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Report to the Subcommittee on Energy and Water Development, Committee on Appropriations, House of Representatives

April 2000

NUCLEAR SAFETY

Concerns With the Continuing Operation of Soviet-Designed Nuclear Power Reactors

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Abbreviations

DOE	Department of Energy
GAO	General Accounting Office
IAEA	International Atomic Energy Agency
MINATOM	Russian Ministry of Atomic Energy
NRC	Nuclear Regulatory Commission
PHARE	Poland and Hungary Assistance for Reconstruction of Economy
PNNL	Pacific Northwest National Laboratory
TACIS	Technical Assistance for the Commonwealth of Independent States
USAID	U.S. Agency for International Development

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United States General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-284374

April 25, 2000

The Honorable Ron Packard
Chairman
The Honorable Peter J. Visclosky
Ranking Minority Member
Subcommittee on Energy and
Water Development
Committee on Appropriations
House of Representatives

This report responds to your request that we review U.S. and international efforts to improve the safety of Soviet-designed nuclear power reactors and assess the management of the Department of Energy's and the Nuclear Regulatory Commission's nuclear safety assistance activities.

As arranged with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this report until 10 days after the date of this letter. At that time, we will send copies of this report to appropriate congressional committees, the Honorable Bill Richardson, Secretary of Energy; the Honorable Madeleine Albright, Secretary of State; the Honorable Richard Meserve, Chairman, Nuclear Regulatory Commission; and the Honorable Jacob Lew, Director, Office of Management and Budget. Copies will also be made available to others upon request.

Please call me at (202) 512-3841 if you or your staff have any questions about this report. Key contributors to the report are listed in appendix IV.

Gary L Jones

(Ms.) Gary L. Jones
Associate Director, Energy,
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Executive Summary

Purpose

The United States and many other countries are concerned about the safety of 59 Soviet-designed nuclear power reactors that operate in the Newly Independent States of the former Soviet Union, as well as in other nations throughout Central and Eastern Europe. Many of these reactors are similar in design to the Chornobyl reactor in Ukraine that exploded in 1986, causing the worst accident in the history of nuclear power. Deficiencies in the design of many of these reactors pose grave safety risks, which are exacerbated by problems affecting reactor operators, who in many cases are poorly trained and erratically paid. In addition, many nuclear regulatory authorities do not have the independence or effectiveness needed to oversee safety. To mitigate these problems, the United States, many European nations, Canada, Japan, and several international organizations have been providing assistance since the early 1990s to improve the safety of these nuclear reactors. The aim of this assistance is to improve the safety of the reactors without extending their operating lifetimes and to find replacement sources of energy so the reactors can be shut down as soon as possible.

The Chairman and the Ranking Minority Member of the Subcommittee on Energy and Water Development, House Committee on Appropriations, asked GAO to (1) provide information on how much money has been spent by the United States and other countries for assistance to improve the safety of Soviet-designed nuclear power reactors—and the types of assistance being provided—as well as planned U.S. expenditures; (2) provide experts' views on the impact of the assistance; and (3) assess the status of efforts to close high-risk Soviet-designed reactors. In addition, GAO was asked to assess the management of the Department of Energy's and the Nuclear Regulatory Commission's safety assistance activities.

Background

After the Chornobyl reactor exploded in April 1986, radioactive contamination spread over Eastern Europe and Scandinavia, and fallout was detected in the United States. The transboundary effects of the accident raised concerns among the international community, including the United States, about the safety of Soviet-designed nuclear reactors, 59 of which are currently in operation at 18 nuclear power plants.[1] Twenty-five of these reactors are of greatest concern because they fall below western

[1]In addition, the Department of Energy is providing assistance to four small RBMK-type reactors and one fast neutron reactor in Russia.

safety standards and cannot be economically upgraded. Located in Armenia, Bulgaria, Lithuania, Russia, the Slovak Republic, and Ukraine, they include 14 RBMK Chornobyl-style reactors and 11 VVER 440 Model 230 reactors. The international community, including the United States, developed an assistance plan designed to quickly improve the safety of the highest-risk reactors and provide longer-term safety improvements. Under this plan, the donor countries have aimed for the earliest practicable shutdown of the highest-risk reactors.

Responsibility for the U.S. contribution to this international safety assistance effort lies with four federal agencies—the departments of State and Energy, the U.S. Agency for International Development, and the Nuclear Regulatory Commission. The Department of State, with assistance from the U.S. Agency for International Development, provides overall policy guidance for the U.S. effort, generally known as the U.S. safety program. The Department of Energy, primarily through Pacific Northwest National Laboratory, focuses on, among other things, improving the physical condition of nuclear reactors and installing safety equipment, developing improved safety procedures and training operators in the use of these procedures, and conducting safety assessments. The Nuclear Regulatory Commission concentrates on strengthening the independence and effectiveness of the regulatory authorities in the countries that operate Soviet-designed nuclear power reactors.

Results in Brief

The United States and 20 other countries and international organizations contributed about $1.9 billion to improve the safety of Soviet-designed nuclear reactors; the United States contributed about $545 million of that amount. The $1.9 billion includes contributions for improving operational safety by providing better training, procedures, and equipment and strengthening regulatory authorities. The U.S. safety program, which provides most of its funding through the Department of Energy and the Nuclear Regulatory Commission, has supplied assistance that includes safety evaluations and reactor upgrades, training, and fire safety equipment. Russia and Ukraine are the leading recipients of U.S. assistance. It is uncertain how long the United States will continue its safety assistance program. Although the Department of Energy plans to complete its assistance efforts by 2005 at a projected cost of $709 million, the Commission has not determined when or at what cost it will complete its assistance efforts. Nevertheless, the State Department believes that funding should continue for some time because the highest-risk reactors continue to operate.

Nuclear safety experts from 32 countries and international organizations met in 1999 to assess the impact of the nuclear safety assistance provided to countries operating Soviet-designed reactors. These experts concluded that progress has been made over the past decade in strengthening nuclear regulatory authorities, improving the operation of the nuclear reactors, and establishing safety improvement programs. Nevertheless, they maintained that further improvements are needed, particularly to strengthen the independence and effectiveness of nuclear regulatory authorities. Furthermore, the extent of safety improvements varies from country to country. According to safety experts, Hungary, the Czech Republic, and the Slovak Republic have made the most significant progress in implementing western safety practices, while Russia has made the least progress. Officials from the countries operating Soviet-designed reactors that have received U.S. safety assistance told GAO that the assistance has had a direct impact on improving the reactors' safety.

While safety improvements have been made, a major goal of the international donor community has not been realized—the permanent shutdown of the highest-risk Soviet-designed reactors. Although Ukraine decided to shut down one of its reactors at the Chornobyl nuclear power plant in 1996, the 25 reactors of greatest concern have continued to operate despite the efforts of the donor countries to obtain their closure. Many safety experts told GAO that countries will continue to operate these reactors as long as it is in their economic interests to do so. Some of these experts also told GAO that an unintended consequence of the safety assistance is that it has encouraged countries to continue operating these reactors. In May 1999, Russia's Minister of Economy stated that international assistance was enabling Russia to modernize its reactors, including those that the United States and other countries want shut down as soon as possible.

Despite the favorable views of those who have received the Department of Energy's and the Nuclear Regulatory Commission's safety assistance, some U.S. safety program officials, including U.S. laboratory and Commission officials, have concerns about the management of both agencies' programs. The Department of Energy has funded several projects that may have worthwhile objectives but are not directly related to improving the safety of Soviet-designed nuclear reactors. In funding these projects, the Department has expanded the program beyond its original mission to upgrade the reactors' safety. These projects include international environmental and nuclear safety centers in the United States and Russia and laboratories in Ukraine. In addition, the Department has funded several

smaller projects or made other expenditures of program funds that some program officials believed were of questionable value in meeting the program's objectives. Management responsibilities for the Nuclear Regulatory Commission's safety program are divided among different offices. Recent internal Commission audits and reviews have reported that this split in management responsibilities could cause duplication of effort and miscommunication with other federal agencies participating in the program. According to some Commission officials, the lack of coordination and communication between different offices responsible for the Commission's nuclear safety assistance activities contributed to the Commission's inability to obligate over $500,000 in program funds that were returned to the U.S. Treasury.

This report contains recommendations to improve the management of the U.S. safety program and maximize the use of funds for projects directly related to improving nuclear safety.

Principal Findings

Countries Contributed About $1.9 Billion to Improve the Safety of Soviet-Designed Nuclear Reactors

The United States and 20 other countries and international organizations contributed about $1.9 billion to improve the safety of Soviet-designed nuclear power reactors. The European Union, which comprises 15 member nations, is the largest donor, and the United States is the second largest, with contributions totaling about $545 million. The major recipients of assistance are Russia, Ukraine, Bulgaria, Lithuania, and the Czech and Slovak republics. The international assistance is targeted toward several safety activities, including operational improvements, such as training nuclear reactor personnel, supplying equipment, and strengthening regulatory authorities.

The U.S. contribution of about $545 million is divided into two components—$101 million for international nuclear safety initiatives administered by the European Bank for Reconstruction and Development and $444 million for safety activities managed by the Department of Energy and the Nuclear Regulatory Commission. These activities include reactor safety evaluations and upgrades, training for plant operators and regulatory authority personnel, and fire safety equipment and materials. Eighty-six percent of the agencies' expenditures were related to activities in Russia and Ukraine. As of September 30, 1999, GAO determined that the

Department had not spent $78 million in appropriated funds carried over from prior years. Because of the large amount of carryover funds, the Congress reduced the Department's fiscal year 2000 budget request for the program by 55 percent—from $34 million to $15 million. As of the same date, the Commission had about $9 million carried over from prior years. Furthermore, the Commission returned over $500,000 for Ukraine-related activities to the U.S. Treasury because the funds were not obligated within a 2-year statutory period covering the availability of those funds. It is uncertain how long the United States will continue its safety assistance program. Although the Department of Energy plans to complete its assistance efforts by 2005 at a projected cost of $709 million, the Commission has not determined when or at what cost it will complete its assistance efforts. Furthermore, the State Department believes that funding should continue for some time because the highest-risk reactors continue to operate.

Experts Believe Assistance Has Improved Reactors' Safety but More Improvements Are Needed

According to the nuclear safety experts from 32 countries and international organizations who met in June 1999 at a conference sponsored by the International Atomic Energy Agency, the assistance provided over the past decade to countries operating Soviet-designed reactors has improved nuclear safety. The experts noted that these countries have strengthened the independence and technical competence of their nuclear regulatory authorities and made progress in implementing western safety practices and in implementing design and operational safety improvement programs. Despite these improvements, the experts found that the governments operating these reactors need to do more to ensure that their nuclear regulatory authorities have the financial resources and enforcement authority necessary to be effective. Furthermore, safety improvements varied from country to country and were affected by each country's economic conditions. According to safety experts, Hungary, the Czech Republic, and the Slovak Republic have made the most marked safety improvements. In contrast, Russia has made the least progress in terms of safety improvements, and Ukraine lacks the financial resources to meet its safety goals. According to representatives of donor and recipient countries, the assistance has improved the safety of Soviet-designed reactors, and U.S. assistance has been particularly helpful. U.S. safety experts cautioned, however, that it is difficult to quantify the extent to which safety assistance has reduced the risks of operating Soviet-designed nuclear reactors.

Progress Toward Shutdown of Soviet-Designed Reactors Has Been Limited

A major goal of the safety assistance program is to shut down the highest-risk Soviet-designed reactors at the earliest possible time. Although Ukraine decided to shut down one of the last two operating reactors at Chornobyl in 1996 (leaving one remaining reactor operating at the plant), all of the other highest-risk reactors have continued to operate despite the efforts of the international community to obtain their closure. Furthermore, it is uncertain whether Ukraine will shut down the last remaining operating reactor at the Chornobyl nuclear power plant this year in accordance with an existing agreement. Although the international community obtained agreement several years ago with Bulgaria to shut down some of its highest-risk reactors, these reactors have continued to operate because Bulgaria has been unable to obtain adequate replacement energy. According to Department of State officials, Bulgaria and Lithuania recently reaffirmed their commitment to shut down several reactors in the 2004-2005 time frame.

The countries operating Soviet-designed reactors depend, to varying degrees, on nuclear power to meet their domestic energy requirements and believe that the reactors provide a low-cost energy supply. Each of the reactors also employs thousands of people who do not have alternative employment opportunities. Experts have recognized for many years that shutting down the highest-risk reactors would require a long-term energy strategy, which includes market reforms, adjustments to energy prices, and the identification of both nuclear and nonnuclear forms of replacement energy. The slow pace of economic reform in many of the countries operating these nuclear reactors has hampered efforts to find financing for replacement energy sources.

According to many safety experts, the countries operating Soviet-designed nuclear reactors will continue to do so as long they perceive the operations to be in their economic interests. Several experts also told GAO that the safety assistance has the unintended consequence of encouraging the reactors' continued operation. In May 1999, Russia's Minister of Economy stated that international assistance was helping Russia continue its efforts to modernize its nuclear power plants, including the highest-risk reactors. A State Department official told GAO that the United States and other donors are concerned about Russia's position because the assistance was meant to protect public health and safety in the countries operating these reactors and throughout Europe until they could be shut down. Countries seeking entry into the European Union, such as Bulgaria, Lithuania, and the Slovak Republic, have an incentive to close their reactors because their

entry depends on their shutting down their highest-risk reactors within agreed-upon time frames.

Management of Some U.S. Safety Assistance Activities Has Raised Concerns

Although the recipients of U.S. safety assistance have viewed it favorably, U.S. program officials have raised concerns about certain aspects of the Department of Energy's and the Nuclear Regulatory Commission's management of their safety activities. GAO found that the Department of Energy has funded several projects that may have worthwhile objectives but are not directly related to improving the safety of Soviet-designed nuclear reactors and do not meet the Department's project selection criteria. For example, environmental centers in Russia and the United States—established by the Department to address nuclear waste issues—are not directly related to improving the reactors' safety. Similarly, GAO questions whether nine joint research projects being performed at nuclear safety centers in the United States and Russia are directly improving the safety of currently operating nuclear power plants. Another project, the Slavutych Laboratory of International Research and Technology in Ukraine, has been described as an economic development project by a Pacific Northwest National Laboratory official and will not directly improve the reactors' safety. In total, the Department has budgeted over $16 million in safety funds to support the environmental centers, the safety centers, and the Slavutych Laboratory, including $1.7 million to renovate and furnish the building where the laboratory is located. The Department maintains that the laboratory will facilitate U.S. and other countries' efforts to shut down the Chornobyl nuclear power plant—the top priority for the donor countries—because it will employ about 100 displaced Chornobyl workers. However, GAO believes that the laboratory's influence is likely to be limited, given that the plant employs about 6,000 people, most of whom will be unemployed if the Chornobyl plant is closed.

In addition, several officials from the Pacific Northwest National Laboratory told GAO that they were concerned about the Department's decision to fund projects that either did not improve the safety of Soviet designed reactors or were of questionable value to the program. Although not all of these projects involved large program expenditures, collectively they raised concerns among U.S. laboratory officials because program funds were being spent on low-priority activities. These expenditures included about $1 million to partially finance the operations of offices for departmental representatives in Paris and Tokyo; $169,000 to print documents that had limited distribution; $16,200 to provide summer internships for seven Ukrainian students; and about $10,000 to provide

robotics equipment to Ukraine for a test demonstration that Ukrainian officials did not request or want.

Although the Nuclear Regulatory Commission has provided regulatory assistance to countries operating Soviet-designed nuclear reactors for over 7 years, it has not developed a long-term strategic plan that clearly identifies overall goals and schedules and measures to quantify how the assistance is meeting these goals. According to Commission officials, they have a short-term view of the assistance and have managed it from year to year without a long-term strategy, particularly when it is related to Russia's and Ukraine's activities. Furthermore, the Commission's management of its safety assistance activities is divided among different offices. Recent internal Commission audits and reviews identified the split in management responsibilities as a potential weakness. One of the internal audits stated that this split in responsibilities could cause duplication of effort and miscommunication with other agencies participating in the nuclear safety program. According to some Commission officials, the lack of coordination and communication between different offices responsible for the Commission's nuclear safety assistance activities contributed to the Commission's inability to obligate over $500,000 in fiscal year 1997 and 1998 program funds in accordance with a statutorily imposed 2-year period of availability. This period expired, and the funds were returned to the U.S. Treasury.

Recommendations

To improve the management of the nuclear safety assistance program and maximize the use of program funds, GAO recommends, among other things, that (1) the Secretary of Energy review ongoing and proposed projects and eliminate those that do not have a strong and compelling link to improving the safety of Soviet-designed nuclear reactors and (2) the Chairman of the Nuclear Regulatory Commission integrate the assistance activities of offices that implement nuclear safety assistance to avoid duplication and inefficiencies.

Agency Comments

GAO provided copies of a draft of this report to the departments of Energy and State and to the Nuclear Regulatory Commission for their review and comment. The Department of Energy's and the Commission's written comments are presented in appendixes II and III, respectively. The Senior Coordinator for Nuclear Safety Assistance provided comments on behalf of the Department of State. In general, the agencies agreed with the facts

presented in the report and the report's recommendations. The agencies provided technical comments that were incorporated in the report as appropriate.

In commenting on the report's discussion of program carryover balances (unspent program funds), the Department of Energy stated that it would continue its efforts to reduce carryover balances, and it provided clarifying information about these balances. Both the Department of Energy and the Department of State's Senior Coordinator for Nuclear Safety questioned GAO's assessment of whether certain safety program projects funded by the Department of Energy directly improve the safety of Soviet-designed nuclear power reactors. The Department of Energy also disagreed with GAO's assertion that program funding for the International Chornobyl Center (referred to in the report as the Slavutych Laboratory of International Research and Technology in Ukraine) is not directly related to improving the reactors' safety. While GAO agrees that some of the projects have value, GAO continues to believe that urgent safety needs, such as replacing wooden fire doors with fire-resistant doors in Soviet-designed nuclear power plants, have not been adequately addressed by the Department's safety effort. GAO believes that the most urgent and pressing safety priorities should be addressed first to improve the safety of the highest-risk reactors—a fundamental and long-standing goal of the program. The Department of Energy commented that it would allocate additional funds to provide fire doors for nuclear power plants in Ukraine.

