Institutional Framework and Policies 5

Many national and international institutions are engaged in efforts to develop solutions to the problems of past nuclear waste dumping and discharges into the sea and to ensure careful and safe management of nuclear activities, materials, and wastes in the future. Whether some institutions are more effective than others, and whether their initiatives can bring improvements, are problematic. The improvements needed—and, thus, the goals of many programs—are not clear and sometimes represent compromises among conflicting purposes. Because the problems are international it is much more difficult to harmonize the policies and goals of each affected nation. In addition, a multitude of unilateral, bilateral, and multilateral organizations have developed over many years, each with missions that have evolved and changed over time to meet the challenges of the day and to reflect the unique conflicts or cooperative moods of the times.

Within this complex backdrop, the United States and the international community are attempting to focus attention and resources on the problem of nuclear contamination in the Arctic and North Pacific. The focus now is principally on research and data collection. While this focus can lead to better knowledge and understanding, it cannot soon provide all the answers to reasonable concerns about future impacts on human health and the environment. Therefore research initiatives should be supplemented to some degree by actions that could monitor conditions; provide periodic warnings if they are necessary; and prevent future accidents or releases.

Until now, the United States has focused most organized efforts and made the greatest advances through research initiatives. There are some gaps in the research program relating to regions covered (not much effort in the Far East and North Pacific, for example), pathways investigated (biological pathways and ice transport), and other areas, but the program is evolving as a reasonably comprehensive investigation of key problems. Much work can still be performed by the United States but more cooperation with Russia is needed—especially in the area of increased access to specific dump sites and dumped material.

Minimal efforts are currently under way in the area of monitoring and warning initiatives. It is in this area that international cooperation is imperative if an effective assessment and response program is to follow. International institutions may be the most appropriate to carry

out such initiatives, but one must ensure long-term consistent support of a program of rigorous scientific implementation if they are to be useful.

Some efforts are under way on prevention initiatives but, because most of the key decisions must be made by Russia, it is difficult to engender support for assistance from the United States and other countries. The Office of Technology Assessment (OTA) has identified some possible joint projects that could benefit both the United States and Russia and could be mutually supported. Other countries such as Norway might also be encouraged to support joint prevention projects. Another approach would be to more closely tie prevention projects to demilitarization assistance under the Nunn-Lugar program. This would require some rethinking of justifications, but it might prove beneficial to U.S. interests as a means of preventing future environmental releases and simultaneously encouraging military dismantlement. In addition, support for prevention projects could be used to encourage more cooperation in some other areas (i.e., to gain access to dump sites for advancing research objectives).

One of the more significant prevention programs that has been in effect for the past several years in Russia relating to radioactive contamination is in the area of nuclear power plant safety. The United States and other countries have been funding programs to improve reactor safety in Russia with some success in overall efforts to prevent another Chernobyl. Efforts by the State of Alaska have also been successful in improving regional cooperation and information exchange. Improvements have mainly been in areas of added auxiliary equipment, technical and regulatory training, monitoring and warning systems, and regulatory oversight of existing reactors. This is of particular importance at some sites in the far north where funding is limited and operations are of marginal quality. Here, again, the more substantial improvements that might include replacing old designs and equipment with safer systems, require much more resources and major policy choices that Russia itself must make.

Crucial to U.S. and other international assistance efforts is the need for Russia to strengthen its institutional system responsible for environmental protection and for establishing a nuclear safety culture. Prior to the dissolution of the Soviet Union, most government agencies and institutes responsible for managing nuclear materials operated behind a wall of secrecy with little or no external regulatory oversight. Today, Russia is only beginning to develop the legal framework necessary to effectively enforce basic environmental protection laws, regulate the use of nuclear energy, and manage radioactive materials and wastes. Similarly lacking are liability protection laws capable of facilitating the implementation of nuclear safety initiatives. Currently, various pieces of legislation are being drafted in the Russian Parliament or State Duma that would, in principle, help improve Russia's regulatory system for nuclear and environmental protection. If enacted, these legislative proposals, for example, will make government agencies and research institutes accountable for their nuclear material and radioactive waste management activities.

A number of current policies and programs have been developed in an attempt to address various parts of the overall radioactive contamination problem. For decades, national security and strategic implications largely determined U.S. and international interest in the Arctic. After the dissolution of the Soviet Union, and in response to various reports documenting that country's radioactive waste dumping practices, the United States and other members of the international community began to support domestic and cooperative approaches. The State of Alaska also plays an important role at the regional level. A number of policies and programs have been adopted to assess past, and to prevent future, radioactive contamination in the Arctic and North Pacific regions.

In addition to government efforts, two other types of organizations considered useful for improving environmental cooperation include multilateral lending institutions and nongovernmental organizations (NGOs). With few exceptions, most assistance work by lending groups to date has focused on financing projects that embrace economic reform, privatization efforts, and prodemocracy policies. Their progress has been impaired by internal organizational obstacles or by Russia's socioeconomic and institutional inadequacies. Although recent improvements in current lending approaches appear somewhat promising, little interest, if any, seems to exist thus far among multilateral lending organizations in supporting projects addressing radioactive contamination. The U.S. assistance provided to Russian environmental NGOs, on the other hand, appears successful in providing opportunities to access information and work on technical and scientific environmental issues, including radioactive contamination.

In sum, all three areas—research, monitoring, and prevention—are critical to protecting human health and the environment from widespread and indiscriminate radioactive contamination in the Arctic and North Pacific. Past practices by many nations have given a warning to the international community that was never anticipated. Specific dumping activities by the former Soviet Union have yet to show a direct connection to human health impacts but have nonetheless raised concerns and questions that will require years for even partially satisfactory answers. To facilitate their review and analysis in this chapter, OTA has grouped these policies and programs into three major categories: 1) research initiatives; 2) monitoring and early warning initiatives; and 3) prevention initiatives.

U.S. INITIATIVES AND PROGRAMS SUPPORTING RESEARCH ON RADIOACTIVE CONTAMINATION IN THE ARCTIC

Executive Branch Initiatives

For more than a century following the acquisition of Alaska from Russia in 1867, U.S. Arctic policy focused primarily on the strategic and national security importance of the region, with little emphasis on environmental protection. This policy was conducted without a formal mandate or statement until 1971, when the U.S. government released the National Security Decision Memorandum 144. With the promulgation of the National Security Decision Directive 90 of 1983 and the 1986 Policy Memorandum,[1] the U.S. officially expanded its focus on the Arctic to include research and development of renewable and nonrenewable resources[2] (61,62). The main objectives of these directives included, among others:

- ensuring the protection of national security interests including freedom of navigation in the Arctic seas and the super adjacent airspace;
- maintaining peace throughout the region;
- promoting rational development of Arctic resources for the nation's benefit;
- fostering scientific research to improve our knowledge of the Arctic; and
- developing the infrastructure needed to support defense, social, and economic endeavors.

[1] Prepared by the now-defunct Interagency Arctic Policy Group.

[2] According to recent reports, the Arctic accounts for about 25 percent of current U.S. oil production; 12 percent of natural gas; and extensive coal, peat, and mineral resources, including zinc, lead, and silver. In terms of renewable resources, for example, the Arctic Ocean contains nearly 5 percent of the world's fish supplies, making it an essential source of fisheries products for the United States and particularly the State of Alaska, which reports the largest volume and total value of fish landings for the entire nation (60, 61).

Despite these directives, official U.S. Arctic policy continued to have a strong national defense approach, with little or no support for research on Arctic radioactive contamination issues until 1994. Responding to documentation of Arctic pollution from decades of radioactive waste disposal practices of the former Soviet Union, the U.S. government recently reviewed its policy on Arctic research (16). Of particular concern was the former Soviet Union's release of radioactive materials and wastes into the lands, rivers, and seas of the Arctic and in certain locations of the Pacific Ocean. The National Security Council was requested by the State Department to conduct the review (25).

Based on the National Security Council's report, on September 24, 1994, the State Department announced a new U.S. policy for the Arctic region, emphasizing for the first time a commitment to approaches on environmental protection, institution building, and international cooperation (63,64,94). The Arctic Subgroup of the Interagency Working Group on Global Environmental Affairs in the U.S. State Department is responsible for coordinating and implementing the objectives of the new policy. With the promulgation of this new policy, the U.S. government intends to accomplish the following objectives:

1. expand cooperative research and environmental protection efforts while providing for environmentally sustainable development;
2. further scientific research through development of an integrated Arctic research budget that supports both national and international science projects;
3. improve efforts to conserve Arctic wildlife and protect their habitats, with particular attention to polar bears, walruses, seals, caribou, migratory birds, and boreal forests;
4. strengthen international cooperation for preparing and responding to environmental disasters;
5. support international cooperation in monitoring, assessment, and environmental research;
6. involve the State of Alaska more directly in the Arctic policy process;
7. support participation by Alaska's Natives in Arctic policy deliberations affecting their environment, culture, and quality of life; and
8. improve overall international cooperation, especially U.S.-Russian collaboration on matters of Arctic protection (169).

The 1994 policy for the Arctic region issued by the State Department became the first official attempt by the United States to develop a coordinated research effort on contamination of the Arctic. Yet, like earlier executive directives, the new policy does not mandate any specific research plan, or provide the funds necessary to assess Arctic contamination from nuclear activities of the former Soviet Union (8,156). The most significant U.S. Arctic research institutional initiatives are shown in figure 5-1.

Efforts by the U.S. Congress

Arctic Research Policy Act of 1984

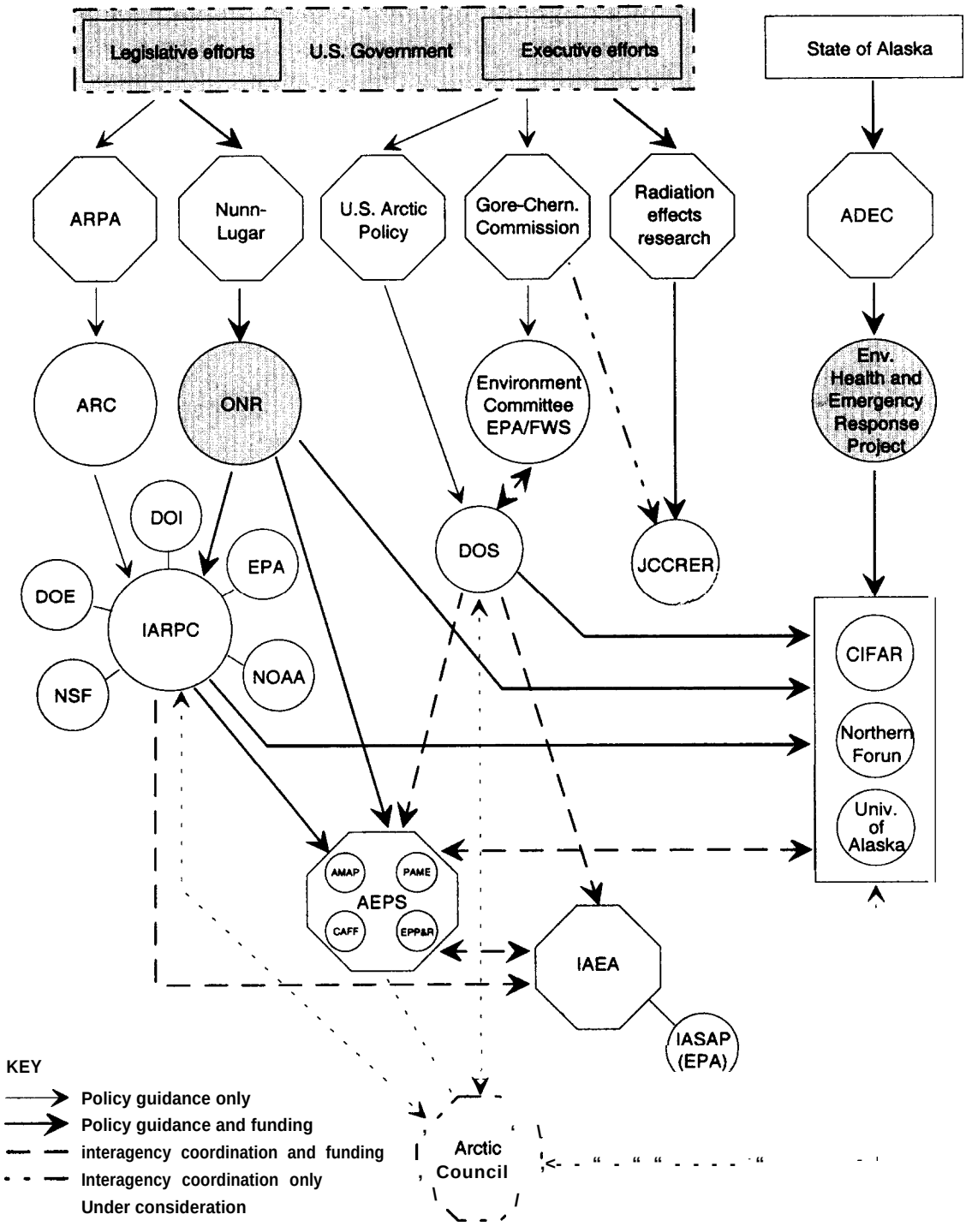
Prior to enactment of the Arctic Research Policy Act[3] by Congress in 1984, no coordinating body or source of information existed on the extent of federal Arctic research programs in the United States. The idea of establishing such a coordinating body was first issued in a report by the National Academy of Sciences' Arctic Research Policy Committee. Using the Academy's report as a basis, members of the Alaskan and Washington State congressional delegations[4] introduced a bill in 1981 entitled "The Arctic Research Policy Act" (157). After nearly three years of debate, the bill was signed into law, becoming the primary instrument for the development and coordination of U.S. research policy, priorities, and goals in the Arctic.

By enacting the Arctic Research Policy Act in 1984, Congress created the institutional infra-

[3] Public Law 98-373.

[4] Senators Frank Murkowski and Ted Stevens for the State of Alaska and Senators Slade Gorton and Henry Jackson for the State of Washington.

FIGURE 5-1: Major Initiatives Supporting Arctic Contamination Research



NOTE: ADEC: Alaska Department of Environmental Conservation; AEPS: Arctic Environmental Protection Strategy; AID: Agency for International Development; ARC: Arctic Research Commission; ARPA: Arctic Research Policy Act; CIFAR: Cooperative Institute for Arctic Research; DOE: U.S. Department of Energy; 001: U.S. Department of the Interior; EPA: U.S. Environmental Protection Agency; IARPC: Interagency Arctic Research Policy Committee; IAEA: International Atomic Energy Agency; JCCRER: Joint Coordination Committee for Radiation Effects Research: NOAA: National Oceanographic and Atmospheric Administration; NSF: National Science Foundation; ONR: office of Naval Research.
SOURCE: Office of Technology Assessment, 1995

structure required to coordinate and conduct federal research programs in the Arctic: the Arctic Research Commission (ARC) and the Interagency Arctic Research Policy Committee (IARPC). According to the congressional mandate, the Arctic Research Commission is the body responsible for coordinating and promoting Arctic research programs in ways that consider all parties involved, including federal agencies, the State of Alaska, and Native Arctic communities. The Interagency Arctic Research Policy Committee or IARPC, on the other hand, consists of all federal agencies with Arctic research programs and is responsible for identifying funds to support Arctic research activities. Internationally, IARPC is also the U.S. representative to the Arctic Environmental Protection Strategy—an effort by the eight Arctic nations (United States, Canada, Denmark, Finland, Iceland, Norway, Russia, and Sweden) to assess and develop means to control and prevent further deterioration of this ecosystem.

Despite establishing the institutional infrastructure for coordinating federal Arctic research programs, the U.S. Congress did not specify any funding source to support the implementation of its Arctic Research Policy Act (ARPA). In fact, little guidance was provided on the extent to which federal agencies were to commit resources to support the congressional mandate. Because of the lack of specific funding authority,[5] approving requests to fund Arctic radioactive contamination research is generally difficult, depending on the particular agency mission to which such requests are made and, more importantly, given the increasing unavailability of financial resources among IARPC's member agencies.

Arctic Research Commission

The Arctic Research Commission is composed of seven commissioners appointed by the U.S. President for the purpose of advising federal agencies on Arctic research policy and programs. They include four commissioners from academic or research institutions, two from private firms associated with Arctic development projects and one U.S. Native representative. Three individuals make up the commission's staff: an executive director and administrative officer in the Washington area office and a senior staff officer in Anchorage, Alaska. A group of advisers serving on a voluntary basis provides information and advice on scientific and research issues of concern to the commission and assists in the review of documents (13,20).

The Arctic Research Policy Act provides ARC with implementing authority but only an administrative budget.[6] ARC is statutorily responsible for developing U.S. Arctic research policy and for assisting all federal agencies with Arctic programs in the implementation of such policy. Reviewing the federal Arctic budget request and reporting to the Congress on the extent of government agency compliance with ARPA are also commission functions. In addition to serving as liaison between federal agencies or organizations and their Alaskan counterparts, ARC supports and promotes international cooperation in Arctic research (14,20). Despite these functions, and because ARPA does not provide research funding, the commission's efforts to persuade federal agencies with Arctic programs to contribute funds from their budgets has become pivotal for ensuring the implementation of Arctic contamination research projects (20,91).

