboratory official, these estimates are based on work completed at a limited number of facilities.

According to a national laboratory official, supporting plans are also being developed by the national laboratories. For example, the lab-to-lab program has developed a unified U.S.-Russian plan for work at MINATOM defense facilities. The plan provides objectives, priorities, a list of facilities to receive MPC&A enhancements, and approaches for providing assurances that equipment and other support are used for intended purposes and for protecting sensitive information. Similar plans for the MINATOM civilian sector and the independent nuclear facilities are also being developed.

Centralized Cost-Reporting System

DOE is developing a centralized cost-reporting system for the government-to-government and lab-to-lab programs. Currently, DOE does not have a consolidated source of information on the obligations and expenditures for the two programs. While DOE program managers receive quarterly financial information from reports prepared by the national laboratories, there is no central point within DOE where data for the government-to-government program and lab-to-lab program are aggregated. A centralized consolidated cost-reporting system will provide DOE managers with current financial and project status information. This would be useful in responding to changes in program requirements and costs and revising program budget requests to reflect operating experiences at facilities in the NIS.

Flexible Approach to Audit and Program Evaluation

Because the United States places a high priority on preventing diversion of nuclear material, the executive branch has agreed, in principle, on the need for flexibility in pursuing adequate arrangements for ensuring that U.S. assistance is used as intended. The arrangements include formal audit and evaluation rights negotiated as part of government-to-government agreements and flexible arrangements developed by the national laboratories to be applied to the lab-to-lab program.

Under government-to-government agreements, which provide basic rights and responsibilities for the government-to-government program, the United States is allowed to conduct audits and examinations during the period of the agreements upon 30 days advanced notice. These agreements give U.S. personnel the right to visit sites receiving U.S. assistance. DOD and MINATOM signed an additional agreement on Administrative Arrangements for the Conduct of Audits and Examinations of Assistance. Using these arrangements, DOD conducts audits and examinations of all CTR-funded assistance and will include MPC&A assistance.

In contrast, the lab-to-lab program, which works directly with Russian nuclear facilities, is not covered by the formal government-to-government agreement with Russia. However, the annex to the lab-to-lab program plan outlines guidance for ensuring that assistance is used as intended. The annex specifies various management controls, such as making progress payments to Russian laboratories only for specific delivered products, and only after U.S. laboratory officials have evaluated the product against the contract to ensure that payments to Russian laboratories are only used for their intended purposes.

The annex also provides a series of direct and indirect measures to determine if U.S. assistance is improving nuclear material controls. Some measures for program success include tracking the amount of nuclear material covered by strengthened safeguards that can be directly assessed through visits to facilities and exchanges of photographs, video tapes, records, and documents to show implementation of an improved system and more limited access on a controlled basis to the facilities.

Agency Comments

The Departments of State and Energy generally agreed with the report. Their comments are presented separately in appendixes I and II. The Department of State provided editorial comments, which have been incorporated in the text as appropriate. DOD officials also agreed with the facts as presented in this report, but expressed concern about how the report portrayed the relative success of the government-to-government and lab-to-lab programs. These officials stated that the programs are complementary approaches to achieving the goal of improving controls and accountability over direct-use nuclear material in the NIS. We agree and have modified the report accordingly.

Comments From the Department of State

United States Department of State

Washington, D.C. 20520

October 31, 1995

Dear Mr. Hinton:

We appreciate the opportunity to provide Department of State comments on your draft report, "NUCLEAR NONPROLIFERATION: U.S. Assistance to Improve Nuclear Material Controls in the Former Soviet Union," GAO Job Code 711098. The Department views the report as a generally accurate assessment of the U.S. effort to improve nuclear material security and a valuable contribution to those efforts. Enclosed are some editorial refinements.

If you have any questions concerning this response, please call Mr. Phillip Dolliff, PM/SPN, at (202) 647-7426.

Sincerely,

Richard L. Greene

Enclosure:
As stated.

cc:
GAO - Mr. Shafer
State/PM/SPN - Mr. Dolliff

Mr. Henry L. Hinton, Jr,
Assistant Comptroller General,
National Security and International Affairs,
U.S. General Accounting Office.

Comments From the Department of Energy

Department of Energy
Washington, DC 20585

February 5, 1996

Mr. Henry L. Hinton
Assistant Comptroller General
National Security and International Affairs Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Hinton:

The Department of Energy has reviewed the draft report by the General Accounting Office entitled "U.S. Efforts to Strengthen Nuclear Material Controls in the Newly Independent States of the Former Soviet Union."

We find that the draft report is accurate and balanced in its discussion of nuclear materials security cooperation, and the report's findings are reasonable. The Department of Energy acknowledges that these programs face a number of uncertainties and, as you note in the report, we are taking steps to address them.

We recognize that in light of continuing interest in these programs, it may be necessary to update the information in the report from time to time. We stand ready to work with you and your staff if follow-on reports are required.

Sincerely,

Kenneth N. Luongo, Director
Office of Arms Control and Nonproliferation

cc: J. Rohlfing, NN-1
K. Baker, NN-2
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