Finally, the Department of State's Senior Coordinator for Nuclear Safety noted that while GAO's recommendations were useful, they proposed to set too narrow an objective for the international nuclear safety assistance program. The Senior Coordinator believes that the international safety program focuses on broader policy matters, such as the shutdown of the Chornobyl nuclear power plant. GAO recognizes that the safety program has broad goals and objectives. However, GAO's recommendations would focus limited resources on activities that directly affect the safety of Soviet-designed reactors and on improving the management of the Department of Energy's and the Nuclear Regulatory Commission's safety assistance efforts.

Introduction

The 1986 disaster at the Chornobyl nuclear power plant in Ukraine and subsequent investigations by western safety experts raised significant concerns about the risks involved in continuing to operate Soviet-designed nuclear reactors. Currently, 59 reactors—located at 18 nuclear power plants—are operating in the Newly Independent States of the former Soviet Union and in Central and Eastern Europe.[1] Many of the reactors pose high risks because of deficiencies in design, construction, safety equipment, training for operators, and safety procedures. Problems have increased with the breakup of the Soviet Union and the slow pace of economic restructuring and reform, which have left these plants without adequate resources to fully fund their safety needs. Equipment shortages are common, many plant workers receive low or erratic pay, and the countries operating most of the Soviet-designed reactors do not have independent and effective nuclear regulatory organizations to oversee plant operations. Many countries, including the United States, have been providing assistance since the early 1990s to reduce the risks associated with these reactors. The aim of this assistance is to improve the safety of the reactors without extending their operating lifetimes and to find replacement sources of energy so the reactors can be closed as soon as possible.

Background

On April 26, 1986, the worst accident in the history of nuclear power occurred at the Chornobyl nuclear power plant. As a result of the accident, the reactor core—containing approximately 200 tons of nuclear fuel—was destroyed. Large amounts of radioactive dust, gases, and debris rose into the atmosphere. The radioactive material contaminated more than 60,000 square miles of Ukraine, Belarus, and Russia. Smaller amounts of material spread over Eastern Europe and Scandinavia, and fallout was detected in the United States. During the 2 weeks after the explosion, workers dropped 5,000 tons of various compounds, sand, clay, and lead out of helicopters to limit the release of radioactive materials. Seven months after the accident, the construction of a 20-story-high metal and concrete shield—known as a sarcophagus—was completed to enclose the damaged reactor.

The transboundary effects of the Chornobyl accident raised significant concerns among numerous countries and international organizations about the safety of all Soviet-designed nuclear power plants. According to DOE, Soviet-designed reactors in general exhibit deficiencies, including

[1]In addition, DOE is providing assistance to four small RBMK-type reactors and one fast-neutron reactor in Russia.

insufficient protection against fire, poor-quality materials and construction, and inadequate separation and redundancy of safety systems. Furthermore, many of these reactors are located in countries such as Russia and Ukraine that do not have fully independent or effective nuclear regulatory organizations that oversee plant safety. Of greatest concern are 25 of the 59 reactors that western safety experts generally agree fall well below accepted international safety standards and cannot be economically upgraded. These 25 oldest reactors include 14 reactors known as RBMKs and 11 reactors known as VVER 440 Model 230s. These reactors pose the highest risks, according to western safety experts, because of inherent design deficiencies, including the lack of a containment structure. The containment structure, generally a steel-lined concrete dome, serves as the ultimate barrier to the release of radioactive material in the event of a severe accident. Other deficiencies in these reactors include inadequate safety systems, insufficient safety backup equipment, unreliable systems that control the operation of the reactor, and deficient systems for cooling the reactor core in an emergency.

Soviet-designed reactors were built under a philosophy that emphasized production over safety and assumed that timely human involvement would prevent accidents. Conversely, western reactor design philosophy stressed safety over production and sought to develop highly automated safety and shutdown systems with minimal reliance on operators' involvement. Because of operational and design priorities, the designers, constructors, operators, and regulators of Soviet-designed nuclear power plants did not believe they needed to follow international safety practices.

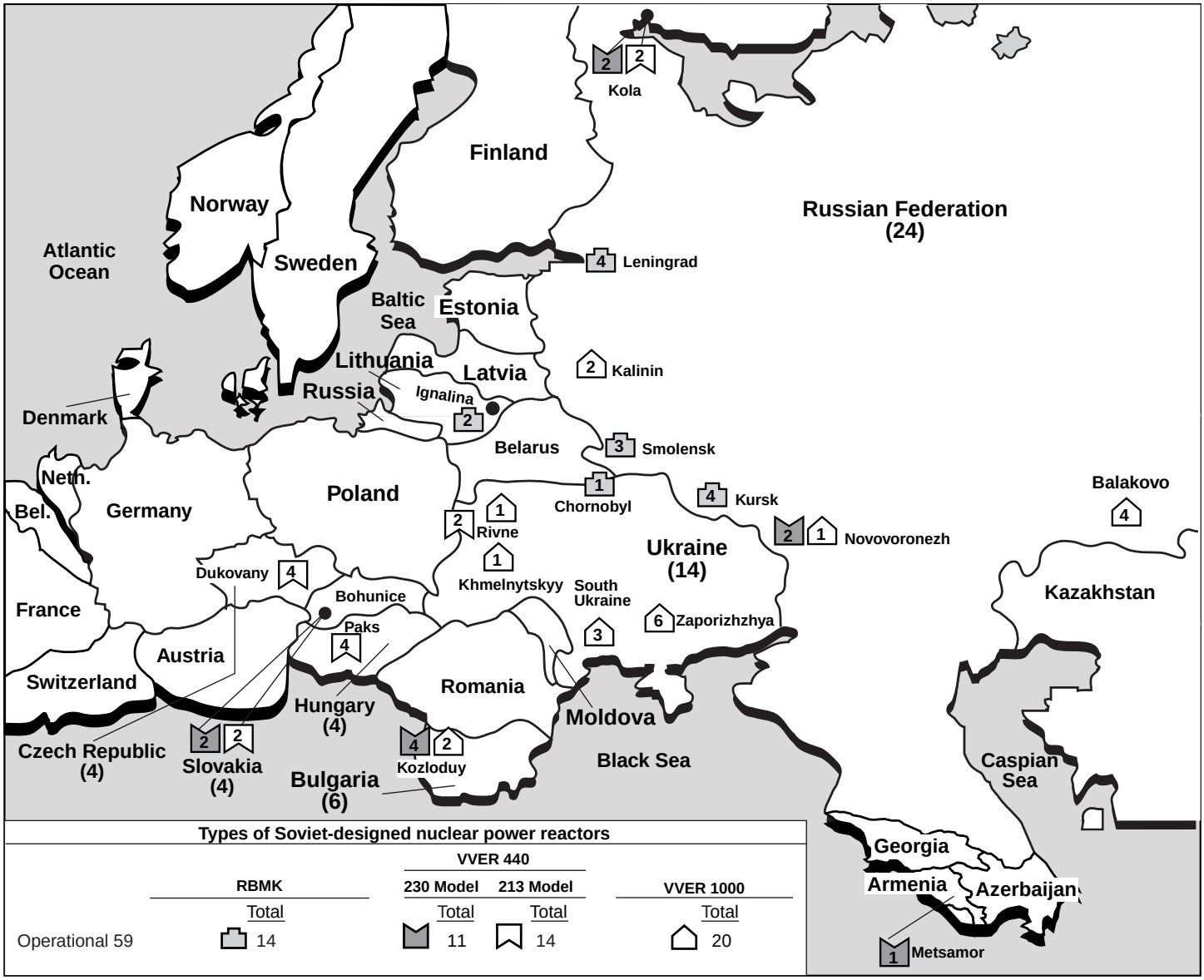
The slow pace of political and economic reform following the breakup of the Soviet Union has further degraded nuclear safety conditions in several of these countries. Furthermore, expertise in both the design and the operation of Soviet-designed reactors was located primarily in Russia under the Soviet Union. After the breakup of the Soviet Union, the Newly Independent States had to establish their own technical and nuclear regulatory infrastructures. Over the past several years, however, the working relationships between employees at plants in these countries and the Russian organizations responsible for designing nuclear reactors have deteriorated significantly. Other factors also contribute to safety problems, including the following:

- Replacement parts often are unavailable, resulting in makeshift arrangements, including the cannibalization of parts from partially completed nuclear power plants.

- Payments to nuclear power plants for electricity production are rarely in cash, are sometimes delayed, and are often insufficient to pay operating costs, let alone the costs of making safety improvements.
- Salaries for nuclear power plant operators are often not competitive with those for other jobs, and the payment of wages at some nuclear power plants in Russia and Ukraine has been delayed for several months. For example, in October 1999, workers at both the Chornobyl and Khmelnytskyy nuclear power plants had not been paid for 2 months, according to Ukrainian officials.
- Regulators in most of these countries earn even less than plant operators. For example, according to the head of Ukraine's regulatory organization, the average salary of a nuclear power plant regulator is $40-$80 per month. As a result, the organization has difficulty hiring and keeping employees.

Figure 1 shows the type and location of the 59 Soviet-designed reactors operating in the Newly Independent States of the former Soviet Union and countries of Central and Eastern Europe.

Figure 1: Operational Soviet-Designed Nuclear Power Plants



Notes:

1. Numbers in parentheses show the total number of reactors in each country, and numbers within symbols show the number of reactors of a specific type at a site.

2. DOE is providing assistance to five other nuclear power reactors in Russia. At one site, Bilibino, four small-scale RBMK reactors produce both steam and electricity. In addition, one fast-neutron reactor is located at Beloyarsk.

Sources: GAO's presentation of information from DOE.

International Nuclear Safety Assistance Efforts

Beginning in the early 1990s—with the breakup of the former Soviet Union—the international community coordinated efforts to address the safety risks posed by the Soviet-designed nuclear power plants. In July 1992, a group of western industrialized nations known as the G-7 [2] developed an international assistance program designed to quickly address the most urgent safety needs at the highest-risk plants and provide for longer-term safety improvements. The G-7 program called for immediate measures to improve the safety of plant operations, make near-term technical improvements based on safety assessments, and strengthen countries' nuclear regulatory authorities. These types of improvements were expected to achieve early and significant safety benefits. In addition, the G-7 program was designed to establish a basis for longer-term safety improvements by examining the possibility of (1) replacing the highest-risk reactors with alternative energy sources and (2) upgrading reactors of more recent design, such as the VVER Model 1000 reactors. Under the G-7 program, the international donors of assistance have always aimed for the earliest practicable shutdown of the highest-risk reactors. However, the G-7 program did not establish any dates for shutting down the highest-risk reactors, nor did it directly link its assistance to the shutdown of these reactors.

[2]The G-7 comprises Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

Because of their proximity to the Soviet-designed reactors, the western European countries have assumed a major responsibility for providing safety assistance, primarily under the auspices of the European Union, a union of 15 independent countries that was founded to enhance political, economic, and social cooperation.[3] The European Commission manages the European Union's assistance effort. The Commission is the European Union's executive body and has a staff of about 20,000. Nuclear safety assistance is funneled through two programs administered by the Commission—(1) Technical Assistance for the Commonwealth of Independent States (TACIS), which provides assistance to Russia, Ukraine, Kazakhstan, and Armenia and (2) assistance to Bulgaria, Lithuania, and the countries of Central and Eastern Europe—known as the (PHARE [4]) program. The TACIS program, which had received over three-quarters of the Union's funds for safety assistance projects through 1998, has focused on several areas, including improving reactors' operational and design safety, managing nuclear waste, closing the Chornobyl reactor, and controlling nuclear materials.

In addition to the two programs managed by the European Union, the United States and numerous other donor countries and organizations are providing assistance through bilateral agreements with individual countries. In 1992, a nuclear safety coordination center was established in Brussels, Belgium, by the G-24 countries [5] to coordinate individual countries' assistance efforts. This center is responsible for developing and disseminating a database that tracks international safety assistance projects. Its secretariat also (1) prepares, in conjunction with participants, annual country overview reports; (2) produces annual status reports on the adoption of nuclear liability legislation in countries operating Soviet-designed reactors; and (3) provides public information on the coordination and cooperation processes through various publications and the Internet.

In 1993, the G-7 created a multilateral fund, the Nuclear Safety Account, directed by its donors and administered by the European Bank for

[3]The member states are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

[4]Also known as Poland and Hungary Assistance for Reconstruction of Economy.

[5]The G-24 includes the G-7 countries plus Australia, Austria, Belgium, Denmark, Finland, Greece, Iceland, Ireland, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, and Turkey.

Reconstruction and Development, to address immediate needs for safety improvement not covered in bilateral safety agreements. The bank's nuclear safety grants have conditionality clauses. Three of the beneficiaries—Bulgaria, Lithuania, and Ukraine—agreed to accept the funds with the understanding that they would close their high-risk reactors under certain conditions, such as obtaining adequate replacement energy. Russia is also a recipient of these grants, but its agreement focuses on establishing new licensing procedures for the high-risk reactors.

The Nuclear Safety Account was initially given a 3-year period of operation. The term was extended for another 3 years in 1996 and was recently extended through 2002, although no additional funds are expected to be added. The remaining tasks to be administered by the bank are (1) completing short-term plant upgrades and implementing safety-related activities at Chornobyl; (2) monitoring compliance with Nuclear Safety Account agreements and their various provisions, such as those requiring closure of the high-risk Soviet-designed nuclear power plants; and (3) distributing funding to improve the independence and effectiveness of regulatory authorities.

The bank also administers the Chornobyl Shelter Fund on behalf of its donors. Similar to the Nuclear Safety Account, it provides funds through grants. The purpose of the fund is to support projects and equipment to assist Ukraine in transforming the existing Chornobyl sarcophagus into a safe and environmentally stable system. The sarcophagus is an environmental and structural hazard because it was built partially on the remains of the ruined reactor building. It has holes and cracks, which allow radioactive contamination to escape, and experts are concerned that it could collapse. Figure 2 shows the shelter covering the remains of the destroyed reactor at Chornobyl.

Figure 2: Chornobyl Shelter

Several other international organizations have participated in efforts to improve the safety of Soviet-designed reactors:

- The Nuclear Energy Agency, a semi-autonomous body within the Organization of Economic Cooperation and Development,[6] has primarily provided information and training on nuclear law, especially third-party liability issues, and conducted some research and development work on RBMK reactors.
- The International Atomic Energy Agency (IAEA) has provided several safety services, including completing more than 100 safety missions to countries operating Soviet-designed reactors and providing technical advice on numerous safety issues, including the possible effects of Year

[6]The Organization of Economic Cooperation and Development provides its 29 member countries with a setting to discuss and develop economic and social policy. The Nuclear Energy Agency's objective is to contribute to the development of nuclear energy as a safe, environmentally acceptable, and economical energy source through cooperation among the participating countries.

2000 computer problems on the safety of these plants. In May 1999, IAEA published a report on the safety of VVER and RBMK nuclear power plants that focused on the scope of activities aimed at identifying safety deficiencies and areas where future work is necessary.
- The Institute of Nuclear Power Operators—an organization established in 1979 to enhance the safety and reliability of U.S. commercial nuclear power plants—has played a role in transferring emergency operating procedure technology to countries operating Soviet-designed reactors.
- The World Association of Nuclear Operators—an organization that seeks to maximize the safety and reliability of nuclear power plants worldwide—has provided, among other things, technical assistance and expertise to improve safety at high-risk plants in Bulgaria.

U.S. Safety Assistance Activities

Four federal agencies share responsibility for the U.S. nuclear safety assistance effort—the departments of State and Energy, the U.S. Agency for International Development (US AID), and the Nuclear Regulatory Commission (NRC). The Department of State provides overall policy guidance with assistance from US AID. State Department officials told us that the goals of the U.S. program have remained the same since the program's inception in the early 1990s—encouraging the shutdown of the highest-risk Soviet-designed nuclear power reactors and reducing the risk of accidents.

DOE's Nuclear Safety Assistance Efforts

DOE implements a major part of the U.S international nuclear safety assistance program with support from the U.S. national laboratories.[7] DOE's program objectives are to

- improve the physical condition of nuclear power plants and install safety equipment;
- establish a nuclear safety culture in which safety takes priority over power production;
- develop improved safety procedures and train operators in their use;
- conduct safety assessments that meet international standards;

[7]DOE manages the largest laboratory system of its kind in the world. Originally created to design and build atomic bombs, these laboratories have since expanded to conduct research in many disciplines—from high-energy physics to advanced computing—at facilities throughout the United States. Nine of DOE's 23 national laboratories are multiprogram, and the remainder are program- and mission-dedicated facilities.

- establish regional centers for training reactor personnel and develop simulators for training control room operators;
- develop an institutional framework for the design, construction, and operation of nuclear plants that is consistent with international practices; and
- address issues at the Chornobyl nuclear power plant.

DOE funds projects in several technical areas: operational safety, training, maintenance, safety systems, safety evaluations, and legal capabilities. DOE uses a pilot approach under which one or two plants, or in some cases several selected plants, receive training or physical upgrades. DOE uses this approach to create a model for other plants in a particular country. For example, the Zaporizhzhya nuclear power plant in Ukraine and the Smolensk nuclear power plant in Russia were selected as pilots for fire safety improvements, including fire doors, smoke detectors, and fire-proofing materials. Several years ago, DOE initiated projects to install this equipment at these locations, and some Smolensk-related projects are still under way. According to DOE, a few other nuclear power plants have received fire protection equipment, including Chornobyl (unit 3) in Ukraine, Leningrad (units 1 and 2) in Russia, and Metsamor in Armenia. DOE has also stressed technology transfer and training in an attempt to ensure that the host country will continue to apply safety improvements and training independent of U.S. assistance.