The Arctic Research Commission was the first ARPA-related organization to recognize radioactive contamination as a key component of the U.S. Arctic research agenda. In its Arctic Resolution of August 11, 1992, ARC indicated the need for the United States to address those sources or activities responsible for contaminating the Arctic environment. The commission listed the following as major Russian sources of contamination:

[5] Although Congress initially considered proposals authorizing funding for Arctic research, the Arctic Research Policy Act, as enacted, did not include any provision of funds for such purpose.

[6] Congress appropriates the commission's operational funds ($530,000 in FY 1993) through the National Science Foundation budget. These funds are expended by the commission with administrative support from the General Services Administration (13, 20).

1) the use of nuclear weapons for civil excavation; 2) dumping of nuclear waste from weapons production facilities; 3) disposal of nuclear waste and reactors from nuclear vessels into the Kara Sea; 4) discharge of industrial chemical pollutants into air, water bodies, and soil. The commission also recognized the need to study human diseases and casualties associated with radiation accidents and overexposure to fissile materials. In a January 1994 report, the commission reiterated the need to examine the environmental and human health impacts from these activities through the establishment of a "multiagency, internationally coordinated scientific monitoring and assessment" program (13).

Despite its success in having these recommendations included in the U.S. Arctic research agenda, the limited financial support by federal agencies for radioactive contamination research and monitoring continues to be a commission concern. In the view of an ARC representative, the failure of U.S. agencies to consider Arctic environmental contamination as a priority research area constitutes the greatest barrier encountered by the commission in its efforts to gather funds for research and monitoring programs (20).

Interagency Arctic Research Policy Committee

In stressing that federal Arctic research programs be coordinated to the greatest level possible as mandated under ARPA, the U.S. Congress established the Interagency Arctic Research Policy Committee (also known as IARPC or the Interagency Committee). The IARPC consists of fourteen federal agencies[7] under the chairmanship of the director of the National Science Foundation (NSF). Working-level meetings are led or chaired by the NSF Office of Polar Programs.

ARPA authorizes the Interagency Committee to prepare and revise the U.S. overall Arctic Research Plan. Under this plan, IARPC provides Congress with a detailed agenda of the federal government's comprehensive research activities and programs on the Arctic for the ensuing five-year period. The first Arctic Research Plan report was introduced to Congress by the President in July 1987. The next review, which is being prepared, will be submitted to Congress later in 1995.

As required under ARPA, the IARPC, in consultation with the Arctic Research Commission, also reviews the Arctic plan every two years and reports to Congress. These revisions, the third of which was recently completed, describe all significant research activities implemented by each participating federal agency in the Interagency Committee. Biennial revision reports inform the Congress about research strategies planned for adoption by federal agencies in the succeeding two years. They are also helpful in coordinating and implementing research activities among U.S. government agencies (57,62).

Arctic radioactive contamination on the U.S. federal research agenda

Prior to 1990, there were no comprehensive efforts by U.S. government agencies to address Arctic environmental pollution in general, or radioactive contamination by the former Soviet Union in particular. The need to adopt a comprehensive Arctic research strategy in the United States was officially recognized for the first time at the Interagency Committee's June 1990 meeting. Without a comprehensive multiagency approach, participating agency members agreed, it would be extremely difficult to ensure mid- and long-term funding for Arctic research programs. Committee members concluded that opportunities for partnerships with the private sector and Arctic residents would also be affected (60,61). After agreeing to set forth an integrated approach starting in 1992, IARPC

[7] The 14 federal agencies comprising IARPC are: the Department of Agriculture, Department of Commerce, Department of Defense, Department of Energy, Department of Health and Human Services, Department of Interior, Department of State, Department of Transportation, U.S. Environmental Protection Agency, National Aeronautics and Space Administration, National Science Foundation, Smithsonian Institution, Office of Management and Budget, and the Office of Science and Technology Policy.

identified three major areas in which such an approach would be most useful: circulation and productivity, geodynamics, and monitoring.[8] More recent Committee work builds upon this initial effort by expanding the areas needed for having a successful integrated multidisciplinary approach to five: 1) data information and management, 2) data rescue and synthesis, 3) observation and monitoring, 4) process-oriented research and development of models, and 5) impact analysis and determination of risk (63,64,65).

Radioactive contamination of the Arctic by the former Soviet Union became part of the U.S. research agenda for the first time in 1992. Instrumental in this decision was the concern raised by various published reports, particularly the Yablokov report[9]—released by the Russian government as a white paper in 1993 (discussed in chapter 2), which documented nuclear and chemical contamination from activities of the former Soviet Union (fSU) in the Arctic. To respond to the growing concern of the U.S. and other nations, and consistent with ARC's 1992 Arctic Resolution, the Interagency Committee assumed responsibility for assessing Arctic contamination as part of its Monitoring of the Arctic Program. To guide U.S. efforts, in 1992 the Interagency Committee issued a policy statement and an agenda for action.

One of the first steps taken by the Interagency Committee to implement its agenda for action was to host an international workshop on Arctic contamination in Anchorage, Alaska, in May 1993. The conference provided U.S. and international agencies with an opportunity to learn the extent of the Arctic contamination problem and identify relevant research needs. Participating IARPC agencies benefited considerably since the workshop permitted review and information exchange on existing programs, which could be used as a baseline to support Arctic contamination research and monitoring efforts.

In 1993, IARPC also issued a list of long-term goals as the basis for making the U.S. Arctic Research Plan more effective. As part of this effort, the Interagency Committee pointed out for the first time the need to assess the contamination of the Arctic environment and the potential impacts on its residents. Inherent in this approach, as with previous Arctic research programs, is the expectation that the funding needed to implement these goals would be the responsibility of individual federal agencies. The long-term goals of U.S. Arctic research policy as issued by IARPC included the following:

- Ensure that Arctic research programs are integrated and interagency in nature.
- Promote the development and maintenance of U.S. scientific and operational capabilities for conducting Arctic research and for supporting national security needs.
- Encourage improvements in environmental protection measures and mitigation technology.
- Promote ecologically sound exploitation of Arctic resources. Develop an understanding, through research, of the roles the Arctic plays in the global environment.
- Improve the science base that now exists about 1) the interaction between Arctic Natives and their environment; 2) the possible adverse effects of transported contaminants and changes in global climate; and 3) approaches to respond to the health needs of these Arctic residents.
- Encourage the participation of Arctic Natives in the planning and conduct of research activities, informing them of the results whenever these become available.
- Develop and maintain the body of information (e.g., databases, networks) gathered from Arctic research activities.
- Promote mutually beneficial international research programs and cooperation (60,61).

[8] One additional area identified as part of this effort was the Bering Land Bridge.

[9] This unprecedented study provides an extensive review of the Soviet Union's dumping of damaged submarine reactors and nuclear waste, including spent fuel from its nuclear fleet, into the Kara Sea, the sea of Japan, and other sites.

Today, most of the research activities by IARPC member agencies in the Arctic are conducted within the framework of these long-term goals. Its proposed program on radioactive contamination research for FY 1996 through FY 1999, shown in box 5-1, also reflects these principles.

Internationally, IARPC participates in a number of cooperative efforts but with limited funding and institutional support. IARPC is the U.S. representative to the Arctic Environmental Protection Strategy (AEPS)—an effort adopted by the eight circumpolar nations to assess the extent of Arctic contamination and encourage its monitoring and control. IARPC's roles in this strategy are to coordinate and support U.S. participation and to cooperate in Arctic research activities with other circumpolar nations. Another IARPC role is to attract funds for U.S. member agencies to support the AEPS program, in particular its Arctic Monitoring and Assessment Program, but so far it has met limited success. (The Arctic Environmental Protection Strategy is discussed in detail later in this chapter.)

Another international effort supported by IARPC is the Global Resources Information Database (GRID) at the United Nations Environmental Program. Through its Arctic Environmental Data Directory Working Group, IARPC has for the past two years helped GRID identify and facilitate access to existing databases of Arctic environmental data among Arctic nations. With funding from the State Department[10] and the ONR Arctic Nuclear Waste Assessment Program discussed below, the U.S. Geological Survey is currently developing, in consultation with IARPC, a cooperative effort between U.S. and Russian scientists to establish a similar database in Russia (91). Current funding limitations also preclude expanding the number of experts presently working on this project.

Department of Defense Arctic Nuclear Waste Assessment Program

Congress authorized, as part of the $400-million Department of Defense (DOD) Appropriations Act for FY 1993 (the "Nunn-Lugar program"), the provision of at least $10 million to assess the nature and extent of nuclear contamination by the former Soviet Union in the Arctic region. Of great congressional interest was the need to: 1) assess the actual and potential impacts that nuclear contamination resulting from practices of the former Soviet Union might have on the Arctic environment and, in particular, Alaska; and 2) identify approaches that would lead to the safe disposal of reactors from nuclear submarines, nuclear weapons materials, and nuclear reactor fuel and processing waste. (Issues associated with Russia's nuclear submarine reactors and their associated fuels are discussed in detail in chapter 4.) DOD was also required to provide periodic updates of its activities to the congressional committees on Appropriations, Intelligence, and Armed Services.

In 1993, DOD became the first federal agency explicitly tasked by Congress with the responsibility for investigating radioactive contamination in the Arctic. To implement this congressional mandate, DOD's Defense Nuclear Agency delegated the Office of Naval Research (ONR) the responsibility to establish and manage the $10-million Arctic Nuclear Waste Assessment Program (ANWAP). As part of this new responsibility, ONR created a core research program under the Naval Research Laboratory to scientifically evaluate past radioactive releases and to develop models for predicting possible future dispersion. To supplement the work of its core program, ONR also invited proposals for Arctic-related field research work from government and private institutions. This component of the ONR program was characterized by some degree of interagency coordination since all submitted proposals were first reviewed by IARPC prior to ONR funding approval.

[10] $50,000

BOX 5-1: Arctic Contamination Research and Assessment Program

To increase Arctic radioactive contamination research, and consistent with its "Agenda for Action" workshop findings and the new U.S. Arctic policy, the Interagency Committee has proposed a new initiative for FY 1996 known as the Arctic Contamination Research and Assessment Program (ARCORA). Considered by its proponents as an expansion of existing research programs rather than a separate entity, this proposed strategy embodies U.S. plans to research and assess the sources, transport, fate, and environmental and health effects of pollutants discharged directly into the Arctic or accumulated from non-Arctic sources (64). However, the program's budget request of $33 million annually was not approved by the Administration. If it were supported in the future, the major radioactive contamination research and monitoring activities under ARCORA, along with their proposing agencies and funding levels, would include the following:

1. *The National Oceanic and Atmospheric Administration (NOAA):* As part of its role in the Interagency Committee's ARCORA program, NOAA proposes to carry out the following activities:
   - Establish an integrated monitoring and modeling program to evaluate industrial and urban contamination sources and their effects on the Arctic's marine and atmospheric ecosystem and identify cost-effective measures for their control. An estimated $4.5 million annually for the FY 1996–99 period is expected to be needed to implement this work.
   - Fund through the interagency National Ice Center a $2-million research program to study the role of sea ice in pollutant transport within the Arctic. Data will be gathered by using satellite, remote sensing, and buoy technologies.
   - Expand the agency's Arctic Marine Mammal Tissue Archive Project to include both the monitoring of selected Arctic marine species (e.g., mammals, birds, fish) and the evaluation of measures to control the transfer of contaminants in the food web. NOAA has requested $4 million for this work.
   - Enhance NOAA's National Status and Trends Program to include sampling of contaminants such as synthetic chlorinated pollutants and petroleum hydrocarbons in the Arctic's atmosphere, coastal environment, and biota. The agency expects this $4.5-million program, in combination with its assessments of coastal ecosystem health and coastal resource use, to be useful in future emergency response and resource development approaches.
2. *The U.S. Environmental Protection Agency (EPA):* Until recently, the EPA contributed significantly to Arctic research through various activities including its Arctic Contaminant Research Program. The agency has now decided to "*redirect*" its Arctic program to promote, along with other government and private bodies, the identification of pollution effects and the application of environmentally sound technologies. Under the proposed ARCORA initiative, EPA plans to request a total of $1 million to support a two-year Alaska-based Environmental Monitoring Assessment Program.[a]
3. *Office of Naval Research (ONR):* In FY 1995, the Department of Defense's Office of Naval Research continues to assess the radioactive contamination caused by the former Soviet Union in the Arctic and North Pacific regions, as well as its potential adverse impacts on Alaska. This $10-million program is currently funded by DOD in addition to the $33 million ARCORA proposal.
4. *National Science Foundation (NSF):* In addition to supporting future workshops on Arctic radioactive contamination, the NSF plans to fund various research projects associated with ocean and atmospheric transport in the Arctic. A total of $3 million annually for FY 1996 through FY 1999 would be needed to support NSF's research activities under ARCORA.
5. *U.S. Department of Energy (DOE):* As part of the Interagency Committee's Arctic research agenda, DOE proposes to request $1 million annually to expand its Atmospheric Radiation Measurement Program in Alaska's North Slope. The purpose of this expansion would be to study and monitor other atmospheric processes (e.g., Arctic haze and aerosols) in addition to atmospheric radiation.

(continued)

BOX 5-1: Arctic Contamination Research and Assessment Program (Cont'd.)

6. *U.S. Department of Interior (DOI):* DOI, the federal agency responsible for managing most of the U.S. Arctic resources, plans to support Arctic contamination research in five major areas at a cost of $8 million. The activities to be carried out by DOI's implementing agencies—the U.S. Geological Survey (USGS), U.S. Fish and Wildlife Service (FWS), and National Biological Survey (NBS)—include the following:
   - Characterization and analyses by USGS of sediment properties (e.g., morphology, geology, deposition, geochemistry, and erosion) at various seafloor locations used for waste disposal in the Arctic Ocean. The proposed budget for this activity is $2 million annually for FY 1996–99.
   - Evaluation by USGS of the migration potential of radioactive and nonradioactive pollutants disposed at the sites considered in the previous project. Contaminant uptake by biota and releases to atmospheres will also be studied. DOI requested a total of $1.4 million annually for this work.
   - Assessment of the Arctic's contamination by key pollutants including radioactivity, heavy metals, organochlorines, and petroleum hydrocarbons. This work, to be conducted by USGS, will require about $1.5 million.
   - Establishment of a contaminant data synthesis, communication, and repository center on the Arctic. The center is to be supported initially with information from existing data management programs.[b] Subsequently, this center will include activities such as: rescue and documentation of critical international Arctic data sets; conversion of Arctic data from analog into digital form; assembling of a geographic information system; and verification of statistical models. USGS also plans to improve access and cooperation with other organizations that maintain Arctic data. The estimated cost of this ARCORA activity is $1.5 million annually for FY 1996 through FY 1999.
   - Evaluation of impacts of radioactive and nonradioactive contaminants on various Arctic animal species. With a proposed annual operating budget of $1.5 million, FWS and NBS plan, among other endeavors, to: 1) study and monitor radionuclides and other pollutants in fish, whales, walruses, polar bears, and other animals; and 2) determine the distribution of these pollutants in walrus prey in the Bering and Chukchi Seas.

According to its proponents, the ARCORA program will focus on evaluating the impacts of Arctic contamination on Alaska, followed by their impacts on the Arctic as a whole, and eventually their global impacts. If funding is approved, two of the most immediate benefits expected from ARCORA's implementation are the development of an Arctic contamination research and monitoring strategy and the development of a data management system. Similarly relevant, its proponents claim, is that ARCORA will help provide the scientific basis needed to formulate a more successful national and international Arctic contamination policy (35,40,64,91,94,96).

[a]This program is discussed in more detail in the section of this chapter dealing with monitoring and early warning efforts.

[b]Namely, the USGS Arctic Environmental Directory and Arctic Data Interactive programs.

SOURCE: Office of Technology Assessment, 1995.

The $10 million funded for ANWAP in FY 1993 was followed by $10 million for both FY 1994 and FY 1995 by means of Congressional action in DOD appropriation bills for those years.

The overall implementation of ANWAP is multiagency in nature. Funds are obligated through the Department of Defense in coordination with, among others, the Department of Energy (DOE), the Environmental Protection Agency (EPA), the National Oceanic and Atmospheric Administration (NOAA), and the national laboratories. ONR field research work is carried out in concert with the Secretary of Defense for Atomic Energy, the Defense Nuclear Agency, and the Interagency Arctic Research and Policy Committee. Many other federal agen-

cies[11] and officials from the State of Alaska have also participated in an advisory capacity.

In carrying out ANWAP objectives, ONR has sponsored a variety of important research activities and has awarded contracts to more than 40 individuals or research groups. The initial emphasis of the ONR program involved collecting, evaluating, and assembling into a usable form the extensive data available on the Arctic environment. The more than 10,000 water and sediment samples from various oceanographic expeditions sponsored by the program are also providing ONR-supported investigation with data for determining background radiation levels, possible leakage from nuclear dump sites, and potential migration patterns of dumped radionuclides in the Arctic.

With its initial results, from the three years of funding to date, expected to be published in the spring of 1997, ANWAP's efforts to date comprise nearly 70 different field, laboratory, modeling and data analysis projects; three major workshops on nuclear contamination of the Arctic Ocean; and extensive collaboration with researchers from Russia, Norway, Germany, Canada, and the International Atomic Energy Agency (26,40,98,145). ANWAP also supports the Arctic Monitoring Assessment Program (AMAP) of the Arctic Environmental Protection Strategy program—nearly $390,000 total for FY 1994 and FY 1995.[12] Table 5-1 shows examples of the variety of scientific research and monitoring projects supported by ONR. According to many experts, ANWAP represents a significant first step toward increasing our understanding of the Arctic contamination problem.