The nuclear safety program is managed at DOE headquarters by an office director and is part of DOE's recently established National Nuclear Security Administration. The director has a staff of 17 technical and support personnel. Pacific Northwest National Laboratory (PNNL) provides the primary technical and management support for the program, including contracting and administrative support. In fiscal year 1999, PNNL had 70 full-time-equivalent positions assigned to the program. PNNL maintains satellite offices in Moscow, Russia, and Kiev, Ukraine. Other national laboratories participating in the program include Brookhaven National Laboratory and Argonne National Laboratory. Brookhaven oversees the installation of training simulators and implementation of training programs. Argonne oversees the U.S. and Russian international nuclear safety centers and provides technical assistance and project direction on Soviet-designed plant safety evaluations.

DOE's program involves other organizations as well. DOE has entered into contracts with more than 90 U.S. commercial organizations to provide assistance in implementing program activities. For example, Bechtel

National, Inc., has provided fire protection equipment. In addition, DOE has entered into agreements with 16 nuclear power plants and 45 scientific institutes and government agencies in the countries operating Soviet-designed nuclear power plants.

Nuclear Regulatory Commission's Efforts

With the breakup of the former Soviet Union, the Newly Independent States had to establish independent nuclear regulatory organizations to oversee the safety of their nuclear plant operations. Furthermore, some of the countries of Central and Eastern Europe that had established regulatory organizations during the Soviet era were significantly understaffed and had limited resources. The objective of NRC's program is to promote the independence and effectiveness of these countries' nuclear regulatory authorities, primarily through training, technical exchanges, and the use of computer equipment and simulators. NRC has worked with these countries to develop a legal foundation that provides for a strong and independent regulator, which is essential for achieving and sustaining safety levels that are consistent with international practices. According to a former NRC chairman, one of NRC's goals is to help improve the enforcement authority and political stature of Russian and Ukrainian regulators so that they command the respect of both the nuclear ministries and the utilities that operate the power plants. He believed that strong and independent regulatory bodies might one day be capable of exercising the kind of authority over nuclear power operations in these countries that NRC exercises in the United States.

NRC's safety assistance activities have included

- training regulators in all aspects of safety reviews, licensing and inspection procedures, and information management;
- advising on how to establish a legal basis for nuclear regulation;
- creating emergency support centers in Russia and Ukraine;
- developing a control and accounting system for nuclear materials; and
- building and establishing regulatory training programs and providing computers and analytical equipment to support these programs.

Objectives, Scope, and Methodology

The Chairman and Ranking Minority Member of the Subcommittee on Energy and Water Development, House Committee on Appropriations, asked us to (1) provide information on how much money has been spent by the United States and other countries for assistance to improve the safety of Soviet-designed nuclear power reactors—and the types of assistance

being provided—as well as planned U.S. expenditures; (2) provide experts' views on the impact of the assistance; and (3) assess the status of efforts to close the high-risk Soviet-designed reactors. In addition, as requested, we assessed the management of DOE's and NRC's safety assistance activities.

To determine the amount and type of international assistance being provided to improve the safety of Soviet-designed reactors, we obtained data from the G-24's nuclear safety assistance coordination center in Brussels, Belgium. This center is responsible for maintaining a database for international nuclear safety assistance. According to G-24 officials, each country and international organization is responsible for the accuracy of the information it provides to the database. However, these officials do review the data to ensure that the information complies with reporting requirements. We compared the amounts reported for the U.S. contribution against the amounts reported by the U.S. agencies that participate in the program to ensure that the data were accurate. In addition, we converted all of the funding from either European currency units or Eurodollars to U.S. dollars, using the following exchange rates: 1 European currency unit equals $1.17, and 1 Eurodollar equals $1.04.

We spoke with several DOE, NRC, and national laboratory program and budget officials on issues pertaining to uncosted and unobligated funds.[8] We reviewed data on some of the largest DOE projects that had significant uncosted funds, including full-scope simulators, safety parameter display systems, and in-depth safety analyses. Those three types of projects accounted for about 65 percent of DOE's uncosted funds as of August 29, 1999. We also reviewed several smaller projects to gain a better understanding of DOE's continuing problems with large carryover balances for its nuclear safety-related activities.

We obtained information from a number of sources to assess the impact of the safety assistance. We attended the International Conference on the Strengthening of Nuclear Safety in Eastern Europe in June 1999. The conference, which took place in Vienna, Austria, brought together representatives from 32 countries and international organizations to

[8]When DOE commits funds, appropriated by the Congress as budget authority, against a project by awarding a contract, placing an order, or using a service, the funds are *obligated*. When DOE pays the contractor, vendor, or service provider, the funds are *expended* or *spent*. Conversely, *unobligated* funds represent budget authority that is available because DOE has not yet committed it. *Unspent* funds include budget authority that may be either (1) unobligated or (2) obligated but not spent.

discuss, among other things, the status of efforts to improve the safety of Soviet-designed nuclear power reactors. We interviewed experts from 25 of these countries and organizations to obtain their views on the impact of the assistance. Specifically, we met with nuclear safety officials from the following countries that have received assistance and are operating Soviet-designed reactors: Armenia, Bulgaria, the Czech Republic, Hungary, Lithuania, Russia, the Slovak Republic, and Ukraine. We also met with numerous donors of assistance, including representatives from the following international organizations: the European Bank for Reconstruction and Development, the G-24's nuclear safety assistance coordination center, the International Atomic Energy Agency, and the World Association of Nuclear Operators. We also met with officials from the following donor countries and organizations: Austria, Canada, Finland, France, Germany, Italy, Japan, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

In addition, we visited Ukraine in October 1999 to obtain information on the impact of both U.S. and international assistance. We chose Ukraine because it (1) is the largest recipient of U.S. nuclear safety assistance funds, (2) includes Chornobyl, the site of the worst nuclear power plant accident in history, and (3) faces severe economic hardships, which affect decisions about shutting down the Chornobyl nuclear power plant. In Ukraine, we visited the Khmelnytskyy nuclear power plant and the Chornobyl nuclear power plant. During our visit, we also spoke with representatives from several Ukrainian organizations that have received assistance or have direct knowledge of its impact. These included officials from Energoatom (the nuclear utility), the Ministry of Energy, and the Ministry of Environmental Protection and Nuclear Safety. We also met with officials from the International Chornobyl Center in Kiev, Ukraine, the Slavutych Laboratory of International Research and Technology, and the Slavutych International Radioecology Laboratory. We discussed economic conditions in Slavutych with its mayor.

To assess the status of efforts to close high-risk Soviet-designed reactors, we met with U.S. and international officials who are focusing on these matters. Specifically, we met with officials from the European Bank for Reconstruction and Development, the European Commission, the World Bank, and the Department of State. We also discussed these matters with representatives from countries operating the high-risk reactors, including Russia, Ukraine, Bulgaria, Lithuania, Armenia, and the Czech and Slovak republics. Additionally, we reviewed documents produced by the European Bank for Reconstruction and Development, as well as other pertinent

information, such as the 1995 G-7/Ukraine memorandum of understanding governing the shutdown of the Chornobyl nuclear power plant.

To assess the management of DOE's nuclear safety assistance activities, we met or spoke with program officials from DOE, as well as representatives from PNNL, Brookhaven National Laboratory, and Argonne National Laboratory. We reviewed project lists provided by DOE and its national laboratories and other DOE documents that discussed project selection criteria. To examine issues pertaining to the Slavutych Laboratory of International Research and Technology, we met with both the director and deputy director of the laboratory in Ukraine as well as the deputy director of the International Chornobyl Center. We also met with other Ukrainian officials who addressed laboratory-related issues. In addition, we had discussions with PNNL contract specialists and project managers who are responsible for implementing contracts with the Slavutych Laboratory. Finally, we discussed these issues with senior DOE officials, including the director for the Office of International Nuclear Safety and Cooperation and the Acting Deputy Administrator for Defense Nuclear Nonproliferation.

To assess the management of NRC's nuclear safety activities, we reviewed pertinent program files and spoke with officials from NRC's Office of International Programs, including its director, and Office of the Executive Director of Operations. We also reviewed reports and other documentation, prepared by NRC's Office of the Inspector General and NRC's Executive Council, which focused on the management of nuclear safety assistance.

We provided copies of a draft of this report to the departments of Energy and State and to the Nuclear Regulatory Commission for their review and comment. The Department of Energy's and the Commission's written comments are presented in appendixes II and III, respectively. The Senior Coordinator for Nuclear Safety Assistance provided comments on behalf of the Department of State. Summaries of the agencies' comments and our responses to them appear at the end of chapters 2 and 5.

We performed our work from April 1999 through March 2000 in accordance with generally accepted government auditing standards.

The United States' and Other Countries' Contributions to Improve the Safety of Soviet-Designed Reactors

About $1.9 billion has been contributed to improve the safety of Soviet-designed nuclear power plants. Of this amount, the United States contributed about $545 million, and 20 other countries and international organizations contributed the rest. The U.S. contribution comprises two components—$101 million to accounts established for funding international nuclear safety initiatives, administered by the European Bank for Reconstruction and Development, and $444 million available to the Department of Energy and the Nuclear Regulatory Commission to implement nuclear safety activities. This assistance has been used to train plant operators and representatives of national regulatory authorities, as well as to purchase fire safety equipment. Neither DOE nor NRC has been able to spend all of the funds it has received for the program in a timely manner. How long the United States will continue its safety assistance program is uncertain. While DOE's safety activities are expected to end around 2005, assuming certain funding levels, State Department and NRC officials believe that U.S. assistance should continue for some time because the highest-risk Soviet-designed reactors have not been shut down.

Total Donor Contributions

The United States and 20 other countries and international organizations have contributed about $1.9 billion toward improving the safety of Soviet-designed reactors, according to data compiled by the G-24's Nuclear Safety Assistance Coordination Center. The majority of the assistance has been provided through bilateral agreements with recipient countries. The European Union is the leading provider of this assistance and obtains funding through the contributions of member nations. The United States contributed about $545 million of the total amount. In addition to contributing to the European Union program, the donors have also provided assistance through bilateral programs.

In addition to the European Union, the major donors are the United States, Germany, Japan, France, the United Kingdom, Sweden, and the International Atomic Energy Agency. Together, these donors have contributed $1.8 billion, or 94 percent of the total. Several other countries have contributed the remaining $115 million, or 6 percent. The major recipients of the assistance are Russia, Ukraine, Bulgaria, Lithuania, and the Czech and Slovak republics. Russia and Ukraine are targeted to receive about $1.4 billion, or 71 percent of the total. Figure 3 identifies the donors of the $1.9 billion contributed for international nuclear safety assistance and shows its distribution to the recipient countries.

Figure 3: Countries Donating and Receiving International Nuclear Safety Assistance, as of November 1999
Dollars in millions

Pledged Assistance

Donor	Amount
European Union	$753
United States	532
Germany	168
Japan	139
France	91
United Kingdom	45
Sweden	44
IAEA	43
Canada	26
Italy	25
Finland	18
Norway	14
Switzerland	13
Belgium	6
Netherlands	5
Denmark	4
Spain	3
EBRD	1
Total	**$1,930**

Received Assistance

Recipient	Amount
Russia	$734
Ukraine	629
Bulgaria	132
Lithuania	123
Regional/Unspecified[a]	58
Slovak Republic	56
Czech Republic	50
Hungary	42
Armenia	32
NIS Regional[a]	26
Other[b]	35
Kazakhstan	15
Total	**$1,930**

Notes:

1. Contributions to the Nuclear Safety Account are included in the amounts shown for each donor country.

2. The $532 million listed here as the U.S. contribution differs from the $545 million we identified because of the method used by the G-24 to classify projects and exchange rate variables. In addition, the G-24 data do not include amounts pledged by the United States for the Chornobyl Shelter Implementation Plan.

3. The cumulative contributions of Austria, the World Bank, and the Organization for Economic Cooperation and Development, which total less than $1 million, are not included in the figure.

[a]Nuclear Safety Account funds not yet allocated to specific recipients have been divided equally among these recipients.

[b]Other recipient countries include Azerbaijan, Belarus, Estonia, Georgia, Kyrgyzstan, Latvia, Moldova, Poland, Romania, Slovenia, and Uzbekistan.

Source: GAO's presentation of data from the G-24's database.

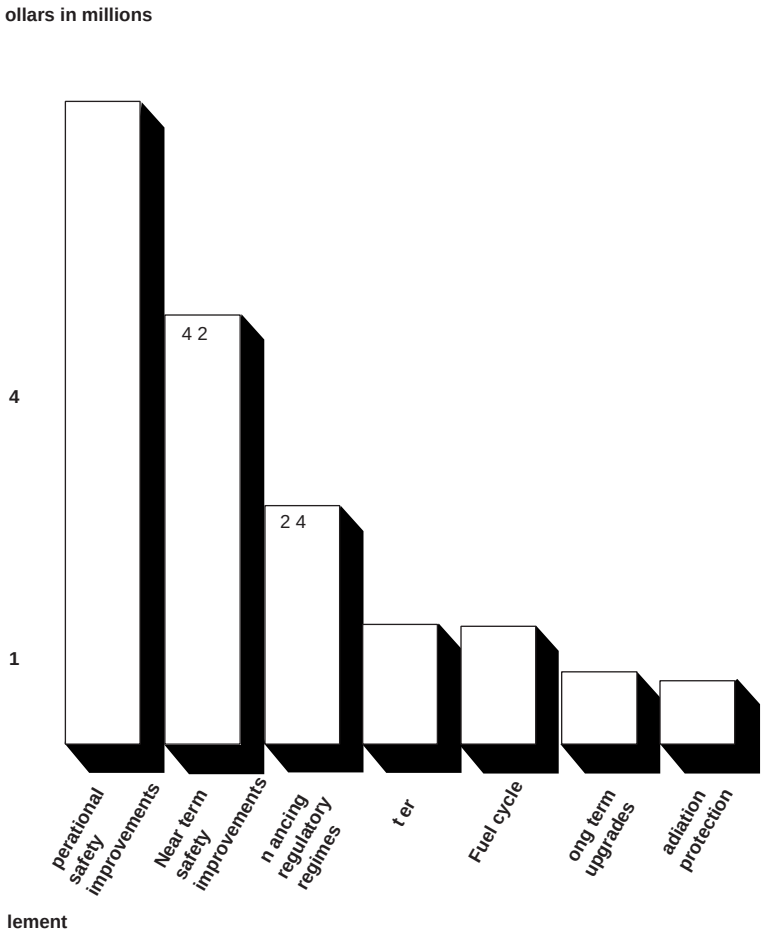
In 1992, the G-7 countries developed an emergency action plan to address the safety problems of Soviet-designed reactors. The plan falls into three

broad categories—operational safety improvements, near-term technical (safety) improvements, and regulatory enhancements. In general, operational safety improvements, such as training plant personnel, can be implemented at all plants regardless of the reactor type. Near-term safety improvements have been implemented at specific reactors, such as the highest-risk reactors. Such improvements include installing metal fire doors and other fire protection material and conducting engineering studies. Donors have also provided assistance aimed at strengthening independent regulatory organizations through training and helping these countries establish a legal basis for their regulatory authorities. Projects covering a wide variety of other areas have also been funded, including

- longer-term safety upgrades that would be targeted toward more recently designed Soviet reactors, including assistance to VVER Model 1000 reactors;
- radiation protection, which would include monitoring systems to protect against the consequences of nuclear accidents; and
- fuel cycle activities, such as storing spent nuclear fuel and managing radioactive waste.

Figure 4 shows how the donors' contributions, totaling $1.9 billion, are divided among the various types of safety activities.

Figure 4: Types and Amounts of Funds for Nuclear Safety Improvements as of November 1999



Note: The "Other" category includes decommissioning studies, nuclear engineering courses, and related training and safeguards support.

Source: GAO's presentation of data from the G-24's database.

U.S. Nuclear Safety Assistance Program

The U.S. contribution of $545 million has been used to provide plant safety evaluations and upgrades, training, fire safety equipment and materials, and regulatory assistance. Most of the U.S. assistance has been spent to improve safety in Russia and Ukraine. However, DOE and NRC have had problems spending appropriated program funds in a timely manner, and NRC returned over $500,000 to the U.S. Treasury because it did not obligate

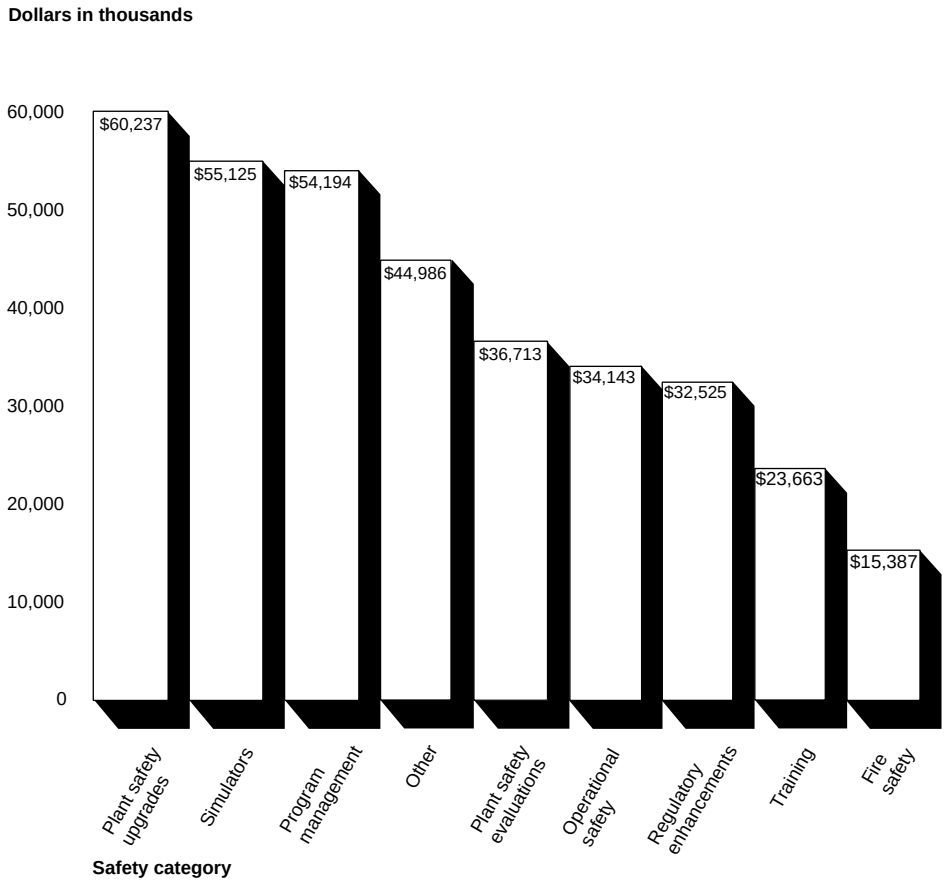
these funds within a 2-year statutorily imposed period covering their availability.

The U.S. contribution is divided into two components: $101 million to two international accounts administered by the European Bank for Reconstruction and Development—the Nuclear Safety Account and the Chornobyl Shelter Implementation Plan—and $444 million in appropriations for safety activities managed by DOE and NRC. Of this amount, $294 million, or 66 percent, was transferred to DOE and NRC from the U.S. Agency for International Development (US AID) through various interagency agreements. The remainder came from direct appropriations to DOE ($139 million, or 31 percent) and through funds transferred to DOE by the Department of Defense ($11 million, or 3 percent).

DOE's and NRC's Expenditures for Nuclear Safety Assistance

Of the $444 million in total funding available to DOE and NRC for nuclear safety assistance, both agencies had spent about $357 million as of September 30, 1999. As shown in figure 5, these expenditures were for safety improvements to nuclear power plants, plant safety evaluations, operator training, fire safety equipment, and training and efforts to improve nuclear regulatory authorities.

Figure 5: DOE's and NRC's Expenditures of Nuclear Safety Funds Totaling $357 Million as of September 30, 1999



Notes:

1. All amounts shown above, except for regulatory enhancements, are related to DOE's assistance activities. Strengthening nuclear regulatory authorities is one of NRC's assistance activities.

2. Program management includes national laboratory salaries and fringe benefits, overhead costs, and miscellaneous costs, such as those for printing, interpreters, and travel.

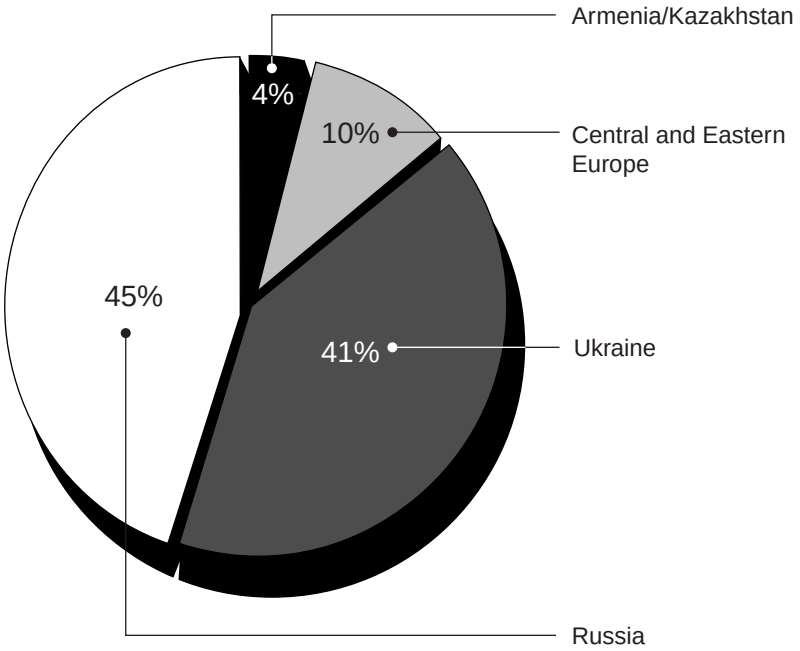
3. The "Other" category includes funds for, among other things, fuel cycle safety, decommissioning, the Slavutych Laboratory of International Research and Technology, studies to identify alternatives for replacing and eventually closing high-risk reactors, and the international nuclear safety centers.

Sources: GAO's presentation of data from DOE and NRC.

DOE and NRC have targeted their nuclear safety expenditures primarily to the countries operating the most Soviet-designed nuclear power plants—Russia and Ukraine. As shown in figure 6, 86 percent of these expenditures

have gone to those two countries. The other major recipients are the countries of Central and Eastern Europe and Armenia.

Figure 6: Distribution of DOE's and NRC's Expenditures Totaling $357 Million to Recipient Countries



Note: Expenditures for Armenia total $11.8 million, and expenditures for Kazakhstan total $1.4 million. In 1999, Kazakhstan shut down a Soviet-designed fast breeder reactor that it had been operating since 1972.

Sources: GAO's presentation of data from DOE and NRC.

DOE's and NRC's cumulative expenditures through fiscal year 1999 comprise several program elements, as shown in tables 1 and 2. DOE incurred the bulk of its costs under three categories—materials/subcontracts, overhead, and labor—which account for 93 percent of its total expenditures. The largest of these costs was for materials and subcontracts, which made up 65 percent of the total. PNNL, which administers the safety program for DOE, spent the most of any DOE organization—$219 million. (See table 1.) NRC incurred the bulk of its total expenditures in three categories—training, equipment, and travel—which accounted for 84 percent of its total expenditures. (See table 2.)

Table 1: DOE's Cumulative Expenditures for the Nuclear Safety Assistance Program Through September 30, 1999

Dollars in thousands

			DOE Activity					
Cost element	**PNNL**	**DOE headquarters**	**BNL**	**ANL**	**CH**	**BAO/ORNL**	**Total**	**Percent of total**
Labor[a]	$23,381	$0	$10,674	$9,473	$0	$41	**$43,569**	13
Travel[b]	4,375	1,209	2,340	1,388	0	6	**9,318**	3
Materials/subcontracts[c]	156,534	8,362	32,110	4,475	10,350	0	**211,831**	65
Other direct costs[d]	6,123	1,479	4,351	509	0	0	**12,462**	4
Overhead[e]	28,625	0	14,790	3,855	0	0	**47,270**	15
Total	**$219,038**	**$11,050**	**$64,265**	**$19,700**	**$10,350**	**$47**	**$324,450**	**100**

Legend:

DOE – Department of Energy
PNNL – Pacific Northwest National Laboratory
BNL – Brookhaven National Laboratory
ANL – Argonne National Laboratory
CH – Chicago Area Office
BAO/ORNL – Brookhaven Area Office and Oak Ridge National Laboratory

[a]Includes salaries, wages, fringe benefits, and pensions that are directly chargeable to the international nuclear safety program. DOE headquarters employees' salaries are not charged directly to the program but are funded through DOE's Office of Nonproliferation and National Security's program direction account. DOE estimated that the fiscal year 1999 salaries and expenses for headquarters employees assigned to the international nuclear safety program totaled $1.7 million.

[b]Includes the travel and per diem costs—foreign and domestic—of DOE and laboratory officials. Does not include the travel and per diem costs of foreign nationals under the program; these costs are included in the "materials/subcontracts."

[c]Includes directly applicable purchase orders, subcontracts (both foreign and domestic), and consulting services. Contractor labor, travel, and overhead charges are included in this category.

[d]Includes the costs of certain centralized services, such as document translation, office supplies, and computer services.

[e]Includes charges for organizational overhead, general and administrative expenses, and service assessments.

Source: GAO's presentation of data from DOE.

Table 2: Cumulative Expenditures for the Nuclear Regulatory Commission's Safety Assistance Program Through September 30, 1999

Dollars in thousands

Cost element	Amount	Percent
Training[a]	$13,671	42
Equipment	8,588	26
Other travel paid by NRC[b]	3,739	11
Computer codes[c]	3,047	9
NRC staff travel	1,574	5
Interpreters/translation services	1,085	3
NRC staff salaries and expenses[d]	821	3
Total	**$32,525**	**99[e]**

[a]Includes the costs of hiring contractor personnel from DOE's national laboratories.

[b]Represents the travel and per diem costs of foreign national officials.

[c]Transfer and training in the use of computer programs used by NRC for safety analysis and participation in user groups.

[d]Represents NRC staff costs that were reimbursed by US AID in fiscal year 1999 for program activities related to Armenia, Kazakhstan, Russia, and Ukraine. All other staff costs were funded from NRC's appropriations. With the exception of fiscal year 1999, NRC did not track actual staff costs but did estimate full-time-equivalent positions for budgeting and planning purposes. These full-time-equivalent estimates ranged from approximately 35 in fiscal year 1994 to approximately 7 in fiscal year 1999.

DOE and NRC Have Unspent and Unobligated Funds

As of September 30, 1999, DOE had carried over a balance of $78 million in appropriated funds from prior years. As shown in table 3, this figure includes about $27 million in unobligated funds [1] and about $51 million in funds that had been obligated but not yet spent. The large amount of carryover funds has concerned the Congress, which reduced DOE's request for additional funds by more than half in fiscal year 2000. Furthermore, NRC had carried over $9 million from prior years as of September 1999; more than half of this amount consisted of unobligated funds and obligated but unspent funds that NRC had received for safety activities in Ukraine. In addition, NRC returned over $500,000 to the U.S. Treasury because the

[1]According to DOE, the $27 million in unobligated funds were fiscal year 1999 funds transferred by US AID to DOE in June 1999. DOE obligated these funds by January 2000.

funds for Ukraine were not obligated within a 2-year statutorily imposed period covering the availability of US AID funds transferred to the program.

Table 3: Obligations and Expenditures for DOE's and NRC's Safety Assistance Programs, as of September 30, 1999

Dollars in thousands

Agency and recipient	Funds available	Funds unobligated	Funds obligated	Funds obligated and spent	Funds obligated but not spent
DOE					
Ukraine	$178,379	$17,262	$161,117	$134,000	$27,117
Russia	172,629	4,889	167,740	148,914	$18,826
Central and Eastern Europe	34,243	1,209	33,034	30,558	2,476
Armenia	16,000	2,744	13,256	10,500	2,756
Kazakhstan	1,000	515	485	477	8
DOE subtotal	**$402,251**	**$26,619**	**$375,632**	**$324,449**	**$51,183**
NRC					
Ukraine	$16,613	$2,550	$14,063	$11,417	$2,646
Russia	13,877	1,093	12,784	12,413	371
Central and Eastern Europe	7,894	719	7,175	6,491	684
Armenia	1,915	82	1,833	1,299	534
Kazakhstan	1,545	82	1,463	905	558
NRC subtotal	**$41,844**	**$4,526**	**$37,318**	**$32,525**	**$4,793**
Total	**$444,095**	**$31,145**	**$412,950**	**$356,974**	**$55,976**

Sources: GAO's presentation of data from DOE and NRC.

As we noted in a prior report,[2] DOE, PNNL, and NRC officials acknowledged that their obligation and expenditure rates for the safety program—particularly for Russia and Ukraine—had lagged over time. In particular, DOE continues to have large amounts of carryover funds. In its report on the fiscal year 2000 Energy and Water Development appropriations bill, the House Appropriations Committee recommended that DOE's request for international nuclear safety assistance funds be reduced because the program was carrying excessive balances of unspent

[2] *Nuclear Safety: Status of U.S. Assistance to Improve the Safety of Soviet-Designed Reactors* (GAO/RCED-97-5, Oct. 29, 1996).

funds from prior years. The committee noted that the program had unspent funding balances that were double the amount of the total new funding provided to DOE in fiscal year 1999. Ultimately, the Congress decided to cut DOE's fiscal year 2000 budget request for the program by 55 percent, from $34 million to $15 million.

According to DOE, three major factors account for its current carryover balances:

- A lag occurs between the date work is performed and the date costs are recorded at DOE headquarters.
- Many projects are executed over several years, but the majority of the funding for these projects is requested and received in advance for contracting purposes. As a result, funds may be obligated during the early years of the projects, but expenditures are spread over several years.
- Difficulties, such as problems with customs and other unforeseen delays, are frequently associated with doing work in the Newly Independent States. For example, in January 1999, the United States imposed sanctions on the Russian designer of RBMK reactors—the Research and Development Institute of Power Engineering—after determining that it had provided sensitive missile or nuclear assistance to Iran. As a result, DOE's nuclear-safety-related contracts with this organization, totaling about $2 million, were suspended and funds, which had been obligated, could not be spent. DOE is now deobligating these funds for reprogramming to other projects or seeking alternative vendors.

According to DOE, although some contracts allow for progress payments, most payments are not made until the end of a project, when deliverables are received and determined to be acceptable. This accounts for the lag between the time program funds are obligated and spent. For example, funds were obligated for projects, such as training simulators, with long procurement cycles. As a result, although DOE obligated funds early on to finance the projects, expenditures were to be made over several years, creating unspent balances during the course of the projects. Thus, for simulators and related training activities, DOE reported an unspent balance of $22.9 million as of August 29, 1999. We found several other instances when program funds were obligated for several years and expenditures lagged. Examples include the following:

- A fire protection project with the Smolensk nuclear power plant has been carrying large unspent balances since the mid-1990s. According to DOE, almost one-quarter of these funds, or approximately $1.3 million, has remained unspent because of delays associated with Russian contractor personnel. The DOE project manager said he believes the funds, which have been obligated, will be spent in early 2000.
- Several other projects for developing emergency operating instructions showed that $505,000 of $1.8 million had not been spent as of September 1999. According to PNNL officials, work had begun on these projects in fiscal years 1994 and 1995 but had not yet been completed. Specifically, these projects are proceeding slower than originally anticipated, and delays have occurred during Russia's and Ukraine's performance of the analyses necessary to validate the instructions. One such project, at the Balakovo nuclear power plant in Russia, was started in December 1995, at which time DOE obligated $120,000. As of September 1999, one half of the funding originally obligated for the project had been spent. About $10 million for in-depth safety analyses at five power plants in Ukraine was unspent as of August 1999. According to a DOE official, the Ukraine projects have been delayed primarily by a lack of technical expertise and resources at these plants.

When we asked why NRC was unable to obligate and spend $506,000 of its fiscal year 1997 and 1998 program funds in accordance with a statutorily imposed 2-year period of availability, we obtained differing and conflicting views. These funds were designated for projects and activities in Ukraine. NRC officials provided several reasons for this problem, including (1) abrupt changes in the management of NRC's Russian and Ukrainian assistance activities, (2) difficulties in adjusting the Ukrainian program to accommodate the 2-year availability of funds, and (3) NRC's inability to accept US AID funding on a timely basis. According to an NRC official, NRC did not effectively monitor the flow of funds from US AID or coordinate efforts to ensure that the funds could be obligated or reprogrammed. This official also stated that Ukraine has numerous pressing needs related to the enhancement of its regulatory authority and could have used these funds for that purpose. However, another NRC official told us that the funds were turned back because he did not believe that NRC staff had adequately justified the use of these funds. According to the State Department, because NRC continues to maintain a large unobligated balance of funds for Ukraine, US AID will not provide any funds to support fiscal year 2000 projects or activities for Ukraine unless some unusual requirement surfaces concerning Chornobyl's closure.

Future Costs of U.S. Safety Program Are Uncertain

Although the Department of Energy plans to complete its safety activities by 2005, State Department and NRC officials did not have a date for completing U.S. safety assistance efforts. According to DOE's Strategy Document, issued in June 1998, DOE estimates the cost to complete its remaining safety activities at Soviet-designed reactors by 2005 at $372 million. DOE based this estimate on its plan for completing individual safety projects at Soviet-designed reactors. For example, at the Balakovo nuclear power plant in Russia, DOE anticipates that funds will be allocated for in-depth safety analyses through fiscal year 2005. Once these projects are completed, according to DOE, the program will have achieved its objectives. The projected costs of DOE's activities will be about $709 million. According to the director of DOE's nuclear safety program, the time frames could increase if anticipated funding during the next several years is not received. However, the Department of State's Senior Coordinator for Nuclear Safety told us that U.S. assistance should continue for some time because the highest-risk reactors have not been shut down and safety culture problems remain. Such a culture implies an awareness of, and commitment to, the importance of safety on both individual and organizational levels. She said that the United States will be engaged for a considerable time in Russia, Ukraine, Armenia, and Bulgaria. Furthermore, she believes that safety assistance should concentrate on regulatory assistance because (1) the role of the regulator is not yet firmly established in most of these countries and (2) strong regulatory bodies are necessary to sustain safety improvements over the long term. In addition, assistance should also focus on improving operational safety through training and safety assessments.

NRC officials also said they believe the role of the regulator must continue to be supported by the United States and other countries. However, given the original short-term nature of NRC's safety assistance effort, NRC has not thus far established a long-term funding strategy. The director of NRC's Office of International Programs said NRC would continue to provide some undetermined level of regulatory assistance as long as unsafe Soviet-designed reactors continue to operate.