Attempts are now under way to expand ANWAP's scope of research and interagency cooperation efforts. Program implementation has been made possible by the $10 million appropriated by Congress annually for FY 1993-95. In FY 1995, ONR is attempting to further strengthen its Arctic contamination research program by emphasizing scientific collaboration with Russian scientists and by expanding its sampling and monitoring activities to include the North Pacific region and major Russian riverine systems such as the Ob and Yenisey River basins (160). Funding for Russian participation in ANWAP will exceed $1 million in 1995 compared to $500,000 in 1993. These funds will support various Arctic environmental data exchanges and several scientific research projects including "comparative surveys of the Kara, Laptev, and East Siberian Seas, human health study in the Tamyr Region, radiological assessment of certain large mammals, monitoring feasibility studies, and radionuclide source term characterization" (145). Sampling of nonradioactive contaminants in the Arctic might be considered if the program is continued with additional funding in the future.

Because of the budgetary constraints ONR does not plan to expand its work beyond the objectives stipulated by Congress. Any expansion of the program's scope of research and of international cooperation in the future will probably not occur without additional congressional support (155). As of this writing no decision has been made about funding ANWAP for FY 1996 and beyond. And although the U.S. Vice President and the Russian Prime Minister at the June 1995 Gore-Chernomyrdin Commission meeting in Moscow highlighted ANWAP as a "premier example of cooperation in support of the U.S.-Russian Bilateral Agreement on Prevention of Pollution in the Arctic," no funding was proposed (145).

[11] These include, for example, the Department of State, Defense Nuclear Agency, Naval Sea Systems Command, Central Intelligence Agency, U.S. Coast Guard, Department of the Interior, U.S. Geological Survey, and National Science Foundation.

[12] ONR provided $40,000 in FY 1994 to AMAP for the development of AMAP's radionuclide contaminant database. In FY 1995, ONR assistance totaled $349,000; of this amount, $261,000 went to database development and the remaining $88,000 to a cooperative U.S./Russian AMAP human health study (40).

TABLE 5-1: Projects Supported by ONR to Assess the Arctic's Radioactive Contamination Problem and Identify Possible Monitoring Strategies

Performing institution	Type of project	Project objectives
Alaska Department of Environmental Conservation	Monitoring	Installation of atmospheric radionuclide monitoring stations in the Russian Bilibino region to improve regional emergency-response cooperation and information exchange
Barnard College	Research	Evaluation of the role played by river runoff and sea ice melt in transporting pollutants into the Arctic
Geomar Research Center for Marine Geosciences	Research	Assessment of sediment transport mechanisms and their morphologic effect on the Arctic's seafloor
Institute of Developmental Biology, Russian Academy of Sciences	Research	Study of exposure and possible effects of radionuclides in certain mammals of northern Russia
Lamont-Doherty Earth Observatory	Research	1) Study of circulation patterns and productivity in certain areas of the Arctic Ocean; and 2) assessment of the pathways by which radioactive wastes dumped in the Arctic might enter the Arctic environment
Lawrence Livermore National Laboratory	Research	Preparation of a risk assessment for the Arctic's radioactive waste dump sites, focusing in particular on possible impacts to indigenous populations and possible monitoring strategies
Mississippi State University	Research	Establishing an international study group to investigate radioactive waste dump sites in the North Pacific (including the Sea of Japan and the Sea of Okhotsk) and identifying possible alternative disposal methods
National Oceanic and Atmospheric Administration	Research	Identification of sources, their associated contamination, and strategies for conducting long-term monitoring in the Arctic and North Pacific regions
Naval Research Laboratory	Research	NRL is carrying out several projects for the Office of Naval Research's Nuclear Waste Assessment Program, including: ■ Developing a geographical information system to archive and evaluate data obtained under the Arctic Nuclear Waste Assessment Program ■ Assessing radioactive contamination in the Kara Sea and in the region where the Ob and Yenesey Rivers discharge into the Arctic Ocean ■ Identifying existing technologies for marine radiation monitoring ■ Developing and validating a numerical modeling system to study and quantify past and potential dispersion of radionuclides from Russia's nuclear waste dump sites and land-based sources
Ohio State University and Canada's Bedford Institute of Oceanography	Research	Evaluation of sources of radioactivity in the Murmansk region
Oregon State University	Research	Analysis of sediment cores from the Laptev, East Siberian, and Chukchi Seas to determine recent radionuclide distribution and fate patterns
Pacific Northwest Laboratories	Research	Improvements to the radionuclide transport model for the Ob and Yenesey River systems
Russian Scientific Research Institute of Hydrogeology and Engineering Geology	Research	Assessment of the distribution of radionuclides in the Ob and Yenesey River basins, and determination of current and future transport

TABLE 5-1: Projects Supported by ONR to Assess the Arctic's Radioactive Contamination Problem and Identify Possible Monitoring Strategies (Cont'd.)

Science Applications International Corporation	Research	Assessment of transport processes and pathways of Soviet-dumped pollutants in the northwest Pacific Ocean off Kamchatka Peninsula
Texas A&M	Research	Quantification of man-made and natural radionuclides in the Kara and Laptev Seas
U.S. Army Cold Regions Research Engineering Laboratory	Research	Quantification of radionuclide transport in sea ice
U.S. Department of the Interior	Research	Biological and sediment sampling at certain Russian Arctic riverine deltas and islands
University of Alaska	Research	1) evaluation of impacts by river ice and estuarine ice on certain Arctic and East Siberian seas; and 2) development, testing, and identification of possible applications of a remote-sensing methodology for detecting radioactive waste disposal sites
University of California	Research	Measurement of the geographic distribution (including sea ice, seawater, and sediment) of radionuclides being discharged into the Arctic from major Russian rivers
University of Miami	Research	Assessment of the potential for marine microorganisms to uptake radionuclides discharged from dumped Soviet nuclear reactors or from radioactive dump sites
University of Rhode Island	Research	Assessment of sources, fate, and transport of radionuclides in the Arctic Ocean, including the Canadian Basin
University of Washington	Research	Assessment of the fate of contaminants from river plumes on the Arctic's continental shelf
Woods Hole Oceanographic Institution	Research	Assessment of radionuclide-contaminant transport into the Arctic from major Russian rivers, particularly the Ob River

SOURCES: Office of Naval Research, "Arctic Nuclear Waste Assessment Program: Project Summary, 1994 Research," Washington, DC, 1994; C.D. Hollister, Woods Hole Oceanographic Institution, personal communication, August 15, 1995; Office of Technology Assessment.

Alaska's Initiatives in Research on Arctic Radioactive Contamination

Traditionally, the Deputy Commissioner of the Alaska Department of Environmental Conservation is the individual assigned by the Governor to represent and coordinate all Arctic environmental protection efforts involving the state. The Deputy Commissioner participates in state, national, and international forums. These responsibilities include, among others, coordinating Alaska's participation in the Arctic Environmental Protection Strategy's Arctic Monitoring and Assessment Program (AMAP); representing Alaska in meetings held by the Arctic Research Commission; and assisting federal agencies (e.g., State Department, National Security Council) in the development and review of national Arctic policy (150).

The State of Alaska participates actively in a variety of regional, national, and international efforts to assess and monitor the status of the Arctic contamination problem. Within the region, the State of Alaska appropriates funds to the University of Alaska and its operating agencies to conduct Arctic research. According to a January 1995 ARC report, about $10 million of the $11.4 million provided by the state to the University of Alaska was programmed for Arctic research. Other agencies supporting state research efforts in the Arctic include the Department of Fish and Game (about $3.5 million) and

the Alaska Science and Technology Foundation (more than $72 million since its inception in 1989) (12,150).

The Environmental Health and Emergency Response Project is the major regional undertaking supported by the State of Alaska to address Arctic contamination issues and concerns. The project was officially established by the Governor at the Northern Forum meeting in September 1992,[13] to cooperate and coordinate Arctic protection efforts among northern regional governments. The project also emphasizes the identification of existing and potential public health and safety hazards, and the sharing of environmental data among all the regional governments participating in the Northern Forum (5, 93).

In the national arena, Alaska plans to participate in the proposed $1-million Regional Environmental Monitoring Assessment Project, a program sponsored by the U.S. Environmental Protection Agency and the U.S. Fish and Wildlife Service to assess environmental contamination in the North Slope area. The State of Alaska, through its Department of Environmental Conservation, also participates in the Risk Assessment Group of ONR's Arctic Nuclear Waste Assessment Program (40). Box 5-2 describes two of the major Arctic cooperative research efforts in which the State of Alaska participates.

Internationally, most of Alaska's efforts are focused on supporting the work of the AEPS, in particular its Arctic Monitoring and Assessment Program (AMAP). Some of the international projects known to have extensive Alaskan participation include the following:

1. reviewing state databases known to contain information about air pollution sources and contaminated sites found throughout the state, and reporting the results to the AMAP Secretariat;
2. providing the AMAP Secretariat with radiation data collected by state monitors and by the monitors planned for installation at the Bilibino nuclear power plant as part of a cooperative agreement with that Russian facility; and
3. paying the salary of an expert who would help to complete the chapter on heavy metals that the United States is required to submit as part of the AMAP report now under preparation (150).

Evaluation of Current U.S. Federal and State Arctic Research Initiatives

For more than a century following the acquisition of Alaska from Russia in 1867, U.S. Arctic policy lacked a formal mandate and focused primarily on the strategic and national security importance of this region. Little emphasis was given to protection of the Arctic environment from waste disposal activities, including dumping of radioactive materials. Even when Congress passed the Arctic Research Policy Act in 1984, calling for the coordination of all federal research efforts, U.S. policy continued to emphasize national defense rather than environmental contamination research.

In response to the growing concerns raised by reports documenting the radioactive and chemical contamination of the Arctic by the former Soviet Union, the United States has opted since 1992 to address this problem in a number of ways. For example, the Interagency Committee and the Arctic Research Commission have put forth various efforts (e.g., expert workshops; long-term research goals; research recommendations) to establish a coordinated radioactive contamination research plan. As part of renewing its 1983 policies, the U.S. government, through the State Department, issued a new Arctic policy in September 1994, emphasizing its commitment to the environmental protection of the Arctic eco-

[13] The Northern Forum is a nongovernmental organization composed of 23 governors from northern and Arctic regions. The regional governments participating in the Northern Forum are: Alaska (U.S.); Lapland (Finland); Hokkaido (Japan); Yukon and Alberta (Canada); S. Trondelag and the Northern Counties Association (Norway); Dornod (Mongolia); Heilongjiang (People's Republic of China); Vaserbotten (Sweden); the Republic of Korea; and the Russian regional governments of: Chukotka Autonomous Okrug, Evenk Autonomous Okrug, Khabarovsk Krai, Magadan Oblast, Nenets Autonomous Okrug, Kamchatka Oblast, Sakha Republic, Sakhalin Oblast, Komi Republic, Leningrad Oblast, Khantiy Mansiisk Autonomous Okrug, and the Jewish Autonomous Region (93, 135).

BOX 5-2: Alaska's Initiatives on Arctic Radioactive Contamination Research

Rapid Assessment of Potentially Significant Pollution Sources in the Russian Far East

The Russian Rapid Assessment Project is an Alaskan initiative to work with the eight regional governments of the Russian Far East in the identification and collection of data from those areas in Russia considered of greatest risk to human health and the environment in the region. This initiative also seeks to provide the basis for long-term cooperation between the United States and Russian national and regional governments. On the completion of the project, the data collected and mapped are expected to benefit the Arctic Monitoring and Assessment Program as well as the state's efforts to prepare an emergency response program.

Implementation of the Russian Rapid Assessment Project involves a complex array of jurisdictions. For instance, the State of Alaska is responsible for overseeing and partially financing the project. The U.S. Environmental Protection Agency and the U.S. State Department have provided funds ($100,000 and $140,000, respectively) for its implementation. At least seven Far East regions of Russia are participating in the project: the Chukotka Autonomous Region, Kamchatka Oblast, Khabarovsk Krai, Magadan Oblast, Primorski Krai, Sakhalin Oblast, and the Sakha Republic (184,185). According to experts, the project has provided a great opportunity for local government officials to learn about pollution sources in their regions since the number of contaminated sites that might be involved ranges from a few dozen (Sakhalin and Magadan Oblasts), to several hundred (Kamchatka), to several thousand (Primorsky Krai).

As originally proposed, the implementation of this effort is twofold. The first phase consisted of training two Russian representatives selected by a sponsoring committee or department from each Far East region on the use of computers to collect and store pollution data. The second phase involves assisting Alaskan scientists to enter the collected data into a computer mapping system (global information system, or GIS) so the Russians can subsequently reproduce maps of their pollution sites and areas of contamination. Training of regional representatives was carried out by the University of Alaska's Environmental Resources Institute (ENRI) in June 1994 (117,118,126,185).

Thus far, the Rapid Assessment Project appears to be a promising cooperative effort; environmental monitoring data previously collected by regional organizations is being mapped for the first time. Assurances by project staff of the availability of data on Alaska's contaminated sites to the participating Far East regions have played a key role in the Russians' willingness to reciprocate. Plans are under way to develop an agreement—to be signed at a future meeting—by which all participating regions have access to any monitoring information and results, including maps and databases (126).

After the training of Russian participants, ENRI personnel provide computers and payments of about $125 for each project participant until each has received $1,500. Once the project is completed, computers will be returned to the State of Alaska unless the program is extended to cover other Russian regions. Scheduled for release in September 1995, the final report and contamination maps are expected to be highly useful to regional government officials, local concerned individuals, and various international research efforts including the Arctic Monitoring Assessment Program (117,118,184,185).

Despite progress made in improving logistics, the Russian information infrastructure continues to hinder project implementation. Some data from the Russian regions are already being received and integrated into the GIS system. According to Office of Technology Assessment research, several barriers still impede more effective data transfer. These include an inefficient mail service system, an unreliable telephone and fax system, and a limited computer communication system (e.g., Internet/E-mail) (185).

(continued)

BOX 5-2: Alaska's Initiatives on Arctic Radioactive Contamination Research (Cont'd.)

The Cooperative Institute for Arctic Research

The Cooperative Institute for Arctic Research (CIFAR) was established in 1994 as a cooperative effort among the National Oceanic and Atmospheric Administration (NOAA), the University of Alaska-Fairbanks, and the Alaska Department of Environmental Conservation for the purpose of coordinating and integrating Arctic research activities in Alaska.

In addition to NOAA support, CIFAR received $352,000 in FY 1994 and $205,000 in FY 1995 from ONR's Arctic Nuclear Waste Assessment Program to conduct various research activities through 1998. One such project involves analysis of data on contaminant levels, pollutant transport, and associated ecological effects on the coastal and continental shelf areas of the Beaufort and Chukchi Seas collected under the Outer Continental Shelf Environmental Assessment Program from 1975 to 1985. On completing this effort, CIFAR plans to convene an international conference in the spring of 1997 to highlight the results of the Arctic Nuclear Waste Assessment Program (30,40).

CIFAR also proposes to expand Alaska's monitoring program in Barrow to include other areas of Arctic Alaska and to sample other significant pollutants such as persistent organic pollutants and metals. As part of this activity, CIFAR plans to explore opportunities for real-time data exchange with institutions in the Russian Federation and other Arctic nations by use of the Internet (30,96).

SOURCE: Office of Technology Assessment, 1995.

system. Like the policy efforts issued during the 1980s, these new policy initiatives failed to provide or identify funding sources for implementing any radioactive contamination research project.

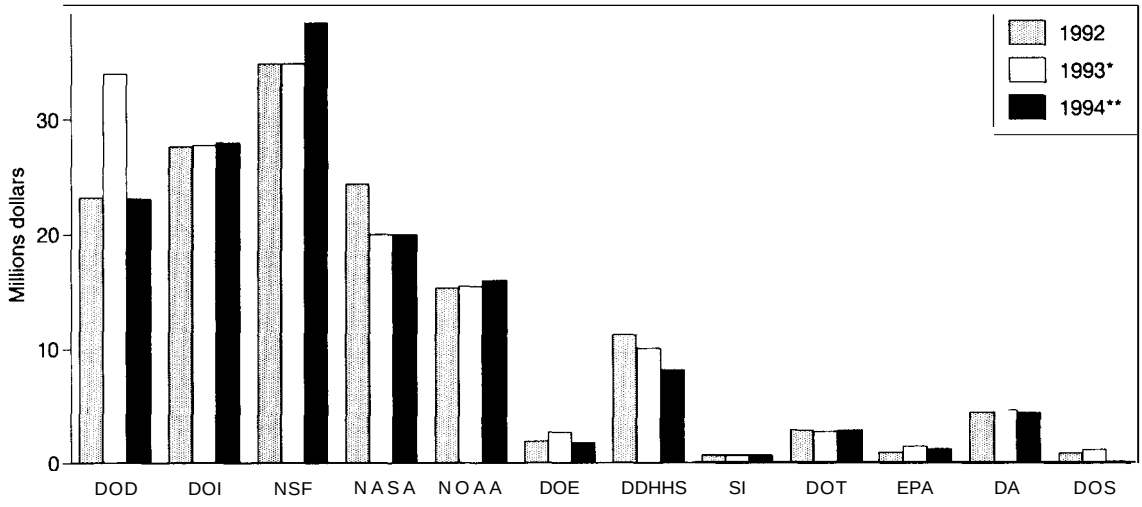
Unlike ARPA and U.S. government Arctic policy, the Office of Naval Research has conducted extensive research on radioactive contamination in the Arctic for the last three years. In addition to data collection and analysis through workshops and information exchanges, ONR has also supported extensive sampling of environmental conditions in neighboring areas of Alaska and certain coastal and riverine areas of the Arctic known to have been used by the former Soviet Union to dispose of radioactive contaminated materials. Although research efforts are now more systematic than in years past, they do not fully characterize the status and trends of pollutants in the Arctic.