Conclusions

A troubling aspect of DOE's implementation of its safety assistance effort has been a large and continuing carryover of unspent program funds. This raises the question of whether certain projects, which contribute to the carryover, are still viable or needed. While DOE has some plausible reasons for the lags in spending program funds, a number of projects with slow

spending rates have been "on the books" for several years. In our view, there is a question as to whether these projects are still important to meeting the program's objectives. In addition, NRC's inability to obligate a portion of its funds for Ukraine within a statutory 2-year period of availability also raises concerns because Ukraine needs assistance in establishing a sound regulatory infrastructure. Furthermore, according to the State Department's Senior Coordinator for Nuclear Safety, future U.S. safety assistance will be in the realm of strengthening the nuclear regulatory authorities in the Newly Independent States to ensure that safety benefits are sustained and NRC is expected to play a continuing key role in this effort.

Recommendations to the Secretary of Energy and the Chairman of the Nuclear Regulatory Commission

To maximize the use of U.S. safety assistance program funds, we recommend that

- the Secretary (1) review all DOE projects with significant carryover balances and consider ways to accelerate the projects' completion, to the extent feasible, and (2) determine whether projects whose progress has been continuously slow or limited are still viable, given the program's current goals and objectives and
- the Chairman consistently monitor the funding for NRC's safety assistance program to ensure that these funds are obligated on a timely basis in accordance with the program's priorities.

Agency Comments and Our Evaluation

DOE agreed with our recommendations and said it would continue its efforts to reduce carryover balances (unspent program funds). DOE also provided clarifying information about these balances. The Department stated that two of the projects we identified as moving slowly and contributing to the carryover problem accounted for less than 3 percent of the total unspent balances. However, DOE's response did not cite another type of project—in-depth safety analyses—with a balance of about $10 million (or about 12 percent of the total carryover balance) that we referred to in the report as well. Furthermore, as stated in the report, we reviewed a number of diverse projects to obtain a better understanding of the Department's continuing problems with large carryover balances for its nuclear safety-related activities. Our recommendation to the Secretary of Energy is intended to encourage the Department to review all of its projects with significant carryover balances and consider ways to accelerate the projects' completion or determine if the projects are still

viable. The Department's comments are presented in appendix II. NRC agreed with our recommendation and its comments are presented in appendix III.

Experts Believe That Assistance Has Improved the Safety of Soviet-Designed Reactors, but More Improvements Are Needed

In June 1999, nuclear safety experts from 32 countries and international organizations met at a conference in Vienna, Austria, to assess the impact of nuclear safety efforts over the past decade in countries operating Soviet-designed reactors and to focus on future international cooperation and assistance. The experts concluded that while progress had been made in improving the safety of Soviet-designed nuclear power plants, more improvements are needed, especially in areas such as strengthening the independence and effectiveness of nuclear regulatory organizations. Officials from many countries operating Soviet-designed reactors said U.S. assistance had a direct impact on improving the reactors' safety. However, according to U.S. safety experts, it is difficult to quantify the extent to which safety assistance has reduced the risks of operating these reactors.

Experts' Views on the Safety of Soviet-Designed Reactors

In June 1999, the International Atomic Energy Agency, in cooperation with the European Commission and the Nuclear Energy Agency, organized the International Conference on Strengthening Nuclear Safety in Eastern Europe.[1] The objectives of the conference were to assess the impact of nuclear safety efforts over the past decade in countries operating Soviet-designed reactors and to focus on areas where future international cooperation and assistance should be targeted. The conference was chaired by the Department of State's Senior Coordinator for Nuclear Safety and included representatives from all of the countries operating Soviet-designed nuclear reactors and all of the major donors of assistance, including a delegation from the departments of State and Energy and the Nuclear Regulatory Commission.

The safety experts from 32 countries and international organizations who attended the conference concluded that the countries operating the Soviet-designed reactors had made significant progress on nuclear safety issues, such as

- strengthening the independence and technical competence of nuclear regulatory authorities,
- demonstrating clear progress in improving the way plants are operated, and
- establishing design safety improvement programs.

[1]The Eastern European countries operating RBMK and VVER reactors were Armenia, Bulgaria, the Czech Republic, Hungary, Lithuania, Russia, the Slovak Republic, and Ukraine.

The conference reported that the governments operating Soviet-designed reactors need to ensure that their nuclear regulatory authorities have the financial resources and enforcement authority required to fully execute their missions. Furthermore, the conference concluded that significant additional efforts—and further assistance—were required to maintain and enhance an effective safety culture. The conference report further noted that improvements in the design of nuclear reactors varied from country to country and were affected by economic conditions.

According to the U.S. Mission to International Organizations in Vienna, Austria, while the conference clearly established that safety has improved in all countries operating Soviet-designed nuclear power plants, only Hungary, the Czech Republic and, to a certain extent, the Slovak Republic showed real progress in implementing western safety practices. However, according to the U.S. representatives, Ukraine lacks the financial resources to achieve its stated safety goals, and Russia was behind all of the countries in terms of safety improvements and safety culture.

Recipients Find U.S. Safety Assistance Beneficial

Several officials from countries that have received U.S. safety assistance provided us with their views on the quality and effectiveness of the assistance. These officials told us that the assistance had a direct impact on improving safety because it focused on equipment and training. The officials cited examples of useful projects, including the following:

- The Director-General of the All-Russian Research Institute for Nuclear Power Plant Operations (VNIIAES [2]) characterized U.S. training and simulator equipment as effective. He noted that the U.S. assistance complemented Russia's own efforts to improve the safety of its reactors.
- The vice president of Armenia's Nuclear Power Plant Company said that U.S.-supplied equipment, specifically the safety parameter display system, improved plant operators' ability to systematically monitor various safety systems. This system collects and displays safety information at a computer workstation in the control room of a nuclear power plant.
- A Hungarian nuclear safety official told us that U.S. safety assistance has contributed to major changes in how plant operators view the importance of safety.

[2]VNIIAES assists nuclear power plants with startup activities, operations, and training in Russia. It also manufactures full-scope and analytical simulators.

In October 1999, we visited two nuclear power plants in Ukraine—Chornobyl and Khmelnytskyy—and met with officials from Ukraine's nuclear regulatory organization and nuclear utility to obtain their views on the impact of U.S. assistance. These officials told us that the assistance provided by DOE and NRC was important, and they showed us functioning safety equipment, such as full-scope simulators, fire extinguishers and metal fire doors, and safety parameter display systems, that they received through the U.S. safety assistance program. A full-scope simulator is a replica of a nuclear reactor's control room.

At Khmelnytskyy, nuclear power plant officials told us that the full-scope simulator provided by DOE in 1998 is an excellent training tool. Before receiving the simulator, the plant obtained all of its training through books and the training was theoretical. Simulator training, by contrast, is practical and "hands on." One plant official told us that U.S.-provided simulator training enabled plant operators to avoid shutting down the plant during an actual safety incident because plant personnel were familiar with the correct procedures to follow. According to these officials, they would have lost $600,000 in potential electricity revenues if they had been forced to shut down the plant's operations. A Chornobyl control room shift supervisor told us that the emergency operating instructions developed with assistance from the United States were very valuable because they made the operators think about the importance of safety in the day-to-day operations of the plant. Emergency operating instructions specify actions for operators to take in response to changes in a plant's conditions and allow the operators to stabilize the reactor without having to first determine what caused the changes.

Ukrainian officials also showed us safety-related projects funded by NRC that they said had helped strengthen the effectiveness of their regulatory organization:

- An emergency response center at the headquarters of Ukraine's nuclear regulatory organization, which became operational in 1998, serves as a countrywide coordinating center in the event of a nuclear accident.
- Analytical simulators, used by Ukrainian nuclear safety regulators for training purposes, familiarize them with plant operations. Analytical simulators use computer screens with graphic displays that imitate plant systems. Operators enter computer commands to "operate" equipment, rather than using switches and controls as they would with a full-scope simulator.

Fire safety has been a component of the U.S. safety assistance program since its inception. According to DOE, over 100 fires occurred in nuclear power plants in the former Soviet Union from 1980 through 1988. In response to this concern, DOE has funded a limited number of fire safety projects at selected sites, but these projects are almost completed. Some Ukrainian officials identified a need for additional fire safety equipment, particularly metal fire-retardant doors, which they said are needed to replace the wooden doors now found in Soviet-designed reactors. According to representatives of a Ukrainian company that is manufacturing and installing metal fire doors, the company has stopped producing the doors because the plants cannot afford to pay for them. They said that Ukraine plants need about 2,000 more fire doors and Russian plants also need more doors. Figures 7, 8, and 9 illustrate safety equipment provided through the U.S. safety assistance program.

Figure 7: Safety Parameter Display System at Khmelnytskyy Nuclear Power Plant

Figure 8: Full-Scope Simulator at Khmelnytskyy Nuclear Power Plant

Figure 9: Analytical Simulator Used by Ukrainian Nuclear Regulators

Impact of U.S. Safety Assistance Is Difficult to Measure

U.S. safety experts told us that although they believe the safety of Soviet-designed nuclear power plants has improved, it is difficult to quantify the extent to which safety assistance has reduced the risks of their operation. According to a 1999 PNNL study, objective performance measurement is very difficult because nuclear power plants operating in these countries have only recently started recording and reporting standard safety performance activities. Thus, historical data are not available to establish a baseline for gauging the impact of improvements. Notwithstanding these limitations, DOE has developed two sets of performance indicators. These include (1) quantifiable measures of progress to reflect the transfer of equipment, procedures, and software and the effectiveness of training and (2) indicators in six key technology areas—operational safety, training, maintenance, safety systems, safety assessments, and regulatory and institutional policy and capabilities.

DOE has provided examples of how U.S. safety projects were being implemented as measures of the program's success. For example, in its fiscal year 2001 budget request, DOE identified several quantifiable activities, including

- training over 6,000 nuclear plant operators in programs that were based on U.S. methodology,
- installing seven training simulators and manufacturing six additional training simulators,
- installing safety parameter display systems at eight reactors and manufacturing five additional systems, and
- completing fire safety upgrades at five reactor sites and conducting upgrades at two other reactor sites.

NRC officials told us that they also gauge the program's impact by quantifying the results of projects, such as the number of Russian and Ukrainian regulators who have received training from NRC. In addition, the regulators have provided NRC with numerous examples of regulations and regulatory-related documents that have been produced as a result of NRC's assistance.

A major issue that arose during the 1999 International Conference on Strengthening Nuclear Safety in Eastern Europe was the use of probabilistic risk assessments by countries operating Soviet-designed reactors to show that plant safety had been significantly improved. According to PNNL officials, probabilistic risk assessments have been used

for about 25 years in the United States to provide insights for improving the safety of nuclear power plants. The results of the assessments are reported in terms of the chances, or frequencies, that certain events may lead to an accident. The assessments, however, have limitations, and their results can vary widely depending on the accuracy of the input data, the depth of analysis, the software used, and the amount of peer review. According to DOE, the value of such assessments is their systematic evaluation of the safety of a plant's design, not the bottom-line frequencies that they generate. As a result, changes to the bottom-line frequencies should not be used alone to demonstrate that safety has improved or declined, unless the frequencies reflect the results of a complete safety assessment (performed with valid input data, validation of computer codes, and international peer review).

U.S. officials expressed concern that countries operating Soviet-designed nuclear power plants were misusing the results of probabilistic risk assessments. For example, Lithuanian officials at the safety conference sponsored by IAEA cited bottom-line frequencies to demonstrate safety improvements at one of Lithuania's RBMK reactors. Several U.S. safety experts believed that Lithuania's presentation, based on the reactor's safety assessment, were misleading. According to PNNL officials, nearly all Soviet-designed plants have had a probabilistic risk assessment performed to some degree, and the results of these assessments are increasingly being used to determine that the plants are now safe. The officials noted that this practice continues despite warnings by experts that the results are uncertain and subject to manipulation.

Progress Toward Shutting Down Soviet-Designed Reactors Has Been Limited

For donor countries, the goal of nuclear safety assistance continues to be the earliest practicable shutdown of the highest-risk Soviet-designed reactors. Although Ukraine decided to shut down one of its reactors at the Chornobyl nuclear power plant in 1996, all of the other highest-risk reactors continue to operate despite the efforts of the international community to obtain their closure. The countries operating Soviet-designed reactors depend, to varying degrees, on nuclear power to meet their domestic energy requirements, and, in their view, the reactors provide a low-cost energy supply. Furthermore, safety experts from several countries and IAEA told us that the assistance provided to improve the safety of the reactors has had the unintended consequence of encouraging plant operators to continue operating them despite their inherent safety flaws.

Goal of International Assistance Program Was to Encourage the Shutdown of the Highest-Risk Reactors

In 1992, the donors of safety assistance began working toward the early shutdown of the highest-risk reactors as part of the G-7 nuclear safety assistance program. The United States has consistently supported this objective. The 1992 Lisbon Initiative on Multilateral Nuclear Safety, which established the U.S. safety assistance program, also noted that these reactors should be shut down. In addition, the Congress, in the 1992 Freedom Support Act, viewed U.S. assistance as providing short-term upgrades to civilian nuclear power plants and seeking to shut down those plants where economically feasible. In 1996, Ukraine shut down a reactor at the Chornobyl nuclear power plant because it lacked the resources to replace deteriorating reactor components. Currently, only one of the plant's four originally functioning reactors remains operational. However, it appears unlikely that many, if any, of the other highest-risk Soviet-designed reactors will be closed in the near future.

During our review, officials from Finland, France, Italy, Sweden, the United Kingdom, and IAEA told us it was unrealistic to believe that these plants would be shut down quickly because the countries operating them all rely, to a certain extent, on nuclear power for their energy needs. For example, as of 1997, the nuclear share of electricity production was 14 percent in Russia, 47 percent in Ukraine, and 83 percent in Lithuania. Further complicating efforts to obtain their early closure, these nuclear power plants each employ several thousand people who do not have alternative employment opportunities. Additionally, the plants are a primary source of domestic heat.

Officials from these countries, as well as DOE and State Department officials, have also noted that when the shutdown policy was begun in the early 1990s, the G-7 countries believed that the countries operating these reactors would adopt market economies and attract investment capital to acquire replacement energy. Some of these officials said that certain economic and political assumptions have not proved to be accurate. For example, Ukraine has been unable to restructure its energy sector to implement sustainable energy reforms. A nuclear safety official from Sweden told us that the G-7 document advocating the early shutdown of the high-risk reactors is unachievable and irrelevant, and although some Soviet reactor designs are inherently unsafe, economic and political factors will prevent their closure in the near future. The Department of State's Senior Coordinator for Nuclear Safety told us that no one fully understood how much political resistance to closure would be raised by the countries operating these reactors.

As we noted in our 1994 report,[1] international nuclear safety officials recognized that closing the highest-risk reactors would require an integrated, long-term energy strategy. Nuclear safety assistance is considered one part of a larger effort that must include market reforms, adjustments to energy prices, and the identification of both nuclear and nonnuclear forms of replacement energy. In 1993, a study by the World Bank and other international institutions concluded that it would it would be technically feasible to shut down the highest-risk reactors and replace them with alternative energy sources by the mid- to late 1990s at a cost of about $21 billion. However, a World Bank official told us that the original estimate assumed that economic conditions in these countries would improve. He noted that economic conditions had not improved, political systems in some of the countries are unstable, and the amount of money required to facilitate the shutdown of the highest-risk reactors would be significantly greater than originally estimated.

[1] *Nuclear Safety: International Assistance Efforts to Make Soviet-Designed Reactors Safer* (GAO/RCED-94-234, Sept. 29, 1994).

Assistance May Be Used to Justify Continued Operation of Highest-Risk Plants

Many safety experts told us that the countries operating Soviet-designed nuclear power plants will continue to do so as long as they perceive the operations to be in their best economic interests. However, safety experts from Austria, Finland, Sweden, the United Kingdom, and IAEA told us that the assistance provided to improve the safety of the reactors has had the unintended consequence of encouraging plant operators to continue operating them despite their inherent safety flaws. A United Kingdom safety expert said he recognizes this dilemma but believes that the donor countries must continue to reduce the risks involved in the operation of the highest-risk plants. According to the State Department's Senior Coordinator for Nuclear Safety, all donor countries determined that it was worth the risks to provide the assistance to improve the reactors' safety because of the known health and safety dangers posed by the operation of the highest-risk reactors. She noted that it was later that the donors recognized that the assistance might encourage the continued operation of these plants.

Russia has taken advantage of international nuclear safety assistance to bolster its claims that its highest-risk reactors are likely to operate for many more years. In a May 1999 letter to a personal representative of the German Chancellor, Russia's Minister of Economy expressed his appreciation for the safety assistance provided by the international community to improve the safety of Russia's nuclear power plants. He noted that this assistance was helping Russia continue its wide-scale efforts to modernize its plants, including the highest-risk reactors. The Minister stated that in 1998, Russia had adopted a program of nuclear energy development, whose principal task is improving the safety of all nuclear power plants, including those posing the highest risks, through 2010.

The Department of State's Senior Coordinator for Nuclear Safety told us that the United States and other donors were concerned about Russia's position. She stated that the assistance was meant to protect public health in the countries operating these reactors and to protect people in Europe and other locations from needless exposure to radiation until the reactors were shut down. In her view, the assistance was never intended to extend the lives of these reactors, although the countries operating them never accepted this view. The May 1999 letter made it clear, for example, that Russia did not intend to close any of its RBMK and VVER 440 Model 230 reactors. The Senior Coordinator said that in response to Russia's position on closure, the donors would have to reassess their position on continuing

to provide safety assistance to Russia. She thought the donors might focus more attention on strengthening the role of Russia's nuclear regulatory organization to help it develop the ability to close the reactors that, according to safety assessments, pose the highest risks.

Safety experts from the United States, Japan, the European Commission, and the European Bank for Reconstruction and Development told us that the donor countries have tried not to provide equipment that could be used to extend the lives of the highest-risk reactors. As we reported in 1996,[2] however, DOE had allocated about $8.5 million to a project that transferred western maintenance practices, training methods, and technology to staff operating RBMK reactors. DOE stated that it was not providing any equipment that would extend the lives of these reactors, such as larger components or major piping or wiring systems. More recently, we found that DOE had rejected projects proposed by Russia's Ministry of Atomic Energy (MINATOM) because of concerns about extending of the lives of certain reactors. In June 1999, for example, DOE informed MINATOM that it could not support the replacement of a main steam isolation valve at a VVER 440 Model 230 plant because the project could extend the plant's operation. DOE noted that the policy of the U.S. government was to assist in improving the safety of these plants but not to undertake activities that would extend their lives.

According to Russian nuclear safety officials, no technical analysis or requirement has conclusively demonstrated that the older reactors should be shut down. They noted that it is impossible to predict how long these reactors will continue to operate and stated that Russia is currently studying this matter. If technical analysis demonstrates that it is possible and economically efficient to continue to operate these plants, then Russia will continue to do so. One official noted that it is now time to start conducting the technical analysis, while there are still 5 to 6 years to make a decision. However, another high-level official from Russia's nuclear regulatory organization told us that RBMKs are inherently unsafe and should be shut down. According to him, a similar generalization about VVER reactors is more difficult because they include a variety of models and have been modified in different ways. One IAEA official told us that it was "wishful thinking" to believe that Russia would shut down its RBMK reactors. Another IAEA official said that no one should be surprised that

[2] *Nuclear Safety: Status of U.S. Assistance to Improve the Safety of Soviet-Designed Reactors* (GAO/RCED-97-5, Oct. 29, 1996).

Russia is publicly stating its intention to continue operating these reactors. He noted that Russia has stated the same position for many years.

Donors' Efforts to Shut Down the Highest-Risk Soviet-Designed Reactors Have Met With Limited Success

The donor countries, including the United States, believe that using the multilateral nuclear safety fund administered by the European Bank for Reconstruction and Development is the most probable way to link safety assistance to a plant's shutdown. Although the bank negotiated closure agreements with Bulgaria and Lithuania, efforts to obtain shutdown are tenuous. For example, Bulgaria is continuing to operate its reactors beyond the agreed-upon time frames in the bank agreement. In 1993, Bulgaria agreed to a phased shutdown of its four VVER 440 Model 230 reactors by 1998 in exchange for a $28 million equipment grant from the bank, assuming the availability of adequate replacement energy. However, Bulgaria has not had the resources to develop sources of replacement energy. According to a high-ranking representative of Bulgaria's nuclear safety organization, it was very clear that the first two VVER 440 Model 230 reactors would be shut down in 2004 or 2005 because these plants have design deficiencies that can never be fixed.

In 1994, Lithuania agreed to stop producing electricity at one its two RBMK reactors by mid-1998 unless Lithuania's safety authority granted a new operating license for that reactor. The safety authority granted the license, authorizing the plant to operate the reactor until it requires a major upgrade. Lithuania's government has prepared an energy strategy that assumes the reactor will be shut down not later than 2005, but no decision will be made on the second reactor until 2004, when a revised energy strategy is due. According to State Department officials, recent decisions by both Bulgaria and Lithuania to reaffirm closure conditions are significant because they demonstrate a commitment on the part of these countries to shut down some of their highest-risk reactors.

Agreements with Russia do not specify dates for closing its VVER 440 Model 230 or RBMK reactors. Russia has agreed to continue operating these reactors in accordance with the results of in-depth safety analyses being conducted for each plant, licensing extensions granted by the Russian regulator within specified time frames, and the development of a power sector strategy that includes measures to promote energy efficiency. In 1998, the European Bank for Reconstruction and Development concluded that there have been major difficulties getting Russian authorities to accept the conditions established in bank agreements for reactors' continued operation and that Russia's regulatory organization did

not feel bound by these conditions. As a result, it was doubtful that the safety analyses would be completed on time. A bank official told us that his organization has limited capacity to influence closure despite the agreements that are in place. The bank alone cannot insist that the countries operating the highest-risk reactors shut them down. This official—as well as other European safety experts—said the grants that the bank provides to countries operating the highest-risk reactors are not sufficient to be a determining factor when a country makes a decision about closing its reactors. The bank official noted that the entire international community of banks and governments needs to use its collective influence to encourage closure. (App. I provides more information on the status of efforts to obtain the closure of the highest-risk reactors.)

Some officials noted that the most effective way to bring about the shutdown of some reactors is through the expansion of the European Union. The Union is considering expanding and extending its membership to certain countries of Central and Eastern Europe. Countries that wish to join must demonstrate their commitment to nuclear safety. This includes the earliest possible closure of reactors that cannot be upgraded to internationally accepted safety levels at a reasonable cost. Timetables for closure are required to be consistent with the requirements of the Bank's Nuclear Safety Account agreements. Countries with high-risk reactors interested in joining the European Union include Bulgaria, Lithuania, and the Slovak Republic.

Shutdown of Chornobyl Remains Uncertain

The G-7's top priority is closing the last operating reactor (unit 3) at the Chornobyl nuclear power plant in Ukraine. In 1995, the G-7 nations and Ukraine signed a memorandum of understanding that includes Ukraine's commitment to close the plant by 2000. Although the agreement does not identify specific funding levels to help achieve closure, it does indicate that about $2.3 billion in loans and grants were anticipated to facilitate the shutdown of Chornobyl.

According to several U.S., European, and Ukrainian officials, the closure of Chornobyl in 2000 is uncertain. Several impediments to closure exist, including a lack of funding to provide replacement nuclear reactors that Ukraine believes would compensate for Chornobyl's closure and concerns about the social and economic well-being of workers who would be displaced once Chornobyl is closed. Ukraine's First Deputy Minister of Energy told us that the G-7 nations are not honoring their financial

commitments to help Ukraine facilitate the shutdown of Chornobyl. Furthermore, in his view, the agreement commits the G-7 countries to help complete two nuclear power reactors in Ukraine that can provide adequate replacement energy. He noted that in order to obtain financing for the completion of the two plants, the European Bank for Reconstruction and Development is requiring expensive safety improvements that will significantly increase the cost of completing the unfinished reactors.

The First Deputy Minister said he would advise his government not to shut down Chornobyl unless it receives adequate financial support from the G-7 nations. The head of Ukraine's regulatory organization told us that Ukraine will abide by its commitment to close Chornobyl. However, Ukraine expects the G-7 nations to abide by their commitments to provide financial assistance. The director and assistant chief engineer of Chornobyl told us that the plant should not be closed. The director, who is responsible for operating the entire plant and its surrounding support institutions, said that the positions of thousands of plant employees would have to be terminated, significantly increasing unemployment in the local area. He noted that closure was a political issue. The assistant chief engineer said concerns about the premature shutdown of the plant are affecting the attitudes of Chornobyl workers toward safety. He believes that Chornobyl requires maintenance to correct safety problems and that it would be better to repair the old plant than to build new ones.

There are other impediments to Chornobyl's closure. For example, Ukrainian officials stated that the plant will not be closed until there is an adequate supply of heat for the workers who will be performing decommissioning activities, which could last for a few decades. Currently, an obsolete plant is providing heat. The United States plans to spend about $30 million to finish the construction of a new heat plant. According to PNNL representatives, Chornobyl fire department officials have been uncooperative and have delayed issuing fire permits for the construction site because the Chornobyl plant's management owes the fire department money. They further noted that the plant's management has not been aggressive in trying to resolve these differences because it does not want to shut down the plant. During our visit to Chornobyl in October 1999, the construction of the heat plant was about 4 months behind schedule. The U.S. heat plant project manager told us that he seriously doubted the heat plant would be finished by the end of 2000—a delay that could jeopardize the plant's shutdown.

U.S. officials also expressed concern about Ukraine's ability to contribute to the heat plant's construction. Ukraine is expected to contribute approximately $7.5 million in in-kind support, including an 18-kilometer pipeline to carry fuel to the heat plant. As we noted in our 1996 report, Ukraine has had difficulty meeting its cost-sharing obligations under a number of joint U.S.-Ukraine nuclear safety projects. Officials from the U.S. embassy in Kiev and from PNNL told us that it was uncertain if Ukraine would meet its cost-sharing obligations for the heat plant. According to the State Department's Senior Coordinator for Nuclear Safety, DOE has recently obtained a commitment from the President of Ukraine to provide support for the heat plant. Figure 10 shows the status of the heat plant's construction at the time of our visit.

Figure 10: Status of Construction of the Chornobyl Heat Plant, as of October 1999

Management of Some DOE and NRC Safety Assistance Activities Has Raised Concerns

Despite the generally favorable views of the countries that have received DOE's and NRC's safety assistance, some U.S. program officials have raised concerns about the management of both agencies' programs. Specifically, DOE has funded several projects that do not meet its own project selection criteria. Although these projects may be worthwhile, they are not directly related to improving the safety of Soviet-designed nuclear reactors. As a result, DOE appears to have expanded the program beyond its original mission to upgrade the reactors' safety. In addition, DOE has funded several other projects that have raised concerns among program officials, who told us that the projects are of questionable value in meeting the program's objectives.

NRC has managed its nuclear safety assistance program from year to year without adopting a long-term strategy. Furthermore, NRC's program management responsibilities are divided among several offices, making the program vulnerable, according to NRC's Inspector General and others, to duplication of effort and miscommunication with other federal agencies participating in the program. These management weaknesses contributed to NRC's inability to obligate over $500,000 in program funds for fiscal years 1997 and 1998. The funds were subsequently returned to the U.S. Treasury.

Some DOE Projects Are Not Directly Related to Improving the Safety of Soviet-Designed Nuclear Power Plants

DOE established goals for its nuclear safety program and related project evaluation criteria in three documents—its 1997 strategic plan (which includes, as an objective, the improvement of international nuclear safety), in a 1997 strategy document for nuclear safety, and in a March 1999 report to the Congress on improving the safety of Soviet-designed nuclear power plants. According to the 1999 report, proposed projects are first screened by program staff to ensure that they will improve the safety of operating plants, prevent or contain damage to reactors in the event of accidents, and apply established technologies. Projects that meet the screening criteria are evaluated in more detail by program staff and host country experts, who apply the following criteria to determine if a project meets the program's mission: impact on safety, cost-effectiveness, and the host country's commitment. On the basis of this evaluation and the availability of resources, priorities and schedules are established for the project. According to DOE, this process ensures that projects are consistent with the policies and goals under which U.S. financial support is committed, the needs of the host countries are met, and the required resources are available.

Several projects that we reviewed do not, in our view, meet DOE's project selection criteria because they do not support the mission of improving nuclear safety. The former manager of the international nuclear safety program at PNNL told us that some of these projects are indicative of efforts by DOE's program management to find new ways of expanding the program. In his view, these types of projects may be worthwhile but should not be funded at the expense of projects that are focused on improving the Soviet-designed reactors' safety—the primary objective of DOE's effort.

The projects that we consider outside the scope of DOE's efforts to upgrade unsafe reactors are summarized below and fall into two areas. The first area includes environmental and nuclear safety centers that DOE is funding in several countries. It also includes two laboratories that were established in Ukraine to address the social impact of closing the Chornobyl nuclear power plant and support research on the environmental and biological effects of the Chornobyl accident. The second area comprises a number of projects or expenditures that either fall outside the scope of reducing the risks of accidents or otherwise represent a questionable use of program funds.

International Centers for Environmental Safety

In fiscal year 1999, DOE's international nuclear safety program allocated $100,000 for the establishment of international centers for environmental safety in the United States and Russia. According to DOE, the centers are expected to provide a way for the United States and Russia to coordinate efforts to mitigate the effects of Cold War nuclear activities on the environment, including developing strategies to manage radioactive waste and spent nuclear fuel. Idaho National Energy and Environmental Laboratory and Argonne National Laboratory were responsible for starting up the centers in coordination with Russia's Ministry of Atomic Energy. DOE officials, including the director of the international nuclear safety program, told us that the project is consistent with the goals of the nuclear safety program because radioactive waste and environmental cleanup issues are components of broader nuclear safety issues facing Russia.

Some Members of Congress have criticized the project because it is not directly related to upgrading unsafe reactors. Specifically, in its fiscal year 2000 conference report, issued in July 1999, the House Committee on Appropriations, Subcommittee on Energy and Water Development, noted that each year DOE seeks to expand the international nuclear safety program beyond its original mission—to upgrade unsafe reactors. According to the report, previous efforts to expand the program included

international nuclear safety centers and research laboratories. The report noted that such efforts are of particular concern because of (1) continuing delays in implementing the original program and (2) large carryover balances indicating that the program's implementation is lagging. According to DOE, the administration proposed in fiscal year 2000 that the environmental centers be funded entirely on their own merit. The Congress did not approve this activity and no funds are being spent in this area.

International Nuclear Safety Centers

DOE has used program funds to support nuclear safety centers in Russia, Kazakhstan, and Ukraine. The mission of the U.S.-Russian center, which is the largest of the three centers, is to facilitate ongoing technical exchanges between the United States and Russia and to improve nuclear safety technology and safety culture through joint research projects. DOE has allocated over $20 million since fiscal year 1995 (including $8.8 million in safety funds) to pay for research activities both in the United States and Russia. About $1.7 million of the total has been provided to the center in Russia to buy equipment, pay overhead costs, and supplement the salaries of about 20 to 25 Russian scientists who work on research projects. Currently, the centers are managing nine joint research projects, including the preparation of a safety database. The database provides information on nuclear power plants, research reactors, and fuel cycle facilities and is available to the public through the Internet. According to DOE, the database also contains important analytical information. The centers are also involved in a variety of other projects.[1]

In our view, while several of the centers' joint projects appear to involve worthwhile research, it is questionable whether these projects directly improve the safety of currently operating nuclear power plants. For example, one of the projects dealing with in-depth safety assessments in Russia may in the future be a useful part of Russia's licensing program, according to an Argonne National Laboratory official. Furthermore, a DOE official told us that projects related to Russia's nuclear research facility and

[1]Projects include the measurement and review of material properties data; compilation of information on Russian nuclear safety research facilities; experiments and computer codes; development of advanced coupled neutronic codes; accident management technology development for Russian nuclear power plants; validation of U.S. computer codes for transient analysis of design-based accidents; validation of three-dimensional structural analysis software and models; development of techniques for monitoring and diagnostics of sensors, systems, and equipment; and development of a strategic plan for Russian nuclear safety research.

the development of a strategic plan for safety research do not contribute to improving the safety of Soviet-designed nuclear power plants.

Lithuania and Kazakhstan have independently established safety centers, and DOE has spent $211,800 to further the centers' infrastructure-building and safety culture objectives. DOE funds have been used by the Lithuanian safety center to develop a nuclear safety Web site at the Lithuanian Energy Institute. The Kazakhstan center was established to reduce Kazakhstan's technical isolation following the breakup of the former Soviet Union and support that country's need to close a breeder reactor that poses both safety and proliferation risks.

International Radioecology Laboratory

The International Radioecology Laboratory performs studies on the wide-scale biological and environmental effects of the Chornobyl accident. DOE has used two sources of funds to support the development of the laboratory. First, DOE's Office of Environmental Management provided about $400,000 to purchase supplies and equipment for the laboratory. Second, PNNL, which was tasked by DOE to purchase the equipment and supplies, spent $8,560 in safety funds during fiscal year 1999 to provide administrative support in the areas of procurement, customs, and taxation issues. According to the former manager of PNNL's international nuclear safety program, the project has no relation to improving nuclear safety, but DOE directed PNNL to support the project because of PNNL's expertise in providing program support for safety activities in Ukraine. After we brought this matter to DOE's attention, DOE determined that no safety funds should have been used to support this activity. As a result, DOE is charging the $8,560 against the Office of Environmental Management's project account.

The Slavutych Laboratory of International Research and Technology

According to DOE officials, the Slavutych Laboratory of International Research and Technology is an important component of U.S. efforts to facilitate the shutdown of the Chornobyl nuclear power plant. DOE expects the laboratory to become self-sufficient and employ Chornobyl workers who will be displaced when the Chornobyl nuclear power plant is closed. At the time of our review, the laboratory had approximately 25 full-time employees. DOE's goal is to transform it into an enterprise that can eventually employ about 100 people. Such a goal, however, would not accommodate the approximately 6,000 personnel who work at the Chornobyl nuclear power plant, most of whom will be unemployed if the plant shuts down. DOE has allocated about $7.5 million to support the

laboratory through fiscal year 1999, including about $1.7 million to renovate and furnish a building that houses the laboratory.

The laboratory has relied heavily on DOE funds for financial assistance. It has, however, also received some support from the United Kingdom, Japan, France, and Germany. Some U.S. and Ukrainian officials questioned the value of the laboratory, and one PNNL official described it as a "middleman" for contract support, rather than a true laboratory that conducts research. The laboratory has provided, among other things, translation services and logistics support and has performed various technical studies in areas such as computer modeling and training. The director of DOE's international nuclear safety program told us that the laboratory has not done a good job of attracting clients other than DOE. He said that if it is to become self-sufficient, it will have to develop good business relationships with other organizations and countries.

One PNNL official told us he questioned whether nuclear safety funds should be used to support economic assistance projects such as the laboratory. In addition, the former chief engineer of the Chornobyl nuclear power plant–who is also the former head of Ukraine's nuclear regulatory agency–told us that the use of these funds for the Slavutych Laboratory has caused some Ukrainian officials to question DOE's safety assistance priorities because it is difficult to determine what the United States has received for its investment of over $7 million. Rather than spending money on the Slavutych Laboratory, he said the U.S. nuclear safety program could target funds to pay the salaries of workers at nuclear plants or buy certain spare parts needed to operate the plants more safely.

During the course of our review, 14 U.S. and Ukrainian officials expressed their concerns to us about the Slavutych Laboratory's business practices. Specifically, many officials told us that there was a perception that the laboratory's management lacked business ethics or an understanding of western business practices. Furthermore, several PNNL officials stated that the laboratory routinely submitted inflated cost estimates for proposed contracts to PNNL and other firms.