Despite U.S. policy development efforts, attracting funds for Arctic contamination research continues to be difficult for the Interagency Committee and the Arctic Research Commission (20,91,94,96). According to OTA research, funds provided by federal agencies to carry out their responsibilities under the Interagency Committee are considerably less than those for overall Arctic research.[14] In fact, the level of funding available for Arctic contamination research totaled $16 million for FY 1993 through FY 1995, $10 million of which corresponded to congressional authorizations supporting ONR's Arctic Nuclear Waste Assessment Program. IARPC agencies, such as the National Science Foundation, provided the remaining $6 million. The overall federal Arctic research budget for the same period, on the other hand, averaged nearly $170 million. Figure 5-2 shows the U.S. Arctic research budget, by agency, for FY 1992-94.

According to the currently proposed IARPC budget request, implementation of the Arctic Contamination Research and Assessment pro-

[14] Due to funding limitations, unilateral efforts by the United States to assess radioactive contamination in the Arctic have been limited primarily to a few workshops, several information exchanges, and a small number of field research projects.

FIGURE 5-2: Total Federal Arctic Research Budget, by Agency, FY 1992-1994



KEY: DOA: Department of Agriculture; DDHHS: Department of Health and Human services; DOD: Department of Defense; DOE: Department of Energy; DOI: Department of the Interior; DOS: Department of State; DOT: Department of Transportation: EPA: Environmental Protection Agency; NASA: National Atmospheric and Space Administration; NOAA: National Oceanic and Atmospheric Administration; SI: Smithsonian Institution.

SOURCES: C. Myers, National Science Foundation, personal communication, Mar. 3 and June 15, 1995; Interagency Research Policy Committee, National Science Foundation, "United States Arctic Research Plan, Biennial Revision: 1996-2000," final draft report, May 1995.

gram (box 5-1) would require about $33 million for FY 1995. Nearly 85 percent ($27.8 million) is expected to come from NOAA and the Department of Interior; NSF will provide about 9 percent of this total ($3 million). The level of funding needed for FY 1996-99 is calculated to be relatively similar to the FY 1995 budget request. While contributions from DOE and EPA will not exceed $1 million, it is unknown whether the ONR program participation ($10 million in past) will continue (63,64,66).

Funding uncertainties and limitations are obstacles for U.S. agencies in their attempts to assess radioactive contamination and evaluate its potential adverse impacts, In light of recent budget-cutting measures among federal agencies, little expectation exists of future increases in funds to programs responsible for assessing the Arctic's radioactive contamination problem,

Most experts anticipate that the search for funds to support Arctic contamination projects will become more difficult, particularly in light of the present climate of competing priorities and budgetary hardships among federal agencies with Arctic programs.

U.S.-Russian Bilateral Cooperative Initiatives on Arctic Contamination Research

For several decades prior to the breakup of the Soviet Union, U.S. efforts had been centered on mobilization of the vast economic and military resources needed to enable the nation to withstand any potential threats. After the dissolution of the Soviet Union—as an indication that the Cold War was over—the U.S. Congress embarked on an effort to assist the newly independent states, and particularly Russia, in partnerships with the United States and other Western nations. This assistance was geared primarily to support the establishment of democratic institutions and economic reforms and policies. U.S. assistance efforts also embraced strategies for safe dismantlement and destruction of nuclear weapons. Figure 5-1 shows the relationship between U.S. national and international efforts to support Arctic research and monitoring.

The Gore-Chernomyrdin Commission

As part of the April 3-4, 1993, summit meeting in Vancouver, Canada, the Presidents of Russia and the United States agreed to forge a new mutually cooperative venture between the two nations. Because the venture was to be guided primarily by high-level government officials, a U.S.-Russian Joint Commission on Economic and Technological Cooperation was established under the leadership of U.S. Vice President Albert Gore and Russian Prime Minister Viktor Chernomyrdin. Since its creation, the Gore-Chernomyrdin Commission (GCC), as the joint venture is known, has lacked the funding mechanism or budget required to support any of the cooperative initiatives undertaken under its jurisdiction (8,51).

The GCC was established shortly after the Vancouver summit. The first commission meeting took place in Washington in September 1993. Since then, the meeting site has alternated between Russia and the United States. The fifth and most recent meeting was held in Moscow in June 1995.

The scope and complexity of the commission have expanded since the presidential summit in Vancouver. Created to provide a framework for cooperating in the areas of space, energy, and high technology, the Gore-Chernomyrdin Commission has to date expanded to include five additional areas of interest (business development, defense conversion, health, environment, and agriculture). Today, the commission has working committees for each of these issues which are chaired by Cabinet members (figure 5-3). The Environment Committee, headed by the administrator of the U.S. Environmental Protection Agency, is the GCC branch responsible for developing and implementing the U.S. portion of cooperative environmental plans with Russia (54,180).

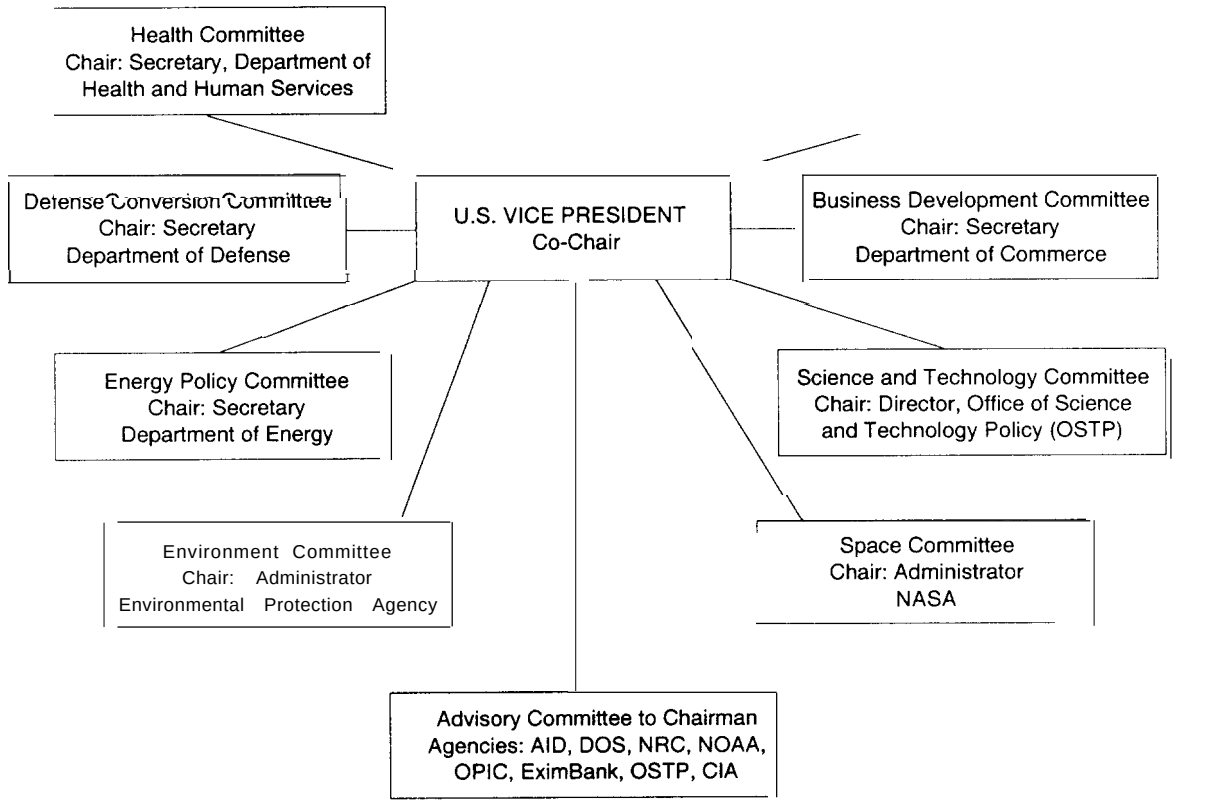
Little progress, however, has been attained thus far by the commission in the field of Arctic nuclear contamination. Most of its work, particularly that of the Environment Committee, appears focused on the areas of sustainable management of natural resources, conservation of biodiversity, and environmental technical assistance and education. Among the activities of current interest to the GCC, for example, are: the application of remote sensing data and technologies; training in pollution control, risk assessment, and environmental law and economics; cleanup of the oil spill in the Komi Republic; and more recently, the phasing out of leaded gasoline. Of the various bilateral research initiatives supported by the United States under the Gore-Chernomyrdin Commission, only one relates to researching the radioactive contamination problem in the Arctic: the U.S.-Russian Agreement on Cooperation in the Field of Environmental Protection of 1994.

A cooperative research accord that might be beneficial to U.S. efforts in assessing radioactive contamination is the agreement between the United States and the fSU to cooperate in research on radiation effects, described in box 5-3. This agreement is a bilateral, stand-alone, government-to-government accord whose implementation is coordinated with the GCC's Health Committee. No GCC funds are provided for implementation of this agreement. The Environment Committee has also been active in facilitating opportunities for U.S. and Russian military and defense communities to cooperate in solving environmental problems (51,145,180); to prevent future radioactive contamination, the committee is assisting the Russians with improvements in radioactive waste management and nuclear reactor safety—a subject discussed later in this chapter.

U.S.-Russian agreement on cooperation in the field of environmental protection

In May 23, 1972, the United States and the Soviet Union signed the U.S.-U.S.S.R. Environmental Agreement, an unprecedented protocol designed to build long-term cooperation in the field of environmental research and ecological protection. Despite the unfavorable diplomatic conditions that existed between the two nations throughout the Cold War, the 1972 agreement proved successful in fostering collaboration

FIGURE 5-3: Organizational Structure of the U.S. Component of the Gore-Chernomyrdin Commission



KEY: AID: Agency for International Development; CIA: Central Intelligence Agency; DOS: Department of State; EPA: U.S. Environmental Protection Agency; Exim Bank: Export-Import Bank: NRC: Nuclear Regulatory Agency; NOAA: National Oceanic end Atmospheric Administration; OPIC: Overseas Private Investment Corporation.
SOURCE: Office of Technology Assessment, 1995.

BOX 5-3: U.S.-Russian Agreement on Cooperation in Research on Radiation Effects

The breakup of the Soviet Union has provided U.S. and Russian radiation research experts with an unprecedented opportunity to overcome some of the limitations of the scientific studies used for determining chronic radiation exposures and predicting radiation health risks.[a] Prior to the breakup of the Soviet Union, there was little opportunity to study localities where populations were known to be externally and internally exposed to low radiation levels over long periods of time. One example of such a location is the radioactively contaminated area in Russia's southern Urals. Recognizing the importance that preservation and analysis of radiation exposure data from the southern Urals may have in answering questions concerning chronic low-level exposures, the U.S. Secretary of State and the Russian Foreign Minister, at their January 1994 Moscow summit, entered into an historic binational agreement to cooperate on matters relating to radiation effects research. This five-year accord,[b] known as the *Agreement Between the Government of the United States of America and the Government of the Russian Federation on Cooperation in Research on Radiation Effects for the Purpose of Minimizing the Consequences of Radioactive Contamination on Health and the Environment,* identifies six major areas of cooperation:

1. health effects studies of radiation-exposed workers and community members;
2. preservation of existing data and development of relevant databases and information systems;
3. environmental studies reconstructing past doses to human populations and assessing impacts of radioactivity on the environment;
4. health communication of risk assessment information;
5. policy analysis, including review of detection and reporting mechanisms; and
6. support of scientific research capable of identifying means to reduce the environmental and human health impacts of radioactive contamination.

The Joint Coordinating Committee for Radiation Effects Research (JCCRER) was established to implement the agreement.[c] The JCCRER is responsible for coordinating and reviewing "all aspects of cooperation under the Agreement" and for arranging working groups, conferences, and seminars to discuss and study radioactive effects issues.[d] According to Article III.5, the JCCRER may also develop "*projects and programs for radiation effects research, exchanges of scientific and technical safety information, personnel and equipment, and procedures for addressing and resolving questions of such matters as payment of costs under this cooperation, and patent and/or publication rights for joint activities administered under this Agreement . . .*" All programs of cooperation developed under the JCCRER are to be established on an annual basis and implemented the following year.[e]

Collaboration under the agreement is multiagency in nature and coordinated with the Gore-Chernomyrdin Commission's Health Committee. U.S. technical participation in the committee is carried out by the Department of Energy, Nuclear Regulatory Commission, Department of Defense, and Department of Health and Human Services. The Russian agencies currently represented at the JCCRER consist of the Ministry for Civil Defense Affairs, Emergencies, and Elimination of Consequences of Natural Disasters (EMERCOM); Ministry of Atomic Energy; and the Ministry of Health and the Medical Industry. The Department of Energy and EMERCOM are the executive agents responsible for coordinating the overall research plan and activities agreed to by the United States and Russia under the accord.

The text of the agreement provides ample flexibility to the parties to determine the type of funding mechanism to be employed to fund administrative and research activities. The U.S. government has budgeted more than $1 million to implement activities under this agreement during FY 1995; funding for subsequent years will be determined on a year-by-year basis. During the first JCCRER held in Bethesda, Maryland, on October 24–25, 1994, Russia indicated its intent to provide a relatively similar level of financial support through a centralized funding authority under EMERCOM. The availability of information on the progress made by the Russian government in carrying out this intent has not been addressed during this first year of work under the agreement.

(continued)

BOX 5-3: U.S.-Russian Agreement on Cooperation in Research on Radiation Effects (Cont'd.)

For the purpose of demonstrating successful collaborative research, the JCCRER plans to focus on implementing, at least for the first year, only a small number of radiation research projects. The areas of study would include feasibility studies on updating dose reconstruction models, estimating carcinogenic-noncarcinogenic effects and potential risks, and assessing radionuclide metabolism in exposed residents. The Russian communities to be studied will consist of the residents living along the Techa River and the southern Ural region, an area extensively contaminated by radioactivity from waste discharges and accidents, and the Mayak industrial nuclear complex, where many plant workers are thought to have been exposed to excessive radiation levels. Radiation effects among Mayak's nonworking population are also considered in JCCRER's initial program of cooperation (52,87,88,179)

Since the signing of the agreement, the JCCRER Executive Committee and Project Research Teams have focused on improving understanding of the Russian scientific approach and on developing the institutional relationship needed to collaborate successfully with the Russians. To this end, the Executive Committee recently conducted two workshops, one in Florida to discuss implementation of selected occupational exposure projects at the Mayak facility. The second workshop, conducted in July 1995 in St. Petersburg, Russia, focused on how the research on radiation effects along the Techa River population and community studies will be performed (179).

[a]Our knowledge about the health effects and possible risks associated with radiation exposure is based largely on medical studies of survivors from the Hiroshima and Nagasaki bomb explosions. In addition, the data collected from these studies only pertain directly to populations exposed to high radiation doses for relatively short periods of time. Because of these limitations, scientists extrapolate the data in order to develop regulatory and safety standards for controlling risks associated with low radiation dose and low dose rates. Many critics, however, question the validity of using high-dose and high-dose-rate to determine the risks associated with chronic low radiation exposures since, as indicated in the Agreement's proposed implementation plan of October 1994, high-dose data do "not correspond to the pattern of exposure normally encountered or expected in the nuclear fuel cycle and in other uses of radiation and radioactive materials.

[b]The agreement is to remain in force at least until 1999, at which time additional five-year extensions can be approved by the U.S. and Russian governments.

[c]In addition to the JCCRER, both governments agreed to create an Executive Committee responsible for JCCRER day-to-day activities and for initiating a few research proposals in the first year of implementation; Scientific Review Groups for reviewing and evaluating the research conducted under the agreement; and Project Research Teams composed of the principal U.S. and Russian scientists carrying out the work.

[d]Articles III.4 and III.5 of the agreement.

[e]Article III.6.

SOURCE: Office of Technology Assessment, 1995.

between the scientific communities in both nations.

By virtue of the Soviet Union's dissolution and as an effort to provide continuity to the collaborative work conducted under the 1972 protocol, Vice President Gore and Russian Prime Minister Chernomyrdin signed on May 23, 1994, the U.S.-Russia Agreement on Cooperation in the Field of Protection of the Environment and Natural Resources. This agreement replaced the 1972 accord with the Soviet Union. The conditions of the agreement will remain in force until May 23, 1999, unless the United States and Russia sign an additional five-year extension. The U.S. Environmental Protection Agency, in consultation with the State Department and other federal agencies, is responsible for administering the accord (144).