We presented these concerns to DOE, which subsequently tasked PNNL with investigating them. In December 1999, PNNL reported that allegations of corruption have come from various sources, including former laboratory staff from the Chornobyl Shelter Project Management Unit who have done business with the laboratory's management. According to PNNL, the employees of Westinghouse, Bechtel, Electricite de France, and Batelle

Memorial Institute (including PNNL) who are part of the project management unit also shared this negative perception of the laboratory. PNNL determined that some of these allegations stem from instances when the laboratory tried to charge the project management unit extremely high prices for basic services, such as photocopying, equipment rentals, and parking. According to PNNL officials, they did not find evidence to support the allegations of corruption but did determine that the laboratory's management "engaged in activities that reflect their misunderstanding of appropriate business practices in a market economy and represent a serious misperception of what is acceptable business practice." According PNNL's acting nuclear safety manager, PNNL has implemented several corrective measures including

- funding a financial audit of the laboratory by KPMG, an international audit firm,
- funding a project to introduce a western-style accounting system at the laboratory, and
- amending PNNL-funded contracts to require that the laboratory's management and staff certify that agreed-upon salary payments have been made and received for all work.

During our review, we found that DOE made cash payments totaling $38,570 to the Slavutych Laboratory over 4 years. These cash payments concerned us because of the allegations of mismanagement at the laboratory. Furthermore, according to DOE's accounting handbook, adequate internal controls are required to ensure that cash payments are controlled from the receipt of a payment to its final disposition. According to PNNL officials, they are aware that cash payments are often indicators of bribery or corruption but have documented cash payments to allow for audit transparency.

Specifically, Oak Ridge National Laboratory officials made cash payments for translation, interpreter, and support services totaling $7,044. Oak Ridge officials said that Ukraine is a cash economy and it made sense to conduct the transactions in this fashion. They said they requested and received receipts for these payments. Other cash payments totaling $31,525 were made to Slavutych Laboratory from 1996 through 1999. That amount included $4,354 to support the Secretary of Energy's visit in 1999 and $1,278 for a luncheon attended by the Deputy Secretary of Energy's delegation in May 1999. When we told the director of DOE's nuclear safety program about these cash payments, he said he is opposed to providing cash payments because they present a security risk to travelers and can lead to

paperless transactions. However, DOE's Acting Deputy Administrator for Defense Nuclear Nonproliferation told us that Ukraine is not a credit card society and that under certain circumstances, the use of cash is appropriate. She noted that she had reviewed DOE's procedures on the use of cash payments and believed that officials acted correctly when making these payments.

In January 2000, KPMG completed a financial audit of the Slavutych Laboratory in order to evaluate whether the laboratory's management had performed any improper activities with funds received from PNNL. The audit comprised two parts—(1) a financial audit, which covered the period from January 1, 1999, through September 30, 1999, and (2) a review of a number of cash payments made by PNNL to the laboratory. For the limited period covered by the audit, KPMG did not identify any misappropriation of funds by the Slavutych Laboratory's management, nor did it find any evidence that the laboratory had performed any illegal or unlawful activities. It did note, however, that some invoices relating to 1997 PNNL task orders were not found. The audit also found that a former laboratory employee, who accepted cash payments of $4,334 from Oak Ridge National Laboratory officials on behalf of the laboratory, did not immediately deposit the dollars into a local bank where the funds would be converted into Ukrainian currency. Rather, the employee kept the funds in U.S. dollars longer than necessary. The managing partner of KPMG (Ukraine) told us that the former employee appears to have kept the excess funds realized by waiting for a more favorable exchange rate.

The audit also found that the laboratory's office building is owned by the Chornobyl nuclear power plant and that there is no formal lease between the plant and the laboratory. However, the two parties have signed a 10-year cooperation agreement under which the laboratory is allowed to use the building for its operational activities. If the plant decided to cancel the agreement and no longer allowed the laboratory to use the office space, the laboratory would not be reimbursed for any expenditures made to improve the facility. According to DOE, the laboratory has submitted a formal, long-term lease agreement that is in the process of being approved by Ukrainian authorities. Furthermore, the laboratory and the Chornobyl nuclear power plant are seeking to transfer ownership of the building to the International Chornobyl Center.

The KPMG (Ukraine) managing partner told us that KPMG was unable to perform a financial audit of the International Chornobyl Center, the parent organization of the Slavutych Laboratory. According to KPMG officials, the

center has been unable to provide all necessary information, primarily because its accounting staff has changed several times. The current accounting staff had no idea what previous accountants had been doing. As a result, the center could not prepare a reconcilable balance sheet. DOE had paid the center about $45,000 for translation and interpreter services as of March 2000. Figures 11 and 12 show the exterior and interior of the laboratory.

Figure 11: Slavutych Laboratory of International Research and Technology

Figure 12: Interior of the Slavutych Laboratory

Other Program Projects and/or Expenditures Raise Concerns

During the course of our audit, several PNNL officials told us they were concerned about DOE management's decision to fund projects that either did not improve the safety of Soviet-designed nuclear reactors or were of questionable value to the program. While individual projects did not generally represent large program expenditures, the projects collectively raised concerns because program funds were being spent on low-priority activities.

DOE Representatives' Offices in Paris and Tokyo

DOE spent about $1.04 million in nuclear safety program funds to partially finance the operations of its representatives' offices in Paris and Tokyo during fiscal years 1998 and 1999. According to DOE, these representatives support the Department in a variety of activities related to nuclear safety and nonproliferation through interactions with the European Bank for Reconstruction and Development; the Organization for Economic Cooperation and Development; and coordinating committees, workshops, and student exchanges. The director of DOE's nuclear safety program said that these offices used to be funded from other DOE accounts in the Office of Nuclear Energy. When the nuclear safety function was transferred to the Office of Nonproliferation and National Security in 1998, the funding responsibility was transferred as well. According to DOE, it has submitted

a reprogramming request to fund all expenses for the Paris and Tokyo offices from another departmental account in fiscal year 2000 and has requested that these representatives be funded from this same account in fiscal year 2001.

Printing Costs

DOE spent about $78,000 to print a limited number of copies of a report to the Congress on the status of the nuclear safety program. This report went to full publication (50 copies) four different times because of changes made by the director of DOE's international nuclear safety program. PNNL, which was responsible for preparing the report, assumed that the initial draft of the report was ready for publication and printed 50 copies. However, the director was not satisfied with the report and made changes. This occurred three times, and each time PNNL assumed the report was ready for publication and printed it. A DOE official told us that the reports should not have cost more than $500 per copy, including labor and printing costs. However, because of all the revisions, it cost about $1,554 per copy for the 50 reports that were finally delivered. In addition, PNNL reported that over 3 years, the program spent about $91,000 for various graphic presentations. One of the presentations, which included about 100 overhead slides, was revised eight times for the director of DOE's international nuclear safety program, who was planning to give the presentation to members of the Ukrainian parliament. At one point, the director required changes that had to be made by a Ukrainian printing company at a cost of about $2,500. According to DOE, although the director never gave the presentation, several program managers have used the documents for other presentations.

Summer Internships

In mid-1999, DOE hired seven Ukrainian college students for a summer internship program. The cost of the program was $16,200 and was paid from nuclear safety assistance program funds. The students worked at six locations in Ukraine, including the PNNL Adjunct Office, the Slavutych Business Development Agency, the International Chornobyl Center, and Kiev State University. Their work included developing database information, translating technical manuals, and supporting energy efficiency projects. Three PNNL officials, including the former manager of the safety program, were concerned that the internship project, while worthwhile in its intent, did not support the program's overall goal of improving the safety of Soviet-designed nuclear power plants. Furthermore, PNNL officials responsible for overseeing the internship project and employing some of the students said that although the project had benefits, some of the students were engaged in "busywork."

The director of DOE's international nuclear safety program, who initiated the project after meeting with some of these students at an energy conference in Ukraine, said the internship program provided these students with a unique opportunity to learn about western business practices, which supported the goals of the program. He believes that all of the students did useful work at a minimal cost to the United States. Furthermore, DOE's Acting Deputy Administrator for Defense Nuclear Nonproliferation said that it was important for the United States to engage these students in activities that could be beneficial in the longer term by promoting broad nonproliferation and nuclear safety policy goals. She believes these students are critical to Ukraine's future and it is important for the United States to engage them in useful and productive activities as a gesture of goodwill. She said she would recommend continuing the program in the future if funds were available.

Robotics Equipment

PNNL and Ukrainian officials expressed their concerns to us about the value of robotics equipment that was shipped to the Chornobyl nuclear power plant for a test demonstration in May 1999. The equipment was developed to collect visual and physical data from areas in the damaged Chornobyl reactor that are too contaminated for human access. The robotics project has been funded as part of a joint research program between DOE and the National Aeronautics and Space Administration. DOE provided $487,000 to PNNL to modify the equipment and arrange for its shipment to Ukraine. In addition, DOE has spent about $10,000 in program funds over the past few months to support the transfer of the equipment to the Chornobyl nuclear power plant.

According to two PNNL officials, Ukrainian officials did not ask for the equipment and did not want it. After the robot was shipped and the demonstration test was completed, the equipment was placed in storage at Chornobyl for several months. The director of the Chornobyl nuclear power plant said he had reservations about the equipment but was not against its use if realistic tasks could be developed. However, the deputy chief of the Chornobyl shelter project told us that Ukraine never requested the robot and does not have the funds to support research for it. According to DOE, the Chornobyl nuclear plant has recently decided to accept ownership of the equipment for use in its decommissioning activities.

DOE and NRC Have Spent $1.9 Million for U.S.-Based Interpreters

Since fiscal year 1992, NRC and DOE have spent about $1.9 million for interpreters who live in the United States and are under contract with the Department of State. Because the interpreters live in the United States, NRC's and DOE's expenditures for the interpreters include—in addition to standard service fees—travel and per diem costs. Neither agency has developed a policy to determine when and whether it would be more advantageous to hire in-country interpreters—an option that could, in some circumstances, be more cost-efficient.

NRC estimates that it has spent about $1.1 million for interpreters hired by the State Department but has never formally analyzed whether it might be cost-effective to hire in-country interpreters. DOE has spent about $791,000 since fiscal year 1992 for these interpreters' trips to Russia, Ukraine, Bulgaria, Belgium, the Slovak Republic, Lithuania, Hungary and Austria. According to DOE, high-quality State Department translators were required to deal with complex technical and nuclear terms, and the rate for an interpreter's service was $475 per day, as of November 1999. Over the past 2 years, DOE estimates it has used in-country interpreters in over 90 percent of the cases. U.S. officials from the Kiev, Ukraine, embassy told us that a local company charges about $140 for 8 hours of translation. Embassy officials noted, however, that the quality of local interpreters is uneven.

The director of DOE's international nuclear safety program asked that the services of one particular interpreter be obtained under a PNNL contract on very short notice in the fall of 1998 at a cost of $16,713. The former manager of PNNL's safety program questioned the use of a directed contract and asked whether this approach complied with a U.S. government policy requiring that arrangements for interpreters for senior officials be made through the Department of State. Since that time, PNNL has not entered into other such directed contracts, although the director has used this interpreter under arrangements made with the Department of State.

NRC's Safety Program Lacks a Strategic Plan and Coordinated Management

NRC has traditionally managed its nuclear safety assistance program from year to year without adopting a long-term strategy. In the last few months, it has started to take a longer-term approach for its activities in Russia and Ukraine, but it is still too early to assess the impact of this new strategy. The responsibilities for managing NRC's program are divided among several offices, making the program vulnerable, according to NRC's Inspector General and others, to duplication of effort and

miscommunication with other federal agencies participating in the program. According to some NRC officials, the lack of coordination and communication between different NRC offices responsible for nuclear safety assistance activities contributed to NRC's inability to obligate over $500,000 in fiscal year 1997 and 1998 program funds.

NRC Has Not Developed a Strategic Plan

Although NRC has been providing regulatory assistance to the Newly Independent States and other countries in Central and Eastern Europe for over 7 years, it has not developed a long-term strategic plan that clearly identifies the regulatory program's overall goals, ways to quantify how well the program is meeting these goals, and time frames for meeting these goals. In our view, such a plan is necessary if, as the State Department's Senior Coordinator for Nuclear Safety believes, NRC will play a more prominent role in future assistance efforts.

Several years ago, NRC officials and Russian and Ukrainian officials jointly developed project plans and priorities, and NRC staff periodically review the progress made in meeting these priorities. NRC staff told us that they also periodically meet with officials from Kazakhstan, Armenia, and Central and Eastern European countries to review projects and develop plans for future work. Central and Eastern European safety projects are also reviewed with US AID officials to determine the status of projects and identify any additional resource requirements. NRC has taken a short-term view of the assistance, particularly for Russia and Ukraine, and has managed it from year to year without a long-term strategy.

Although NRC has provided assistance since 1992, it has not significantly changed its management approach—described by the director of NRC's Office of International Programs as "cautious" and by others as being in a maintenance mode for assistance to Russia and Ukraine. NRC is phasing out its assistance in some countries in Central and Eastern Europe. Within the past several months, however, NRC has revised its planning process for assistance to Russia and Ukraine in order to obtain a longer-term perspective. According to NRC, this effort should provide a more coherent view of the program than has been evident in the past and should provide additional support to sustain improvements that have resulted from NRC's prior assistance.

NRC officials noted that the agency's ability to develop a longer-term approach to nuclear safety assistance has been complicated by concerns about the use of NRC funds to finance the salaries of staff working on international programs. NRC typically recovers nearly 100 percent of its annual budget through licensing and inspection fees assessed on the U.S. nuclear industry. As we pointed out in a prior report,[2] the U.S. nuclear industry has generally opposed the use of NRC funds to support international activities. Over the past few years, NRC has reduced its staff allocations and level of effort for international activities. In fiscal year 1999, however, US AID and the Department of State allowed NRC to use a portion of the funds US AID provides for nuclear safety assistance activities to finance NRC staff costs related to nuclear safety activities in the Newly Independent States. For fiscal year 2000, these staff costs are being funded from NRC's general fund appropriation—that portion of the agency's budget that is not subject to fee recovery from NRC licensees.

Management of NRC's International Nuclear Safety Assistance Is Divided

The management of NRC's international nuclear safety assistance effort is divided between two offices—the Office of the Executive Director for Operations and the Office of International Programs. The Office of the Executive Director for Operations supervises and coordinates the activities of several offices within NRC. The Office of International Programs plans and recommends policies on international cooperation and assistance in nuclear safety and radiation protection. The Executive Director for Operations has responsibility for Russia and Ukraine, while the Office of International Programs has responsibility for Armenia, Bulgaria, the Czech Republic, Hungary, Lithuania, Kazakhstan, and the Slovak Republic. Within the Office of International Programs, the programs for Armenia and Kazakhstan are managed by one program manager, while a different program manager manages the Bulgarian, Czech, Hungarian, Lithuanian and Slovak programs. For Russia and Ukraine, the technical program manager within the Office of the Executive Director for Operations has overall management responsibility for assistance activities, while responsibility for individual projects is divided among several other additional offices. Different staff in the Office of International Programs support the technical program manager in the administration of the Russian and Ukrainian assistance programs.

[2] *Nuclear Safety: Information on the International Nuclear Regulators Association* (GAO/RCED-99-243, Aug. 6, 1999)

The split of management activities among these offices has raised concerns. In December 1997, NRC's Program Review Committee found, and NRC's Executive Council recommended, that the agency should develop options to integrate or consolidate the Office of International Programs and the support office staff providing assistance in order to minimize duplication of effort.[3] In April 1998, NRC's Office of Inspector General observed that the lack of a management structure for the international nuclear safety program could cause duplication because each program requires similar activities, such as travel, funding coordination, and reporting to US AID and the Department of State. It could also lead to possible duplication of assistance procured through DOE's national laboratories and to miscommunication.

A major impact of NRC's fragmented program management was NRC's inability to obligate $506,000 in fiscal year 1997 and 1998 US AID funds for Ukraine. These expired funds were returned to the U.S. Treasury because the money could not be obligated within a statutory 2-year period of availability. NRC officials provided us with differing reasons as to why the funds were not obligated. For example, some officials told us that the funds were not obligated because of a lack of coordination and communication between the different offices responsible for Ukrainian assistance activities.

Conclusions

In managing its nuclear safety program, DOE has funded a number of projects that may be worthwhile in their own right but do not directly contribute to improving the safety of Soviet-designed nuclear reactors. Consequently, by funding these projects, DOE is diverting limited resources from other pressing needs. For example, we question why DOE used program funds to create environmental centers in Russia and the United States and to operate support offices for DOE representatives in Tokyo and Paris. We also question DOE's decision to allocate about $7.5 million, including $1.7 million for building renovations and furnishings, to the Slavutych Laboratory of International Research and Technology in Ukraine. We believe that it is problematic that this laboratory will facilitate the closure of the Chornobyl nuclear power plant. These expenditures, as well as others, raise questions about the program's priorities. It was clear to us

[3]The Program Review Committee and Executive Council are internal NRC groups that periodically examine the operations and effectiveness of various NRC functions and activities.

during our visit to Ukraine that basic safety needs still need to be addressed. For example, according to Ukrainian officials, there is still a need to purchase 2,000 additional fire doors for Ukrainian nuclear power plants, but the Ukrainians do not have the funds to do so.

Regarding the Slavutych Laboratory in Ukraine, we believe, and DOE officials recognize as well, that if the Laboratory is to become self-sufficient and change the perception of mismanagement, it, at a minimum, needs to establish sound accounting systems and business practices in order to attract clients. Furthermore, for this project, as well as for other projects where similar arrangements exist, we believe that DOE must exercise extreme caution when paying for services and/or deliverables in cash. We are concerned that cash payments are being made to an organization that does not have adequate internal controls or western-style accounting systems. We are also concerned that there is no formal lease agreement between the Chornobyl nuclear power plant and the Slavutych Laboratory, although it appears that efforts are now under way to clarify this matter. DOE needs to ensure that the U.S. investment in this laboratory is protected to the extent feasible.