The 1994 agreement seeks to support long-term joint cooperation for studies on the harmful environmental impacts of pollution and for the development of "measures to improve the condition of the environment...including work on the areas of pollution prevention and remediation."[15] Of the nearly 20 fields of cooperation included in the new agreement—shown in table 5-2—the fifth area specifically calls for both nations to focus on protecting the Arctic environment by

[15] Article I of "Agreement Between the Government of the United States of America and the Government of the Russian Federation on Cooperation in the Field of Protection of the Environment and Natural Resources," June 23, 1994.

TABLE 5-2: Areas of Cooperation Identified Under the 1994 Agreement on Cooperation in the Field of Environmental Protection

1	Atmosphere; water and soil resources
2	Environmental aspects of agricultural production
3	Preservation, conservation, and management of natural and cultural resources in the context of their relationship to the environment, including the organization of preserves and other specially protected areas
4	Marine and coastal areas and resources
5	Arctic and sub-Arctic areas and resources
6	Environmental impact assessment
7	Global environmental issues, including climate change, depletion of the ozone layer and conservation and restoration of the biological diversity of local, regional, and global ecological systems, including forest ecosystems.
8	Impact of environmental factors on human health and the condition of flora and fauna
9	Application of digital mapping and GIS (geographic information systems) technologies and use of sensor technology in addressing environmental issues
10	Energy-saving measures and creation of alternative energy sources
11	Legal and administrative measures relating to the protection of the environment, including legislation, enforcement, and access to the administrative and judicial systems
12	Participation of the public, including nongovernmental organizations in environmental decisionmaking
13	Education in the field of environmental protection and natural resources
14	Economics and the management of environmental issues and the use of natural resources
15	Role of the military in the field of protection of the environment and natural resources
16	Environmental emergencies
17	Earthquake prediction and assessment of seismic risks
18	Environmental monitoring
19	Any other area of cooperation agreed to by the parties

SOURCE: U.S.–Russia Agreement on Cooperation in the Field of Protection of the Environment and Natural Resources, May 23, 1994.

supporting technical and scientific projects, information exchange, and meetings.

Active collaboration is also found in the area of "Conservation of Nature and the Organization of Reserves" included in the agreement. Under this section of the agreement, various U.S. agencies—such as the Fish and Wildlife Service, the Forest Service, and the Office of Naval Research—have worked with Russian government agencies[16] and nongovernmental institutions to promote natural resource conservation and to improve technical training and research opportunities. The research projects supported include, among others, joint mapping of sea ice and snow cover in the Bering and Chukchi Seas; surveying animal populations of ecological importance to the U.S. and Russian Arctic regions; and conserving the genetic diversity of threatened animal populations such as the Siberian tiger (36,83,84,178).

[16] For example, the Ministry of Environmental Protection and Natural Resources, Ministry of Fisheries, and Russian Academy of Sciences.

The Fish and Wildlife Service also plans to participate in the joint Russian-U.S. scientific expedition planned and funded by the Office of Naval Research for August 1995. Collection of water and sediment samples—also funded by ONR—will take place in the area extending from the Bering Strait, westward of the Chuckchi Sea to the mouth of the Kolyma River in the East Siberian Sea. Collected samples will then be analyzed to assess existing levels of radioactive and chemical contamination, evaluate their long-term effects on the marine plant and animal populations of the area, and study the pathways through which these contaminants are transported within this region of the Arctic (40,84,173).

Despite the increased impetus to carry out collaborative work under the Agreement on Cooperation in the Field of Protection of the Environment and Natural Resources, experts view the current economic hardship experienced by Russia as a major obstacle limiting their participation under the agreement. In the view of an official on the Russian side of the agreement, adoption by the United States of "a significant share of the [financial] burden" associated with implementing the accord is the main reason for the success thus far (36).

MONITORING AND EARLY WARNING INITIATIVES DESIGNED TO ADDRESS RADIOACTIVE CONTAMINATION IN THE ARCTIC

Concerns about Russia's Environmental Monitoring Data

Considerable concern exists among Alaskan residents and Arctic nations about the limited Russian monitoring of environmental contamination, and the inadequacy of its existing data and of the institutional regulatory framework responsible for monitoring and enforcement. Regarding air and water pollution, for example, Russian monitoring efforts were generally limited to samples taken through a federally funded network that consisted of a few monitoring points located in key sites. The Committee for Air and Hydrology was the Russian agency responsible for overseeing the sampling. Under the committee's supervision, samples were analyzed periodically for only 10 different contaminants, and the data were summarized and reported annually. One reason for this appears to be that "Russian environmental laws list allowable limits for numerous pollutants but only 10 are actually considered. All the rest are not actually measured, rather they are estimated." Resource limitations also preclude more extensive sampling and data reporting, as evidenced by the committee's recent decision to reduce the number of monitoring stations in the network due to shrinking federal funds (117,118,126).

The poor quality of data regarding contaminated lands in Russia, particularly in the Far East region, is also of concern among Alaskans and Russian regional governments. The responsibility for monitoring and reporting the nature and extent of pollutants on land in Russia traditionally falls on the polluting facilities. Operating facilities are required to collect and report all samples for laboratory analysis to the Committee of Environmental Protection and Natural Resources (CEPNR). Upon completion of analysis, results are submitted to statistical bureaus where status reports of the region's contamination are prepared.

Because of the limited capacity of its laboratory facilities and funding shortages that prevent the hiring of additional personnel, CEPNR's analytical staff is often forced to test only a few pollutants. Additional contaminants could be tested and regulated, but current funds are too limited for CEPNR to expand its staff and testing activities (126). The inadequacy of regional environmental data and shortage of agency resources also limit the ability to map the status of contamination in Russia's Far East region. In the past, mapping of contamination (e.g., in the Russian Far East) consisted of providing a limited qualitative depiction of what was present at contaminated sites, rather than supplying accurate pollutant levels and the locations of such contamination sources. In most instances, such data also exclude discharges from the military's

extensive nuclear and nonnuclear industrial complexes. Data inadequacy, according to a recently published report, only adds to the difficulty of addressing environmental contamination problems in Russia (48,90).

The fragmented nature of the institutional infrastructure responsible for ensuring environmental protection in the Russian Arctic region also precluded interagency cooperation to improve data quality and adequacy. Prior to 1993, the responsibility for environmental protection in the Far East regions of Russia was traditionally organized by medium (e.g., water, air, soil) and therefore carried out by more than one committee, unlike natural resource management, which came under the jurisdiction of one committee. Jurisdiction for air, surface water, groundwater, and environmental protection was generally found in separate committees. Since 1993, Russia has attempted to reorganize all committees with a responsibility for environmental protection into one authority.

Despite Russia's recent attempts to disclose environmental monitoring information, the United States and other Arctic nations are supporting studies to assess the radioactive contamination problem in the Arctic and to formulate monitoring approaches. The following section discusses three major monitoring initiatives: the Regional Environmental Monitoring Assessment Program proposed by the U.S. EPA, the Arctic Environmental Protection Strategy established by the eight circumpolar nations, and the International Arctic Seas Assessment Project sponsored by the International Atomic Energy Agency.

The U.S. Regional Environmental Monitoring Assessment Program

The Environmental Monitoring Assessment Program (EMAP) is a U.S. Environmental Protection Agency project designed to gather data on the condition and long-term trends of ecological resources, including wetlands, forests, and coastal areas. To reflect the increasing concern about contamination of the Arctic environment, and in particular the potential impact that such contamination might have on the health and livelihood of Alaska Natives, EPA, in cooperation with the Fish and Wildlife Service, is proposing to establish a regional version of its nationwide program to be known as the Regional Environmental Monitoring Assessment Program (R-EMAP).[17]

As part of project implementation, EPA plans to first identify those methodologies used in its nationwide monitoring and assessment program that are appropriate for sampling and assessing ecological impacts from pollutants in estuarine environments.[18] Once appropriate methodologies are identified, the R-EMAP program staff proposes to assess the physical, chemical, and biological conditions in 62 randomly selected locations in northwest Alaska. Samples of sediments, fish, birds, and snow, for example, will be analyzed for pollutants such as heavy metals, PCBs (polychlorinated biphenyls), pesticides, and other organic pollutants. In its first year, the program will assess 32 estuarine locations in the Kasegaluk and Elson Lagoons near Barrow, Alaska.

Although the EPA's plan is to undertake an EMAP-like program specifically focused on Alaska, the agency—as well as the Interagency Committee through which the proposal was made—still awaits OMB's approval of the $500,000 annual operating budget needed for its implementation. If funded, R-EMAP might prove helpful to national and international Arctic research programs in which the United States participates. Examples of these include the Arctic Monitoring and Assessment Program established as part of the circumpolar nations' Arctic Environmental Protection Strategy. The Arctic

[17] Regional EMAPs are also proposed for other regions of the United States; however, the only one discussed here deals with the Arctic region.

[18] The Alaska Department of Environmental Conservation and the U.S. Fish and Wildlife Service are cooperating with EPA in developing the design, sampling procedures, and protocols of the project.

contamination research program under the Interagency Arctic Research Policy Committee will also benefit from this project. The Arctic Monitoring and Assessment Program (discussed in detail in the next section) will benefit because 1) the sampling of two Alaskan estuarine systems for pollutants identified under AMAP would take place consistent with AMAP-approved sampling procedures (35,172); and 2) because the monitoring techniques to be developed and tested by EPA could be then adopted for further assessing environmental contamination in the Arctic (35).

The Arctic Environmental Protection Strategy

The concept of establishing a charter among circumpolar nations to promote cooperation for the protection of the Arctic was first voiced in 1989 by the Finnish government at an international conference in Rovaniemi, Finland, attended by all eight Arctic countries (United States, Canada, Denmark, Finland, Iceland, Norway, Russia, and Sweden). After consultative meetings in Sweden and Canada, these eight nations approved the Declaration on Arctic Environmental Protection on June 1, 1991. The Arctic Environmental Protection Strategy, also known as the Rovaniemi process or the Finnish initiative, became the central component of the declaration.[19]

AEPS is a nonbinding legal statement for cooperation on the development and implementation of programs to protect the Arctic environment. Its major objectives include "*preserving environmental quality and natural resources, accommodating environmental protection principles with the needs and traditions of Arctic Native peoples, monitoring environmental conditions, and reducing and eventually eliminating pollution in the Arctic Environment.*" To facilitate meeting these objectives, AEPS identifies six major types of pollutants as priorities for action: radioactivity, heavy metals, oil, noise, acidification, and persistent organic contaminants.

Implementation of AEPS requires national and international cooperation and coordination of efforts. To this end, the eight circumpolar nations have formed four major working groups under AEPS to lead their research work in the Arctic. They are: the Arctic Monitoring and Assessment Program; the Conservation of Arctic Flora and Fauna (CAFF); the Protection of the Arctic Marine Environment (PAME); and the Emergency Prevention, Preparedness and Response (EPP&R). Concerns about sustainable development in the Arctic are also addressed by the AEPS. The responsibility for coordinating U.S. participation in these groups falls on the U.S. State Department. The federal agencies leading the U.S. technical cooperative efforts are the Environmental Protection Agency, the National Oceanic and Atmospheric Administration, and the National Science Foundation, through IARPC, for AMAP; the U.S. Fish and Wildlife Service for CAFF; the National Ocean and Atmospheric Administration for PAME; and the U.S. Coast Guard for EPP&R. Cooperation also takes place among AEPS working groups, the eight Arctic countries, and various international organizations (e.g., IAEA, London Convention). Significant collaboration and coordination also exists between the Arctic Nuclear Waste Assessment Program of the Office of Naval Research and the AEPS, particularly AMAP—nearly $390,000 in FY 1994 and 1995—and to some extent PAME (40).

Arctic Monitoring and Assessment Program

The Arctic Monitoring and Assessment Program is the central component of the Rovaniemi process or AEPS. Its three main objectives are to: 1) monitor, assess, and report on the environmental health of the Arctic; 2) document the sources, levels, trends, and pathways of pollutants; and 3) assess the effect on the Arctic environment of man-made pollutants originating in Arctic and lower latitudes. Attempts to achieve these basic objectives must also take into consideration the

[19] Several non-Arctic nations and organizations also participate in the Arctic environmental protection process, generally as observers.

ecological and cultural importance of the Arctic among native peoples.

The objectives of AMAP are implemented through the Arctic Monitoring and Assessment Task Force, consisting of representatives from each of the Arctic countries supporting the Arctic Environmental Protection Strategy. Representatives from native groups, such as the Inuit Circumpolar Conference, the Nordic Saami Council, and the Russian Association of Small Peoples of the North, participate in the Task Force as observers. Representatives from non-Arctic nations (e.g., United Kingdom) and international organizations (e.g., International Arctic Science Committee) involved in Arctic research are also invited as observers (120). With IARPC's support, and in coordination with the NSF and the State Department, NOAA hosted AMAP's Assessment Steering Group and Working Group meetings in Washington last October (96).

As agreed under AEPS, AMAP member nations are responsible for preparing a report on the assessment of the Arctic environment by December 1996. The United States and the Russian Federation were given the lead responsibility for preparing the chapter of the report that assesses heavy metals (e.g., sources, emissions, environmental levels and trends and possible effects).[20] The remaining key portions of the report are the responsibility of Canada and Norway (pathways of contamination), Canada and Sweden (persistent organic pollutants, such as PCBs), Norway and Russia (radioactivity), Finland (acidification), and Denmark (human health). The plan to have the AMAP report finished by December 1996, however, appears overly ambitious to some experts.

AMAP, to date, has focused primarily on the collection of data from sources or activities that emit pollutants. Analytical work to model the mechanisms by which these pollutants affect or might affect the Arctic environment is also under way. To facilitate the research, AMAP has grouped polluting activities into two major categories: land-based and sea-based radioactive contamination sources. Land-based sources include the disposal of radioactive material and the discharge of chemical and industrial pollutants; sea-based sources refer primarily to the shipping and dumping of radioactive waste and of nuclear materials (10).

The United States plays a lead role in various AMAP activities. Together with Russia, the United States is preparing the chapter of the assessment dealing with heavy-metal contamination. According to the U.S. AMAP representative, considerable progress has been made in the preparation of a draft report for the heavy-metal assessment. Several meetings with relevant international experts, particularly from Arctic nations, are under way to collect the additional information required to complete the assessment. The second major U.S. activity under AMAP involves developing the Arctic Data Directory. This undertaking is being led by a data management expert with the U.S. Geological Survey with funding from ONR and the Department of State. One of the objectives of the U.S. work is to provide AMAP countries with the technology and technical assistance required to adapt existing data on the Arctic environment to formats and databases that can be readily accessible by computer (91,120,121).

The overall international budget for AMAP in 1995 is approximately $850,000, but because it is not centrally funded, AMAP is forced to rely on the financial and technical assistance of its members (91,120,121). Norway is the largest contributor, with an annual participation exceeding $500,000. The U.S. financial contribution by IARPC agencies to AMAP for FY1995 is about $150,000, mainly from the Department of State, the National Science Foundation, and the Environmental Protection Agency (94,121,167).

Despite the lead U.S. role in a number of activities, many experts continue to view the U.S. contribution to implement its AMAP data

[20] Other issues of concern to AEPS include for example impacts associated with climate change, oil pollution, and noise.

management activities as seriously underfunded (91,96). Limited funding has not only been reported for U.S. work on the chapter on heavy metals but also for the Arctic data inventory. The Arctic Research Commission concluded recently that ensuring a successful "*and effective* [U.S.] *participation in AMAP and associated AEPS activities*" would require about $500,000 per year (15). Increasing U.S. financial support for AMAP is crucial, especially since U.S. expertise may also be needed for the preparation of other portions of the AMAP report, including a chapter on freshwater contamination (167). Russia's contribution to the program, on the other hand, is expected to remain inconsequential, particularly because of its serious economic difficulties (16) and, to some extent, its failure to consider Arctic radioactive contamination a national research priority. (Russia's environmental regulatory and institutional framework is discussed later in this chapter.)

Conservation of Arctic Flora and Fauna Working Group

The concept of establishing an independent program for protecting and conserving the fauna and flora of the Arctic was first proposed as a memorandum of agreement for signing by the eight Arctic countries meeting in Yellowknife, Canada, in 1990. Support for establishing an independent program quickly dissipated because of the increasing interest on the part of Arctic nations to set forth a comprehensive protection strategy. With the signing of the Arctic Environmental Protection Strategy, and after extensive negotiations, the Conservation of Arctic Flora and Fauna Working Group concept was adopted as an integral component of the strategy (107).

CAFF is composed of a Secretariat and an International Working Group. The Secretariat began operations in January 1994 and is located in Ottawa, Canada. The International Working Group consists of representatives from Arctic government agencies and is headed by a Chair and Vice-Chair. The U.S. Fish and Wildlife Service branch in Anchorage, Alaska, is the U.S. CAFF representative. Native groups have been highly effective in working within CAFF to have their concerns addressed (7,11).

CAFF currently supports the preparation of various documents relating to the Arctic marine environment. These include, among others, an inventory of land-based contamination sources, the preparation of conservation strategies for marine organisms (e.g., the seabird murre), compilation of information on seabird colonies, and preparation of working papers on various circumpolar seabird and fish populations (107). One of Russia's activities under CAFF involves the preparation of a Network of Protected Areas. The results from these projects, considered essential for the work planned by other components of the strategy, will be compiled into a report by Norway and submitted to the AEPS ministerial meeting in late 1995 or early 1996.

Protection of the Arctic Marine Environment Working Group

The Working Group on Protection of the Arctic Marine Environment, led by Norway, first met in Oslo in May 1994, following an invitation by the Norwegian Ministry of Environment. The objective of this component of the Arctic Environmental Protection Strategy is to identify and describe all possible threats to the Arctic marine environment and to provide a review of the international institutional framework that currently exists for protection of the Arctic seas. At their September 1994 London meeting, PAME members officially recognized the Arctic's radioactive contamination by the former Soviet Union and the possibility "of future dumping by the Russian Federation" as critical issues (11).

PAME's principal role in AEPS is to gather data on the effects of man-made contaminants on Arctic wildlife populations and habitats and to submit a final report to AEPS ministers in 1995. PAME is also responsible for examining possible options or actions needed to address the problem and for determining whether existing instruments are sufficient or new as necessary. The five prin-

cipal areas of research currently supported by PAME are:

1. assessing the impacts of pollution on the marine and terrestrial ecosystems as well as on the Native Peoples of the Arctic. A large portion of this work is being led by Norway;
2. identifying all possible land-based sources of pollution affecting the Arctic, such as oil, gas, and nuclear industries; mining; industrial activities; and coastal development. Canada is leading this portion of the report;
3. collecting data on any sea-based activities within and outside the Arctic but with the potential to impact the Arctic. Preliminary work thus far has been conducted by Norway (primarily on offshore oil and gas activities) and the United States (ocean dumping and incineration);
4. evaluating all relevant international instruments for preventing and remediating Arctic marine pollution; and
5. recommending probable approaches to solutions (10).

PAME members are expected to face various difficult issues as work gets underway. One example is linking environmental threats with the level of protection provided by international instruments and pointing out areas where such instruments are inadequate. Because the major focus of PAME is the marine environment, AEPS member nations such as Canada and the United States suggest that prior to proposing protection measures for adoption by international organizations such as the London Convention, a more comprehensive understanding of the Arctic pollution problem is needed (10).

Another potential area of controversy that may result from implementing PAME's approaches without extensive discussion among AEPS members is the question of maritime zones and boundaries. With the exception of Sweden and Finland, which lack jurisdiction over marine waters north of the Arctic Circle, most AEPS members, including Russia, have declared their maritime zones along their Arctic coasts. Canada, Iceland, and Norway claim jurisdiction over territorial waters extending up to 200 nautical miles. Denmark's decision to define its territorial waters in the Arctic is expected in the near future. In addition to PAME, these obstacles appear potentially relevant to other AEPS programs.

Despite these potential obstacles, PAME's research continues to be key to identifying and monitoring the contaminants and their sources that currently affect the Arctic marine environment, and to supporting the activities of the three other AEPS working groups.

Emergency Prevention, Preparedness and Response Working Group

Consistent with the AEPS objective of ensuring the protection of the Arctic environment, the eight circumpolar countries established a Working Group on Emergency Prevention, Preparedness and Response to address the problem of acute environmental emergencies from land-based and offshore activities such as nuclear accidents and oil spills. Led by Canada and the United States, this group is inventorying and assessing the potential for accidental pollution of the Arctic from a variety of sources (e.g., chemical plants, industries, nuclear power plants) now operating in the Arctic countries. Once completed, the EPP&R work is expected to be used in coordination with other prevention protocols (e.g., the IAEA and the London Convention) to determine more precisely the types of additional safeguards that are needed.

The EPP&R Working Group has begun to conduct an environmental risk assessment of the Arctic region. The study is expected to allow EPP&R researchers to classify and inventory the actual impact and potential risks to the Arctic from any transboundary accidental discharge. Once completed, study results will be employed to determine whether relevant international institutions need to adopt additional measures to ensure the protection of the Arctic environment from accidental spills and releases (10).

International Atomic Energy Agency's Arctic Seas Assessment Project

The United Nations established the International Atomic Energy Agency (IAEA) in 1957 to carry out two primary missions: 1) to enhance and support the peaceful uses of atomic energy throughout its member nations, and 2) to ensure that atomic energy is not used for furthering any military purpose. One year later, at its first Conference on the Law of the Sea, the United Nations proposed expanding IAEA's mission to include responsibility for controlling discharges of radioactive waste into the sea. By the end of the conference, the international community had given IAEA the responsibility for promulgating technical and regulatory standards to prevent the ocean dumping of radioactive substances at levels that would affect human health and the marine environment (68,136). However, it was not until 1993 that IAEA, through the International Arctic Seas Assessment Project, would take its first official look at the Arctic's radioactive contamination caused by the Soviets.[21]

As a result of growing concern about the possible regional and global impacts from radioactive waste dumping sites in the Arctic, the contracting parties attending the London Convention's Fifteenth Consultative Meeting in 1992 requested that IAEA devote attention to the Arctic radioactive contamination problem. In responding to this request, in February 1993 the IAEA established the International Arctic Seas Assessment Project (IASAP). The main focus of the project was to study the health and environmental consequences that may be associated with the dumping of radioactive waste in the Kara and Barents Seas and to identify probable remedial solutions. Initially conceived as a bilateral cooperation effort between Norway and Russia, IASAP today involves the participation of several international organizations and member nations including the United States. IAEA plans to phase out the IASAP project in 1996 with the publication of a final report (69, 70, 71,72,136).

To carry out the project, IAEA's Division of Nuclear Fuel and Waste Management Section adopted the four working groups established at its international meeting on the "Assessment of Actual and Potential Consequences of Dumping of Radioactive Waste into the Arctic Seas" held in Oslo, Norway, in February 1994. The groups are the Impact Assessment and Remedial Measures Working Group, the Source Term Working Group, the Existing Environmental Concentrations Working Group, and the Transfer Mechanisms and Models Working Group. The Impact Assessment and Remedial Measures Working Group is primarily responsible for overseeing the work performed by the other three working groups and for preparing the final report to be submitted to the London Convention in 1996 (136).

The Source Term Working Group, chaired by an official of the U.S. Environmental Protection Agency, is responsible for working with Russian institutions and Russian contractors in a variety of technical research areas. These include reconstructing the history of reactor fuels prior to their dumping; collecting information on the nature and properties of containment systems used to prevent releases from dumped reactors; identifying the types of processing wastes disposed; and conducting exploratory cruises to take direct measurements of the waste packages and surrounding seawater and sediments. This group's findings, which are scheduled to be published later in 1995, are expected to support the modeling work by other IASAP working groups (39,69,136).

Through its working group on Existing Environmental Concentrations, IASAP staff collects information on current radioactive contamination levels in the Arctic for compilation in a global database being developed by its Marine Environ-

[21] Prior to 1993, IAEA work in Eastern Europe and the former Soviet Union focused primarily on the identification and assessment of sites at which uranium mining and milling activities had been conducted. One reason for focusing on this type of radioactive contamination sources was the assumption that nuclear facilities, such as nuclear power plants and research laboratories, were already under regulatory control.

mental Laboratory in Monaco. Attempts to evaluate the reliability of this database, known as "Inventory of Radionuclides in World Oceans," are nearing completion (69,136).

The central element of IASAP's fourth component, the Transfer Mechanism and Models Working Group, is the recently established program called "Modeling of the Radiological Impact of Radioactive Waste Dumping in the Arctic Seas." Under this program, IASAP staff is working with experts from laboratory and modeling groups from IAEA, Russia, Norway, Denmark, and England in the development of assessment models for the Arctic seas. The progress made by this program is still preliminary and awaits more conclusive data from the other IASAP working groups (72,131,136). In addition to coordinating with Norwegian and Russian experts and institutions, IASAP staff plans to provide AMAP with its project results (72).

Future attempts by IASAP could include the study of radioactive contamination in the Sea of Japan. The government of Japan is concerned about past dumping of radioactive wastes in areas near the Sea of Japan and about Russia's continued unsafe accumulation of nuclear wastes from the Pacific fleet and decommissioned submarines in the region (29,92,99). Interest in expanding IASAP to include the study of radioactive contamination of the Sea of Japan was first reported at the Source Term Working Group's meeting held in Vienna in January 1994. Even with the Japanese government's efforts to cooperate with Russia and its intention to fund the building of liquid radioactive waste treatment project, little progress has been made to date toward involving the IAEA in this region. Even if the relevant governments (i.e., Japan, South Korea, and possibly Russia) agreed to participate in the program, it is unknown who would provide the financial resources to develop the research strategy needed to effectively accommodate an institutional infrastructure and marine environment different from the Arctic.

According to the IAEA, the United States is one of the nations providing financial support for IASAP activities. The U.S. contribution for the first year of the program was $135,000, followed by $100,000 for FY 1995 (131). U.S. assistance is also provided in the form of support staff (for example, by the State Department) and facilitating travel to meetings and data gathering for U.S. experts participating in the IASAP program (by the Office of Naval Research) (16,40,131). IAEA is currently seeking funding from other member states (70,72).

Evaluation of IAEA's Arctic Seas Project

Although nuclear contamination data are being progressively disclosed by the Russian Federation, IAEA officials point out that the work to conclusively assess the extent of nuclear contamination in the Russian Federation continues to face difficulties. One major difficulty is incomplete data associated with nuclear contamination. In addition, the data are often scattered throughout a multitude of organizations that, because of recent political changes, appear to have poorly delineated or overlapping responsibilities. The unavailability of data in a language other than Russian has also hampered the agency's contamination assessment work. Another concern is the inability to gain access to data on radioactive waste practices at Russian military sites. According to IAEA officials, this factor constitutes a serious obstacle to developing a comprehensive and accurate assessment of radioactive contamination sources in Russia.

Although IASAP represents the first major attempt by IAEA to address environmental contamination in the Arctic, many view this undertaking as limited since it focuses only on radioactive materials dumped in the Kara Sea. Little or no focus is given to those radioactive contaminants already disposed into rivers emptying into the Arctic. In addition, little information exists on how IAEA plans to implement IASAP's findings once the project is completed.

The Arctic Council

Despite the progress made through existing international initiatives (e.g., AEPS and Northern

Forum), some view their focus as too specific and often lacking an overall coordinated approach and intergovernmental policy forum to deal with the wide variety of issues facing Arctic nations, such as trade, transport, communication, pollution, sustainable development, and the welfare of Native communities. Due to these limitations, Canada and other Arctic nations proposed in May 1993 to establish an Arctic Council to serve as the principal institutional umbrella, under which, existing and new institutional bodies will address, manage, promote, and resolve these issues. Unlike existing initiatives which invite Native community representatives as observers, the Arctic Council would recognize them as permanent members. The Council would also serve as the vehicle to mobilize resources among Arctic countries when needed as, for example, in emergency situations. With the exception of the United States, all Arctic nations have signed by December 1994 the original intent or declaration to create the Council. At the February 1995 Ottawa Summit, the U.S. announced its interest to join Canada and the other Arctic nations to organize the Council (8,20,67). Full participation by the United States is anticipated soon after negotiations are completed.[22]

INSTITUTIONAL INITIATIVES AND PROGRAMS DESIGNED TO PREVENT FUTURE ARCTIC RADIOACTIVE CONTAMINATION

A number of bilateral and multilateral initiatives exist today to collaborate with Russia in the prevention of future radioactive contamination of the Arctic (figure 5-4). Depending on their approach, preventive initiatives may focus on supporting proper storage and processing of radioactive waste to avoid their dumping into the Arctic and North Pacific regions, or on improving the operational safety and emergency response capability of Russia's most dangerous operating nuclear reactors. This section discusses the nature and status of major national and international programs to address both types of prevention approaches.

Initiatives to Improve Radioactive Waste Management

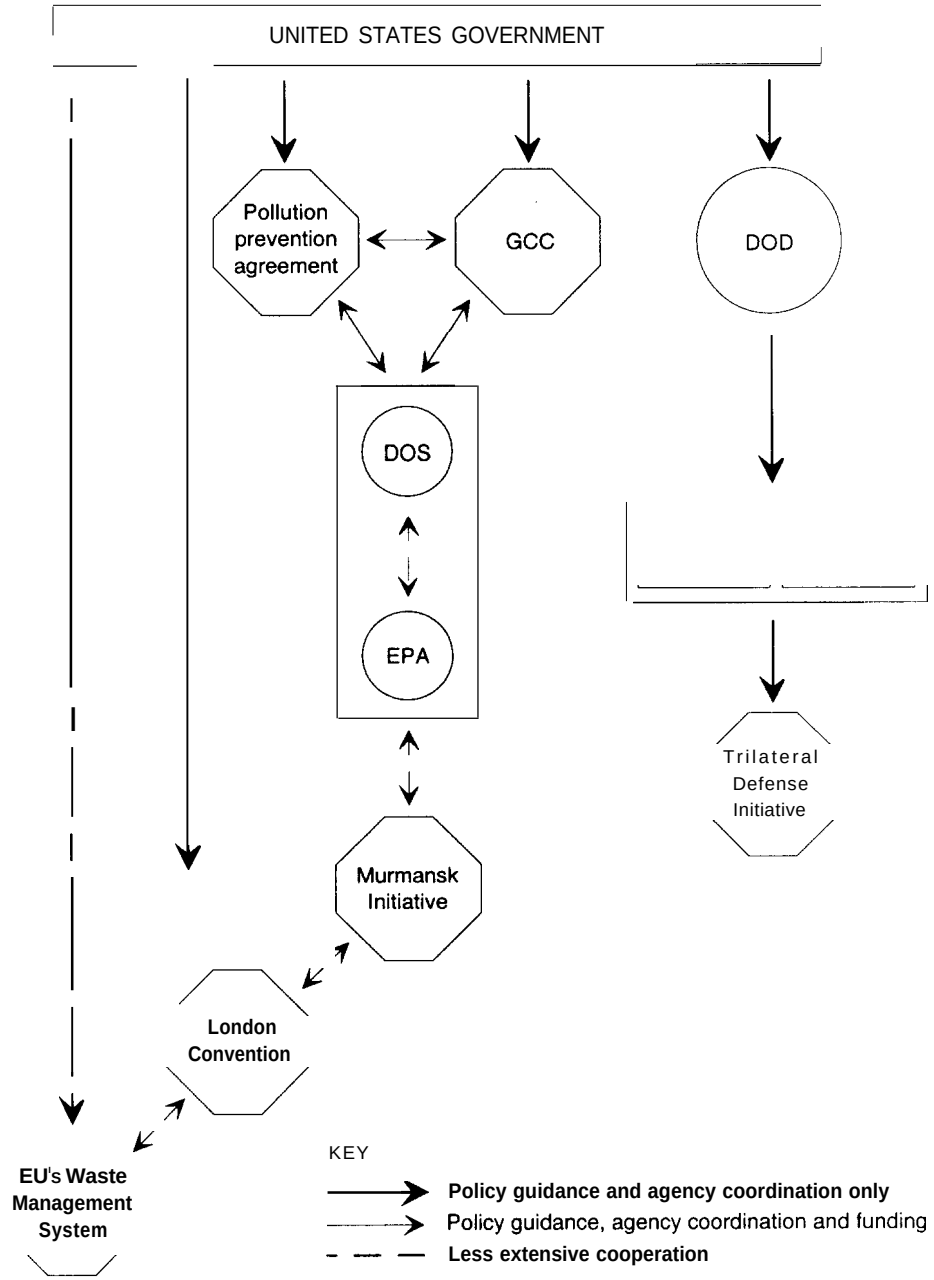
The two major U.S.-supported efforts that are under way to prevent the future disposal of radioactive waste by Russia in the Arctic are the London Convention and the Murmansk Initiative. Box 5-4 describes three other assistance programs of relative significance.

The London Convention

Without exception, the efforts adopted by the international community before 1972 to address concerns about the adverse human and environmental impacts from ocean dumping of contaminated wastes were regional in nature. The "Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter," signed in November 1972, became the first global attempt to address this problem. The main purpose of the protocol, now commonly known as the London Convention, is that all *"contracting Parties shall individually and collectively promote the effective control of all sources of pollution of the marine environment, and pledge themselves especially to take all practicable steps to prevent the pollution of the sea by the dumping of waste and other matter that is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea."* To achieve these objectives, the contracting parties are required by Article II of the London Convention to *"take measures individually, according to their scientific, technical and economic capabilities, and collectively, to pre-*

[22] Although U.S. diplomatic officials voice general agreement with the structure and objectives of the proposed council, discussions are underway to, for example, incorporate the Arctic Environmental Protection Strategy and its working groups under the Council's umbrella and to rotate the Secretariat functions of the Council rather than establish a permanent Secretariat. The possibility of high-level representation by the United States at Council functions is also unknown.

FIGURE 5-4: Major Initiatives to Improve Russia's Nuclear Waste Management



KEY: DOE: Department of Energy; DOS: Department of State; EPA: U.S. Environmental Protection Agency; EU: European Union: GCC: Gore-Chernomyrdin Commission.
SOURCE: Office of Technology Assessment, 1995

BOX 5-4: Other Relevant Efforts to Improve Russia's Radioactive Waste Management

Norwegian–U.S.–Russian Proposed Initiative Addressing Civilian and Military Sources of Nuclear Contamination

Of the Arctic countries, Norway is the most concerned about the need to address radioactive contamination in Russia, particularly in the Arctic region. Of primary concern to Norway are the suspect operational safety of nuclear facilities and the unsafe management of nuclear materials and wastes reported at nuclear facilities operating near Norway's borders. The nearby northern and Arctic regions of Russia are of primary concern because of the unusual concentration of past and potential radioactive contamination from civilian and military nuclear sources. These include numerous nuclear-powered ships and submarines; fissile material and nuclear waste storage sites; operating nuclear power plants of questionable, operational safety; and unknown quantities of radioactive materials discharged into regional lands, rivers, and seas. In 1992, for example, Norway cooperated with Russia in sponsoring an expedition to measure the radioactive contamination levels in the immediate vicinity of dump sites in the Kara Sea (136).