Both DOE and NRC need to look for ways to increase the program's efficiency. For example, both agencies have made extensive use of U.S.-based interpreters when traveling to countries operating Soviet-designed reactors. There may be valid reasons to use these interpreters, given the sensitive and/or technical nature of meetings. However, NRC, in particular, has not formally reviewed its use of these interpreters, and there might be instances when it would make sense to hire in-country interpreters and reduce the program's costs.

NRC's management of the safety program also raises concerns. Without a long-term strategic plan, it appears to us that NRC cannot effectively manage its assistance activities because it lacks firm program goals and time frames for meeting these goals. Furthermore, we agree with NRC's internal reviews, which concluded that the lack of an integrated management approach could lead to duplication of effort and other inefficiencies. NRC's inability to obligate program funds in a timely manner raises questions about its future funding requirements. If NRC is to play a more prominent role in future assistance efforts, as the State Department's Senior Coordinator for Nuclear Safety believes, these management issues must be addressed.

Recommendations to the Secretary of Energy and the Chairman of the Nuclear Regulatory Commission

To improve the management of the nuclear safety assistance program, we recommend that the Secretary

- review ongoing and proposed projects and eliminate those that do not have a strong and compelling link to improving the safety of Soviet-designed nuclear power plants.

To improve the Nuclear Regulatory Commission's program management, we recommend that the Chairman

- develop a strategic plan for the Commission's nuclear safety assistance activities that, at a minimum, establishes program priorities and goals, ways to measure how well the goals are being met, and time frames for meeting the goals;
- integrate the assistance activities of offices that implement nuclear safety assistance to avoid duplication and inefficiencies; and
- consistently monitor funding requirements to ensure that funds are obligated on a timely basis in accordance with the program's priorities.

To help ensure that DOE's and NRC's nuclear safety assistance efforts are economical and efficient, we recommend

- that the Secretary
  - ensure to the extent possible that, when cash is paid for services and/or deliverables, organizations in the Newly Independent States have internal controls to adequately document the flow of cash from its receipt to its final disposition; and
  - clarify the lease arrangements between the Slavutych Laboratory and the Chornobyl nuclear power plant to ensure that the U.S. investment in the laboratory is protected to the extent possible; and
- that the Chairman
  - hire in-country interpreters when feasible to do so.

Agency Comments and Our Evaluation

Both DOE and the Department of State's Senior Coordinator for Nuclear Safety questioned our assessment of whether certain projects directly improve the safety of Soviet-designed nuclear power reactors. The Senior Coordinator said that while she believes our recommendations are valuable, they set too narrow an objective for the safety assistance program. In her view, the international nuclear safety assistance program focuses on broader policy matters, such as the shutdown of the Chornobyl

nuclear power plant. She noted that assistance funds are needed for projects designed to help set up the conditions to enable shutdown, such as the heat plant for workers decommissioning the Chornobyl reactor and other efforts that have a small social impact, such as the Slavutych Laboratory of International Research and Technology. While we recognize that the safety assistance program focuses on broad goals and objectives, our recommendations would focus limited resources on activities that directly affect the reactors' safety and on improving the management of DOE's and NRC's safety assistance efforts.

DOE strongly disagreed with our assertion that the program funding it provides for the International Chornobyl Center (referred to in the report as the Slavutych Laboratory) is not directly related to improving safety. DOE stated that it understands that the Slavutych Laboratory played a critical role in Ukraine's recent commitment to shut down the last operating reactor at the Chornobyl nuclear power plant. Furthermore, DOE noted that one of the major functions of the Russian International Nuclear Safety Center is to be a long-term voice in Russia to challenge potentially unsafe practices at the nuclear power plants, as well as an active proponent of creating a sound safety culture. DOE believes that the center will eventually contribute to improved nuclear safety in all other countries operating Soviet-designed reactors. In addition, DOE believes that about one-half of the center's projects directly contribute to nuclear safety because they play a necessary part in conducting in-depth safety analyses of nuclear reactors in Russia.

Regarding the impact of the Slavutych Laboratory on the shutdown of Chornobyl, we continue to maintain, on the basis of our discussions with Ukrainian officials, that the government of Ukraine will ultimately base its decision to shut down the Chornobyl nuclear power plant on broader economic and political factors. As noted in our report, the Slavutych Laboratory has an eventual goal of employing 100 people. Reaching that goal will not accommodate the approximately 6,000 personnel who could become unemployed if the Chornobyl nuclear power plant shuts down. Furthermore, the director of the nuclear safety program acknowledges that the laboratory, which relies heavily on DOE funds for financial assistance, has not done a good job of attracting clients other than DOE. If the laboratory is to become self-sufficient, it needs to change the perception of mismanagement and establish sound accounting systems and business practices in order to attract clients.

Regarding the Russian International Nuclear Safety Center, while we agree that some of the projects are worthwhile and even important to understanding the operation of Soviet-designed nuclear power reactors, these projects do not directly address the most urgent safety needs at these reactors. We continue to believe that urgent safety needs at these reactors, such as replacing wooden fire doors with fire-resistant doors in Soviet-designed nuclear power plants, have not been adequately addressed by DOE's safety effort. We believe that the most urgent and pressing safety priorities should be addressed first to improve the safety of the highest-risk reactors—a fundamental and long-standing goal of the program. DOE stated in its response that it would allocate additional funds for fire doors in Ukraine's nuclear power plants.

Finally, DOE also noted in its response that no safety funds were used to fund the International Radioecology Laboratory in Ukraine. As we noted in our report, DOE spent $8,560 in safety funds related to this laboratory. After we brought this matter to DOE's attention, the Department determined that no safety funds should have been used to support this project. As a result, DOE subsequently used an environmental management project account to pay for this effort. DOE's comments are presented in appendix II.

NRC agreed with all of our recommendations, and its comments are presented in appendix III.

Status of Efforts to Shut Down Highest-Risk Soviet-Designed Nuclear Power Plants

Name of plant and number and type of highest-risk reactors	Country	Agreed-upon date for reactor(s) to shut down	Conditions of shutdown	Funding linked to shutdown	Status
Chornobyl/1RBMK reactor	Ukraine	2000	G-7/Ukraine agreement establishes four- point program, including energy investments in exchange for shutdown	More than $2 billion in loans and grants	Ukraine is tying closure to funding for replacement reactors and a new sarcophagus.
Ignalina/2 RBMK reactors	Lithuania	One reactor was to stop producing electricity in mid-1998 unless it was granted a new operating license. The license was granted.	Bank agreement was tied to energy needs and licensing renewal	$38 million for short-term safety improvements	One reactor is licensed to operate until it receives a major upgrade around 2005. A decision on the date of the second reactor's closure is scheduled for 2004.
Kozloduy/4 VVER 440 Model 230 reactors	Bulgaria	Decommissioning of two reactors was to begin in 1998. No dates were set for the others.	1993 bank agreement tied closure to obtaining a replacement energy source	$28 million grant for safety upgrades	Reactors continue to operate. First two reactors are to be closed 2004-2005.
Bohunice/2 VVER 440 Model 230 reactors	Slovak Republic	2006 for unit 1, 2008 for unit 2	European Union accession requirement	No funding at this time	Slovak Republic decided in November 1999 to comply with the European Union's requirement for shutdown
Metsamor/1VVER 440 Model 230 reactor	Armenia	2004	Possible loan from bank to build gas plant is conditioned on closure plus no restart of another unit that was closed in 1988.	Loan amount estimated at $70 million	Reactor is operating.
Kola/2 VVER 440 Model 230 reactors	Russia	No date established	1995 grant from bank calls for annual operating permits and in-depth safety analysis.	$23 million in short-term safety upgrades to the plant	Units are operating under annual permits; safety assessments are under way.

Continued

Name of plant and number and type of highest-risk reactors	Country	Agreed-upon date for reactor(s) to shut down	Conditions of shutdown	Funding linked to shutdown	Status
Kursk/2 RBMK reactors	Russia	No date established	1995 bank agreement requires longer-term operating license for reactors. Annual operating license is authorized on the basis of safety analysis reports.	No funding associated with agreement	Reactors are operating (although one reactor is currently shut down for repairs); safety assessment for one reactor is stalled because of U.S. sanctions imposed on Russian organization.
Leningrad/4 RBMK reactors	Russia	No date established	1995 bank agreement calls for operating permits and safety analysis reports	$32 million for upgrades	Units are operating; safety assessment for one reactor is almost complete
Novovoronezh/2 VVER 440 Model 230 reactors	Russia	No date established	1995 bank agreement calls for safety analysis reports and annual operating permits. One of the reactors was not supposed to have annual permits granted beyond 2002. The other reactor could be operated with an annual permit until mid-1997 (unless embrittlement in the reactor vessel was shown to be a problem[a]). Beyond that time, regulator was required to base future operation on cost and technical issues.	$24 million in short-term safety upgrades	Units are operating under annual permits; safety assessments are under way.

Continued from Previous Page

Note: The “bank” is the European Bank for Reconstruction and Development

[a]Reactor vessel steel tends to lose ductility (become more brittle) as a result of neutron irradiation. A European Union study found that the reactor vessel's condition was satisfactory.

Source: GAO's presentation of information from the Department of State.

Comments From the Department of Energy

Department of Energy
Washington, DC 20585

March 30, 2000

Mr. James E. Wells
Director
Energy, Resources and Science Issues
General Accounting Office
Washington, DC 20548

Dear Mr. Wells:

Thank you for the opportunity to comment on the General Accounting Office (GAO) Report, "Nuclear Safety: Concerns with the Continuing Operation of Soviet-Designed Nuclear Power Reactors." I understand that our staffs worked cooperatively to resolve many technical questions in the report and on the whole we agree with its content and recommendations. However, there remain a few items that deserve further clarification.

The report recommends that the Secretary of Energy review all projects with significant carry-over balances and to accelerate project completion to the extent feasible. The Department will continue its efforts to reduce uncosted balances. For instance, we are strengthening our past practice of reviewing projects that have been making slow progress so that we may continue reallocating resources as appropriate. In particular, we have given additional direction to project managers and technical integrators to reduce uncosted balances. Additionally, we are taking a new approach to future contracts that will establish intermediate milestones in longer-term projects, thereby allowing payments to be made sooner.

As the report acknowledged, the majority of the uncosted funds are for large equipment-related projects, such as full-scope nuclear power plant training simulators and safety parameter display systems. These projects are proceeding well, but all funds cannot be expended responsibly in a single fiscal year. The examples cited in the report for projects that are moving slowly, fire safety improvements at the Smolensk plant and the development of emergency operating instruction, represent a small portion, less than three percent, of the total uncosted balance.

The report expressed concern that some safety improvement activities may be used to justify continued operation of the highest-risk plants. This concern has been discussed since the program began in 1992. The Administration maintains its long-held belief that it is in the overall best interests of the United States to help improve the safety of all Soviet-designed reactors while they still operate and that this can be done in a manner consistent with the policy to shut down the older reactors as soon as possible. Continuing severe economic conditions in the host countries, however, make early closure an extremely difficult goal for them to achieve. As the report discusses, work continues in the larger forum of international banks and multilateral organizations to encourage early closure. Some success has been seen with the early closure of Chornobyl Unit 1 in 1996, the decision not to restart Chornobyl Unit 2, with the recent firm

commitment by the Government of Ukraine to close Chornobyl Unit 3 this year, and the Government of Lithuania's commitment to close Ignalina Unit 1 in 2005. In addition, the Government of Kazakstan permanently shut down the BN-350 reactor at Aktau earlier this year for safety reasons.

The report also raises concern that some of the work done by the Department does not directly relate or contribute to improving the safety of Soviet-designed reactors. Primary examples listed are funding of the Department's overseas representatives in Paris and Tokyo, the International Centers for Environmental Safety, the International Nuclear Safety Centers, and the International Radioecology Laboratory and the Slavutych Laboratory for International Research and Development that are both part of the International Chornobyl Center. Only two of the five areas listed are pertinent to the concern expressed in the report. The Department has submitted a reprogramming request to fund all expenses for the Paris and Tokyo representatives from the program direction account for this fiscal year and has included these representatives in next year's request for program direction funding. Funding for the International Radioecology Laboratory has come from other sources within the Department and not from the International Nuclear Safety Program. Although we believe that the establishment of International Centers for Environmental Safety is eminently worthwhile, no claim has been made that this proposed activity supports improvements in the safety of nuclear power plants. The Administration proposed in FY 2000 that these centers be funded entirely on their own merit. Congress did not approve this activity and, therefore, no funds are being expended in this area.

The Department strongly disagrees with the conclusion that the International Chornobyl Center does not directly relate to improving the safety of Soviet-designed reactors. One of our primary goals in helping to establish the International Chornobyl Center was to facilitate the early closure of the Chornobyl Nuclear Power Plant. As we stated earlier, the Government of Ukraine recently made a firm commitment to close Unit 3 this year, and we understand that the creation of the Chornobyl Center played a critical part in this difficult Ukrainian decision. The mission of the International Chornobyl Center is to create, acquire, develop, disseminate and implement national and international scientific knowledge and advanced technologies to ensure safe utilization of nuclear energy, to prevent and reduce nuclear incidents' effects, and to create new "hi-tech" industrial locations for the benefit of the residents of Slavutych and for the Ukrainian people. The Chornobyl Center will play a key role in establishing and sustaining a new safety "culture" in Ukraine, thus helping to ensure the continued safe operation of Ukrainian power reactors long after our assistance is completed.

Similarly, one of the major functions of the Russian International Nuclear Safety Center is to be a long-term safety voice in Russia to challenge potentially unsafe practices at the nuclear power plants and be an active proponent of creating a sound safety culture. The safety centers contribute directly to the safety of Soviet-designed reactors. About half of the projects do so because they are a necessary part in conducting in-depth safety assessments of nuclear power reactors in Russia. Other technical projects are underway that have longer-term safety impacts. Making lasting safety improvements is more than doing work at individual plants. If there is not

sustainability of effort, the individual improvements will not last and our considerable investment will be reduced over time, and future improvements will be less effective. In part because the Russian International Nuclear Safety Center is governed by a board of directors that includes all relevant scientific nuclear safety organizations, such as the technical institute within the nuclear regulatory body as well as the nuclear safety institute of the Russian Academy of Sciences, it has already become a leading voice in Russia on making safety a top priority when decisions about nuclear plants are made. Establishing this strong safety advocate has been a major accomplishment of the program for improving the safety culture in Russia. Eventually, the Center will contribute to improving safety in all other countries operating Soviet-designed reactors as well.

The Department's current course of action with respect to the International Nuclear Safety Centers and the International Chornobyl Center strikes the right balance of keeping the primary focus on safety upgrades at the nuclear power plants, while allocating a small portion of the funding to establishing organizations that institutionalize a safety culture in each country as a whole.

In other matters the Department agrees with the conclusions and recommendations made to the Department of Energy. In particular, the Department will allocate additional funds to the provision of fire doors for nuclear power plants in Ukraine, because the plants have not received the revenues that were previously projected by the Department. The Department has also recently strengthened controls over cash payments and western style accounting systems are being implemented in host country organizations when feasible. The Department is also taking further steps to ensure that the International Chornobyl Center will maintain legal control over its laboratory facilities in Slavutych.

Sincerely,

Rose Gottemoeller
Assistant Deputy Administrator
for Defense Nuclear Nonproliferation

Comments From the Nuclear Regulatory Commission

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 3, 2000

Ms. G. L. Jones
Associate Director
Energy, Resources and Science Issues
Resources, Community, and Economic Development Division
General Accounting Office
Washington, D.C. 20548

SUBJECT: GENERAL ACCOUNTING OFFICE'S (GAO) DRAFT REPORT ENTITLED NUCLEAR SAFETY: CONCERNS WITH THE CONTINUING OPERATION OF SOVIET-DESIGNED NUCLEAR POWER REACTORS (GAO/RCED-00-97)

Dear Ms. Jones:

I am writing in response to your letter of March 27, 2000 to Dr. William D. Travers, Executive Director for Operations, U. S. Nuclear Regulatory Commission (NRC), which forwarded copies of the General Accounting Office's (GAO) proposed report entitled Nuclear Safety: Concerns With the Continuing Operation of Soviet-Designed Nuclear Power Reactors (GAO/RCED-00-97). The NRC has reviewed the document. Our comments are summarized below.

In general, the NRC agrees with the recommendations contained in the draft GAO report. NRC's management of nuclear safety assistance activities for countries in which Soviet-designed reactors are operated, which is currently divided between different organizations within NRC, should be consolidated and integrated. Implementing this recommendation will enhance the coordination and consistency of NRC's nuclear safety assistance activities. Further, it will also provide additional assurance that program funds are obligated and expended on a timely basis.

Over the past year, we have taken concrete steps to centralize program management functions. In this vein, the NRC has decided that overall responsibility for management of NRC's safety assistance activities for countries in which Soviet-designed reactors are operated will now reside with the Director, Office of International Programs. We believe this first step will provide a sound foundation for further streamlining program support activities, and will enhance this important program's effectiveness.

G. L. Jones - 2 -

If you have any questions concerning this response, please contact me at (301) 415-1780 at your convenience.

Sincerely,

Janice Dunn Lee, Director
Office of International Programs

cc: Chairman Meserve
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan
Commissioner Merrifield
Dr. Travers, EDO

GAO Contact and Staff Acknowledgments

GAO Contact

Gene Aloise(202) 512-3841

Acknowledgments

In addition, Duane Fitzgerald, Jonathan Gill, Glen Levis, Victor Sgobba, and Jim Wells made key contributions to this report.

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