With the purpose of establishing the financial and institutional framework needed to solve this problem, the Norwegian government in 1994 approved an action plan to support international collaboration for addressing four major nuclear issues in Russia. Four major contamination sources identified in the plan were: 1) the limited operational safety of Russia's civilian nuclear facilities; 2) the environmentally unsafe management and storage of radioactive materials and wastes; 3) the radioactive waste dumping in the Kara and Barents Seas and inland rivers emptying into the Arctic Ocean; and 4) the hazards from weapons-related activities (123). The government of Norway has committed about $20 million for implementation of this plan.

Consistent with its plan of action, the Norwegian government has proposed the creation of an International Steering Committee to cooperate technically and financially with Russia in the sound removal and cleanup of the *Lepse* and its radioactive cargo. The *Lepse* is a Russian vessel currently storing radioactive wastes, including damaged spent fuel from nuclear-powered icebreakers, in generally unsafe conditions (127). Nearly 90 percent of this radioactive cargo consists of civilian icebreaker fuel (39). Norway is leading the work to gather international support for the proposal.

With the realization that available economic assistance is inadequate to address nuclear safety, Norway's approach is that through cooperation and information exchange, considerable progress could be made in institutionalizing nuclear safety as a priority among Russian decisionmakers and regional governments. Norway, like other Western nations, advocates the closing of the least safe Soviet-designed nuclear reactors still in operation. The Kola Nuclear Power Plant located nearby is one example. Through multilateral channels, including the action plan for Eastern Europe and the Nuclear Safety Account program administered by the European Bank for Reconstruction and Development, Norway provides financial assistance for safety improvements at the Kola Peninsula plant. Through these assistance mechanisms, Norway also encourages field participation by Norwegian technical experts (100).

Despite Norway's participation in a variety of cooperative efforts with Russia, the numerous Russian nuclear military facilities located in the Arctic continue to be among the most dangerous sources of potential radioactive contamination in the region. For this reason, Norway's Ministry of Defense recently initiated discussions with its U.S. and Russian counterparts on areas of cooperation that might be adopted to address this issue. According to information provided at the recent Office of Technical Assessment workshop on spent fuel management, the main objective of this effort would be to sign a trilateral cooperative agreement under which Norway and the United States would, for example, 1) provide technical assistance to the Russian Defense Ministry for addressing and monitoring radioactive contamination problems, and 2) support early notification procedures and information exchanges in the event of accidents at military or civilian nuclear facilities (16,100,123,181).

(continued)

BOX 5-4: Other Relevant Efforts to Improve Russia's Radioactive Waste Management (Cont'd.)

In March 1995, Norwegian and U.S. defense officials held a four-day meeting in Oslo with their Russian counterparts to discuss the feasibility of establishing a framework for cooperation, as well as to identify "potentially unique contributions the respective militaries could make" toward improving the radioactive contamination problem in the Russian Arctic (17,177). The Deputy Undersecretary of Defense for Environmental Security, who is also the head of the Steering Group on Radioactive Contamination in the Arctic, is leading the U.S. effort. On June 30, 1995, the U.S. Secretary of Defense and its Russian counterpart signed a memorandum of agreement to exchange information on the environment, particularly in the areas of environmental protection and cleanup, waste management, and weapons material disposal. Although the agreement lacks a specific timetable or plan of action, this broad accord constitutes a potentially meaningful attempt to address environmental contamination issues associated with the Arctic.

European Union's Radioactive Waste Management System

In 1994, the European Union (EU) started a cooperative program with Russia to identify approaches for improving its radioactive waste management system in the Kola Peninsula region.[a] This project consists of two phases. In phase one, the EU will provide funds for a study of the nature and extent of the problem and identification of alternative solutions. Once this study is completed, the EU will cooperate with Russia in developing the technology and building the storage facility necessary for ensuring proper radioactive waste management in the Kola Peninsula region. The estimated level of funding programmed by the EU for this work is $5.4 million. Little information exists on the funding to be programmed for long-term implementation of the facility once it is built (128).

Department of Energy (DOE) Environmental Management Program

Within the framework of the 1973 Peaceful Uses of Atomic Energy agreement and the 1990 Memorandum of Cooperation with the Ministry of Atomic Energy of the Russian Federation (MINATOM), the (DOE) Environmental Management Program is conducting various pilot projects potentially useful to both countries. The Office of Technology Development (OTD) within the Environmental Management Program is the government branch leading U.S. assistance in the area of radioactive waste management and technology development. Its cooperative projects have included holding technical exchange workshops and initiating pilot-scale projects for demonstrating treatment technologies for high-level radioactive wastes; establishing electronic and computer links with Russian institutions involved in cooperative projects; and instituting an Environmental Management Center to facilitate technology transfer between U.S. and Russian institutions working on environmental cleanup. OTD has also sponsored visits by experts from Russian technical institutes to U.S. nuclear weapons complex sites to exchange information on environmental cleanup experience. To continue the implementation of its Russian assistance projects in FY 1996, the Office of Technology Development has submitted a budget request for $1 million—a 20 percent increase from its FY 1995 budget of $800,000 (163,164).

[a]In addition to waste management, the EU is working with Norwegian experts to identify solutions for remediating the submarines *Komsomolets* and *Elexis* (sunk off the Murmansk coast).

SOURCE: Office of Technology Assessment, 1995.

vent marine pollution caused by dumping and shall harmonize their policies in this regard."[23]

The London Convention requires that each contracting party report to the Inter-Governmen-

[23] Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (including amended Annexes) [in] International Maritime Organization, Office for the London Dumping Convention, *The London Dumping Convention: The First Decade and Beyond* (London, England: International Maritime Organization, 1991).

tal Maritime Consultative Organization, now known as the International Maritime Organization or (IMO), and to other parties where appropriate, about its dumping activities. Since 1975, the IMO has been responsible for executing all secretarial responsibilities associated with the London Convention.[24] Consultation with other members, particularly those that are most likely to be affected, is required in case of emergencies.[25] Member nations must also agree to "*keep records of the nature and quantities of all matter permitted to be dumped and the location, time and method of dumping*" and to monitor in an individual manner or in collaboration with other contracting parties "*the condition of the seas.*" Party states are also responsible for enforcing the provisions of the convention among all vessels and aircraft "*registered in* [their] *territory or flying* [their] *flag.*"[26] These principles, however, are not applicable to internal waters of states.[27]

With its signing, the international community essentially agreed to prohibit the ocean dumping of a variety of "harmful" substances and wastes and to establish a licensing process to regulate disposal of the remaining universe of substances (75). The former Soviet Union became a signatory in January 1976, and after its dissolution, the Russian Federation assumed the rights, responsibilities, and obligations under the convention (21).

The London Convention's efforts regarding radioactive waste have grown from attempts to determine their unsuitability for ocean disposal nearly two decades ago to the actual prohibition of such practices in 1994. In 1978, the London Convention made the International Atomic Energy Agency [28,29] responsible for defining the types of radioactive waste unsuitable for ocean dumping and for making recommendations about regulating the discharge of other types of radioactive waste (136). The first radiation levels issued by IAEA were designed explicitly to control the disposal of all high-level waste, spent nuclear fuel, and wastes from nuclear fuel reprocessing activities.

At its Seventh Consultative Meeting held in London in 1983, the London Convention also made the IAEA responsible for providing scientific guidance on issues relating to the voluntary moratorium on the ocean disposal of low-level radioactive wastes entered into by the contracting parties (68). As a result of this work, the convention authorized the IMO to carry out the following: 1) prohibit the dumping of any highly hazardous or radioactive substances or wastes, and 2) establish permitting and reporting requirements[30] for substances not considered highly hazardous or radioactive that still require special care prior to ocean disposal. Adoption of stricter control measures by contracting parties, for example, banning the disposal of less hazardous substances, is also welcome by the London Convention.[31]

Based on IAEA work that identified areas suitable for ocean dumping, the London Convention limited ocean dumping to that region outside the continental shelf located between latitudes 50° N and 50° S, and to depths of at least 12,000 feet (68). With respect to these boundary limitations, the only bodies of water easily accessible to Russia are located in the North Pacific Ocean. However, according to recent reports by IAEA officials, much of the radioactive waste that was disposed of by the former Soviet Union in the Kara Sea, is considered high level in nature and,

[24] Annex I, paragraph 6 and Annex II, paragraph D of the Convention.

[25] Article V, Paragraph 2 of the Convention.

[26] Article VI of the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter at Sea, 1972.

[27] Article III of the Convention

[28] The International Atomic Energy Agency is the international entity with the authority to carry out the convention's recommendations relating to dumping of radioactive wastes in the oceans.

[29] Annex I, paragraph 6 and Annex II, paragraph D of the Convention.

[30] The factors (e.g., characterization of matter to be dumped and of dumping site prior to sea disposal; method of disposal; potential impacts) that must be considered for permit application are contained in Annex III of the London Convention.

[31] Articles VI(3) and VII(5) of the Convention.

therefore, unsuitable for sea disposal and in violation of the London Convention.

Because of the uncertainty about continued adherence by the international community to the convention's voluntary ban on ocean dumping of low-level radioactive wastes, the convention signatories proposed the inclusion of this waste type in the Black List (Annex I). In November 1993, an agreement to voluntarily ban the discharge of all radioactive waste and substances into the marine environment was signed, almost unanimously, at the convention's Sixteenth Consultative Meeting held in London. The Russian Federation was the only party to the convention promising to abide in principle but refraining from formally signing the ban.

In sum, the London Convention has been highly successful in increasing the international community's awareness of the potential global environmental impacts of ocean dumping without appropriate assessment and control. Lamentably for many nations, such as those circumpolar countries neighboring Russia, the guidelines of the convention are voluntary in nature and explicitly applicable to high seas and to the territorial seas of signatory states. As a consequence, these nations view Russia's self-imposed voluntary commitment to the London Convention's official ocean ban of radioactive waste as insufficient to ensure that further dumping does not occur. Of the preventive cooperative efforts under way today, the most relevant is the Murmansk Initiative—described below—because of its attempt to improve Russia's radioactive waste management and "...prevent [the] dumping of liquid radioactive wastes...in accordance with the London Convention" (141).

The Murmansk Initiative

The Murmansk Initiative is a cooperative effort led by the United States and Norway, with Russian participation, to expand the Russian Federation's capacity to store and process low-level radioactive waste (LLW) from the Northern Fleet in the Arctic. The major objective of this effort is to prevent the unsafe management and subsequent dumping of this type of waste into the Arctic Ocean.

The Murmansk Shipping Company, a recently privatized Russian firm, operates the Russian civilian icebreaker fleet and handles LLW. It has also processed, for a fee, some of the low-level radioactive waste produced by the Russian Navy at its Atomflot facility in Murmansk. Most of the space that the Russian Navy uses for the safe storage of liquid LLW is full. In addition, Russia continues to accumulate liquid radioactive waste in the Arctic region, especially at sites (military bases and enterprises) where nuclear reactors from ships, submarines, and icebreakers are operated and repaired and their nuclear fuel is replaced.

The Murmansk Initiative is the direct result of a shared U.S.-Norwegian concern about the need to cooperate in solving Russia's radioactive liquid waste storage and processing problem. Following initial discussion of the Murmansk Initiative concept,[32] the Norwegian and U.S. governments (led by the U.S. Environmental Protection Agency in coordination with the State Department) succeeded in securing Russian participation in the effort. Several technical exchanges, ministerial meetings, and expert site visits were conducted in 1994 and early 1995 to evaluate existing needs and propose possible facility upgrades. A concept paper prepared by the Murmansk Shipping Company claims that, if implemented, the Murmansk Initiative will help improve the regional structure for safe management of radioactive waste from existing sources including Russia's Northern fleet (50).

On September 28, 1994, nearly four months after the initiative was first presented to the Gore-Chernomyrdin Commission, the United States and Russia issued a presidential announcement or formal statement of support. In the state-

[32] Responding to a national concern about the possibility that the Northern fleet's inadequate storage capacity might force the Russians to dispose of their low-level radioactive waste into the Arctic, the Norwegian delegation participating in a 1993 London Convention meeting solicited the cooperation of the United States to help identify a regional-based solution to this potential problem.

ment, both the Russian Federation and the U.S. government claimed to ". . .*confirm their readiness to cooperate in consistently preventing dumping of liquid radioactive wastes, in accordance with the London Convention, and to proceed to a solution of the problem of Arctic Pollution from all sources. To this end, the Russian Federation and the United States of America agree to undertake immediately, in cooperation with other interested countries, a step-by-step expansion and upgrading of a treatment facility for liquid low-level radioactive waste in Murmansk*" (141).

Implementation of this mandate calls for the rapid upgrading and expansion of the Murmansk facility to provide timely storage and processing capacity for the Northern Fleet's LLW. The ultimate goal of the agreement, however, is to serve as "*the focal point of efforts to create the infrastructure for ecologically safe processing and storage of liquid low-level radioactive wastes in the North of Russia*"(141). Information on similar types of preventive initiatives that may be supported by the GCC in the future is scant.

The United States and Norway have signed an agreement with Russia to provide funding for an engineering design report to expand and improve the liquid LLW treatment facility operated by MSC. The design is expected to be completed in 1995. If the recommended design is approved, construction of the project is scheduled to start in 1996. EPA experts anticipate that the Norwegian and U.S. governments will provide funding for construction. Funds (about $750,000) have been committed by EPA, the U.S. AID and DOD for this purpose. Norway has already agreed to provide $750,000 toward the construction of this expanded and upgraded facility (33,39,180).

Initiatives to Improve Nuclear Reactor Safety

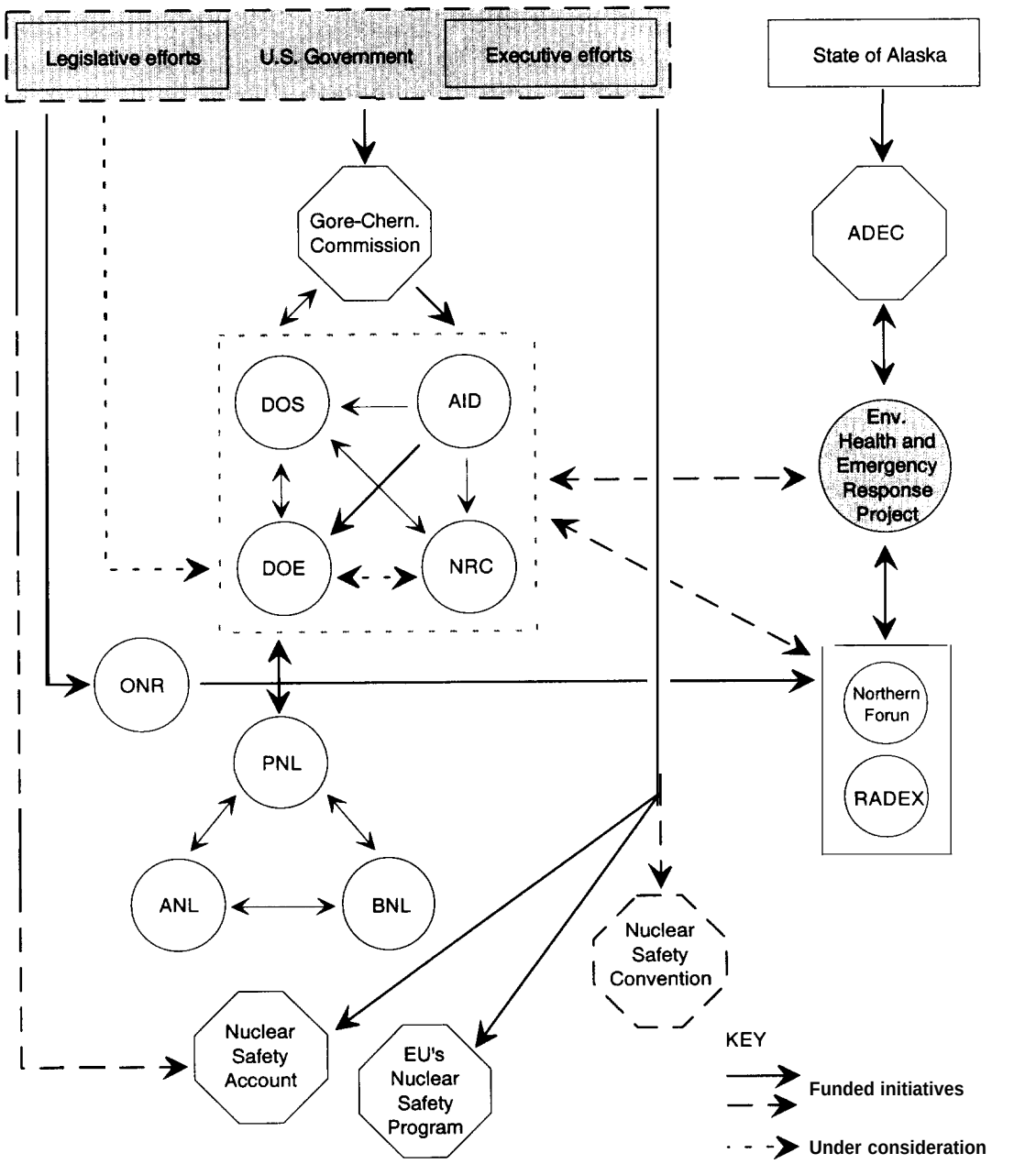
U.S. Bilateral Nuclear Assistance Program

U.S. participation in nuclear safety cooperation with the former Soviet Union (fSU) began in 1986 immediately after the Chernobyl nuclear accident. This cooperation principally involved information exchange efforts by the Nuclear Regulatory Commission and the Department of Energy. Two years after the Chernobyl accident, the U.S. and fSU governments signed a bilateral Memorandum of Cooperation formally supporting these undertakings. Figure 5-5 shows some of the major U.S. efforts underway today to improve nuclear reactor safety in Russia.

Because of the frequent information exchanges conducted under the Memorandum of Cooperation, U.S. government nuclear experts became aware of safety problems at nuclear reactor facilities operating in the former Soviet Union. Some of these problems included one or more of the following: poor or unstable plant design or construction; inadequate operation and maintenance; and limited compliance with regulatory and safety standards such as fire protection.

The U.S. government commitment to cooperate with Russia in the field of nuclear reactor safety was formally announced at the May 1992 Conference on Assistance to the Newly Independent States, held in Lisbon. Known as the Lisbon Initiative, the U.S. announcement consisted of a commitment to provide $25 million in nuclear safety assistance to Russia and other fSU nations. One year later at the Vancouver summit, the U.S. president pledged to expand this assistance by committing an additional $100 million ($80 million in FY 1994 and $10 million in both FY 1995 and in FY 1996) to help Russia with improvements in the operational safety of nuclear power plants, implementation of risk reduction measures, and strengthening of the nuclear regulatory framework (18,116,130). As the implementing body of these U.S. cooperative efforts, the Gore-Chernomyrdin Commission established a Subcommittee on Nuclear Safety. The subcommittee is co-chaired by the heads of the Department of Energy and the Nuclear Regulatory Commission (NRC) for the United States and by the Ministry of Atomic Energy and the nuclear regulatory agency GOSATOMNADZOR for the Russian side (116,122).

FIGURE 5-5: Major U.S.-Supported Initiatives to Improve Nuclear Reactor Safety in Russia



KEY: ADEC: Alaska Department of Environmental Conservation; AID: Agency for International Development; ANL: Argonne National Laboratory; BNL: Brookhaven National Laboratory; DOE: U.S. Department of Energy; DOS: U.S. Department of State; EU: European Union; INSC: International Nuclear Safety Convention; NRC: Nuclear Regulatory Commission; NSA: Nuclear Safety Account: NSP: Nuclear Safety Program; ONR: Office of Naval Research; PNL: Pacific Northwest Laboratory.
SOURCE: Office of Technology Assessment, 1995.

U.S. assistance focuses on improving the safety of nuclear facilities to reduce the risks of another Chernobyl. The United States has committed approximately $205 million for equipment, technical assistance, and training through several bilateral (e.g., Lisbon and Vancouver) and multilateral (e.g., Tokyo and Munich) initiatives (116). Today, the U.S. nuclear assistance program to Russia is multiagency in nature, with AID as the manager; NRC and DOE as executors; and the State Department and the Gore-Chernomyrdin Commission as principal coordinators. The State of Alaska also participates actively in regional and international cooperative nuclear safety and emergency response programs. Box 5-5 describes two of these initiatives

Unlike other agency programs where in-country missions provide the assistance, AID manages the U.S. nuclear safety initiatives from Washington. This departure from agency tradition is attributed largely to the short-term nature of the assistance program and to the U.S. government's coordinating (State Department's Senior Coordinator for Nuclear Safety Assistance) and technical agency (mainly DOE and NRC) missions being located in Washington. The fact that most of the technical expertise required to implement the safety assistance program is found in various U.S. private engineering firms and national laboratories has also contributed to support AID's decision not to manage the assistance program in Russia (174). The following section describes U.S. government programs for implementing the U.S. bilateral nuclear safety initiative.

Department of Energy's nuclear safety program

Cooperative efforts by the Department of Energy to improve operational safety and emergency response at older Soviet-designed reactors began in 1990. DOE activities in nuclear safety are led by its Office of Nuclear Energy and focus primarily on civilian nuclear power plants (140). DOE has also proposed working with Russia on the conversion or replacement of former weapons production plants (104). According to recent congressional testimony by the Secretary of Energy, Hazel O'Leary, DOE's responsibilities under the U.S. nuclear safety initiative include the following:

- Provide the necessary resources for the development of emergency operating procedures by Russian and Ukrainian nuclear plant personnel. The Institute for Nuclear Power Operations and about seven U.S. utilities are the major contributors to this work. Plans to implement the completed procedures are already under way.
- Assist in the establishment of two regional nuclear safety training centers, one in Russia and one in Ukraine. Upon its completion in 1995, the Russian training center is expected to provide operational safety training similar to that employed by U.S. nuclear facilities. (The Ukrainian training center will be completed in 1996.)
- Implement interim risk reduction activities, such as installation of fire detection and emergency equipment and upgrade of confinement systems, at Russia's least safe and oldest nuclear plants to "reduce the safety hazards during their remaining lifetime" (104). Although most conceptual design and feasibility work has been conducted, risk reduction measures await implementation because of difficulties in completing contractor's liability agreements.
- Support the development of a fire safety program that strengthens Russia's capability to detect and mitigate fires at nuclear power plants. U.S. safety equipment is being installed at the Smolensk Nuclear Power Plant; once completed, the fire safety program would then be implemented at other nuclear facilities. Initially, completion of this work was also delayed by the contractor's concern about

Russia's inadequate liability protection[33] (104).

As a means to implement its responsibilities under the U.S. nuclear safety cooperation program, DOE established in 1992 a Nuclear Safety Initiative Office at the Brookhaven National Laboratory (BNL) in New York. This office was to be responsible for administering the various contracts entered into with private firms for the delivery of safety equipment and services to Russian nuclear plants. Although its initial intent was to actively participate in the contracting of technical work, uncertainties about adequate liability protection forced BNL to focus only on projects associated with an "acceptable level of risk" (18). Since transferring its Nuclear Safety Initiative Office work to Pacific Northwest Laboratory on October 1, 1994, BNL functions have been limited to developing accident analysis procedures, improving communications systems, developing an adequate regulatory structure, and training plant personnel in maintenance and operation (38,140).

Today, the technical work supporting DOE's program on international nuclear safety originates at the Pacific Northwest Laboratory (PNL), with both Brookhaven and Argonne National Laboratories as supporting agencies. As part of its management responsibilities, PNL supervises contractors and monitors the quality of the technical work being performed at Russian nuclear facilities. Among the activities supported by this program is training Russian nuclear personnel in the maintenance and operational safety of nuclear power plants. DOE has also supplied fire alarms, hoses, and fire extinguishers to improve the limited fire safety capability at many Russian nuclear power plants. Plans are under way to provide additional safety and training equipment (38,53,174).

Currently, PNL continues to support the contracts entered into by BNL entered with Russian institutions and nuclear power plants in an attempt to reduce unnecessary implementation cost while maintaining a high level of program effectiveness. Because of its efforts to maintain program stability, PNL will continue to: 1) support the Moscow project office established by BNL and staffed by Russians; 2) contract work directly with nuclear power plant personnel to carry out the operational safety measures necessary to reduce risks; and 3) seek engineering support for training and operations from the Russian Research Institute for Nuclear Power Plant Operations (53,81,174).

Since the establishment of the Nuclear Safety Initiative program, DOE has received funds through the Agency for International Development. Of the nearly $205 million earmarked by the U.S. for availability through AID, DOE has obtained $21.9 million (FY 1992), $14 million (FY 1993), $55 million (FY 1994) and $8.5 million for FY 1995. Although in the past DOE received funding through the AID budget, for FY 1996 DOE opted to submit its own request to Congress for nuclear safety assistance projects (116,122).

Nuclear Regulatory Commission's nuclear safety program

The NRC's participation in nuclear safety cooperation projects in the former Soviet Union dates back to 1986 when the "United States tried to ferret out the causes and consequences of the Chernobyl nuclear accident of April 26" of that year (116,130). Two years after the Chernobyl accident and several interchanges with the former Soviet Union, a Memorandum of Cooperation was signed to promote the exchange of information between U.S. and Soviet experts on their nuclear programs—an area previously regarded as secret. Upon signing of the agreement in Washington, D.C., the Joint Coordinating Committee on Civilian Nuclear Reactor Safety (JCCCNRS) was immediately established as the official instrument responsible for implementing the agreement (130).

[33] To overcome this obstacle, the Department of Energy signed a bilateral agreement with the Russians in 1993 to provide liability insurance protection to U.S. contractors in Russia (81).

BOX 5-5: Alaskan Initiatives to Prevent Future Arctic Radioactive Contamination

In addition to its involvement in research and monitoring programs to address the Arctic's radioactive contamination problem, the State of Alaska also participates actively in regional and international cooperative programs designed to improve nuclear safety and emergency response in the region. Two of these efforts, the International Radiological Exercise and the Cooperative Information Exchange with Russia's Bilibino Nuclear Power Plant, are discussed here.

International Radiological Exercise (RADEX)

In late June 1994, the eight nations of the Arctic Environmental Protection Strategy and the regional governments of the Northern Forum, with support from the State of Alaska, convened a four-day International Radiological Exercise (RADEX) to discuss possible cooperative approaches that might be adopted to improve notification and response methods among Arctic nations in the event of a nuclear accident in the Arctic. The exercise, one of the results of an information exchange visit to the Bilibino Nuclear Power Plant the previous year, was attended by representatives from Canada, Denmark, Finland, Norway, Russia, Sweden, the United States, the International Atomic Energy Agency, and various Native groups.

In addition to supporting information exchanges on each country's national nuclear emergency programs, the Northern Forum conference also provided participating countries with an opportunity to test their emergency response procedures. This was accomplished by conducting a "tabletop" radiation drill involving a nuclear accident in the fictitious country of "Arcticland." After the radiation drill, participants discussed the types of improvements that were needed in reference to each of the three phases associated with a serious nuclear accident (threat, release, postrelease). Early results appear to indicate the need to conduct similar drills in the future; to develop Arctic-wide emergency response strategies; to improve information exchange; and to improve current methods for anticipating the movement of radioactive plumes through the Arctic air mass (5,149,150,183). The final results of the drill are expected to provide technical data relevant to the Russian Rapid Assessment Project sponsored by the U.S. Environmental Protection Agency and the State Department.

Of greater significance for future international cooperation was the suggestion by participants to establish a "Regional Arctic Response Plan" as a means of improving the current notification system adopted by Arctic nations for responding to nuclear accidents. This plan would be designed to serve as a framework within which all emergency planning and emergency responses carried out by Arctic nations could be more effectively coordinated, consistent with existing applicable international agreements (5). The Alaskan government is currently supporting the drafting of an Arctic emergency response plan (149).

Cooperative Information Exchange with Russia's Bilibino Nuclear Power Plant

In early August 1993, the Northern Forum, at the request of two of its members—the governors of Alaska and of the Chukotka Peninsula—sponsored a visit by U.S. nuclear experts to the Bilibino Nuclear Power Plant in Chukotka. Visiting experts from the U.S. Nuclear Regulatory Commission and the U.S. Environmental Protection Agency discussed with plant personnel possible areas in which safety improvements may be needed. The Office of Naval Research provided funding for the project.

Although no technical assessment was actually conducted, the visit to the Bilibino Nuclear Power Plant appears to have had various positive results. Among others, it helped to 1) improve communications and cooperation between the Chukotka and the Alaskan governments; 2) set the foundation for developing joint cooperative work to identify funds, equipment, and programs to improve safety at the Bilibino plant; and 3) heighten the interest of other northern governments in participating in similar cooperative efforts (5,149). In June 1994, three representatives from the Bilibino plant and one from the Chukotka regional government participated in the International Radiological Exercise, described above.

SOURCE: Office of Technology Assessment, 1995.

NRC engaged in a number of different cooperative activities under the JCCCNRS. These included 1) technical meetings with Soviet experts for the purpose of exchanging information on the technical, legal, and organizational approaches to nuclear safety employed by both countries; and 2) extended exchange of regulatory personnel and safety research experts to broaden their understanding of their counterparts' regulatory structure and improve available options for solving safety problems. The dissolution of the former Soviet Union forced NRC to modify its then-bilateral nuclear safety cooperation program under the JCCCNRS into two joint committees with Russia and Ukraine, and to share the U.S committee chairmanship with DOE.

NRC implements U.S. nuclear safety initiatives by providing the Russians—and Ukrainians—with analytical equipment or training in key regulatory areas of nuclear plant safety. Attempts by NRC experts primarily involve training Russian nuclear power plant personnel in licensing and plant inspection, emergency response, and safety research. With the exception of a few technical seminars held in Russia, most NRC training activities are conducted in the United States at the agency's facilities or at national laboratories.

The Agency for International Development funds NRC activities under the Nuclear Safety Initiative program. To implement NRC's nuclear regulatory and safety programs in Russia, the U.S. Government, through AID, has earmarked since 1992 the following: $3.1 million in FY 1992; $5 million in FY 1993; $6 million in FY 1994; $1.5 million in FY 1995; and about $10 million, for both DOE and NRC, for FY 1996 (116,122). Though delays in disbursing obligated funds in the past have been reported (151), NRC has recently been highly successful in carrying out its responsibilities under the U.S. Nuclear Safety Initiative program.

International Initiatives to Improve Nuclear Reactor Safety

The first official recognition by the international community that the inadequate safety of Soviet-designed nuclear facilities could result in serious environmental and health problems took place at the July 1992 Munich summit of the Group of Seven (G-7) nations. It led to the creation of a multinational nuclear safety program known as the Nuclear Safety Account for the purpose of financing operational and technical safety improvements in Russia. In addition to the Nuclear Safety Account, this section discusses other initiatives being implemented or proposed by the international community (e.g., the European Union and the International Atomic Energy Agency) to prevent future Chernobyl-type nuclear accidents in Russia.

The Nuclear Safety Account (G-7 Munich Initiative)

At their July 1992 Munich summit, the heads of states of the Group of Seven nations identified the inadequate safety of Soviet-designed nuclear power plants operating in Eastern Europe and the former Soviet Union as a major area for assistance by the international community. To help solve this problem, the G-7 leaders attending the summit approved the creation, in coordination with the Group of Twenty-Four (G-24) nations,[34] of a multinational nuclear safety program. As prepared by G-7's Nuclear Safety Working Group, the assistance program known as the Nuclear Safety Account (NSA) was designed to provide funds for the immediate upgrade of high-risk nuclear reactors,[35] in combination with the preparation of plans for their closure (32,130).

[34] The Group of Twenty-Four consists of the 24 member states of the Organization for Economic Cooperation and Development, including the United States and Japan.

[35] These include 15 RBMKs in the former Soviet Union and the 25 VVER 440/230s known to be in operation throughout the former Soviet Union and Eastern Europe (130).

The objective of the Nuclear Safety Account is to finance, through grants projects, immediate operational safety and technical improvements as opposed to the technical assistance and assessments already financed by other international organizations already financed. The European Bank for Reconstruction and Development (EBRD) functions as the NSA Secretariat, providing technical and supporting services and cooperating with the European Community on NSA's behalf (42,43,44,45).

NSA's assistance is intended to secure an agreement from the recipient nation that unsafe nuclear power plants will eventually be closed. Consequently, the account focuses on implementation of immediate measures to improve the safety and operations of nuclear power plants that are considered essential to the energy needs of Eastern Europe and Russia. For example, immediate assistance may include technical safety upgrades and regulatory improvements. The Nuclear Safety Account may also provide long-term assistance for cases involving the replacement of older nuclear facilities for new alternative energy sources or the upgrade of more recent ones. Assistance for upgrades of more modern plants may be provided without any shutdown prerequisite, as long as such upgrading conforms to safety standards enforced by Western nuclear facilities (116,130).

Of the $785 million programmed in assistance at the Munich meeting, nearly $268 million was destined to assist Russia. According to NSA officials, plans are under way to grant Russia $91 million for the implementation of two nuclear safety projects. A total of three facilities will benefit from this program: the Leningrad, Novovoronezh, and Kola[36] Nuclear Power Plants.[37,38] As an essential element for grant approval, the EBRD is currently discussing with Russian officials the terms of an agreement that would include limitations on the future use of unsafe nuclear reactor facilities (80). Based on recently reported estimates (174), the cost of replacing Russia's older reactors with modern alternative energy sources may approach $20 billion and would take at least a decade to complete.

One of NSA's concerns about its participation in Russia is that this might rapidly consume the agency's funds to carry out work in other fSU nations still operating unsafe nuclear facilities. Because requesting additional funds from donor nations could be difficult and time-consuming, NSA officials might opt to assist countries such as Ukraine instead of Russia. The lower implementation costs of nuclear safety projects in other nations of the former Soviet Union, such as preparing safety plans for shutting down Chernobyl, might appear more favorable to NSA than supporting the considerably more expensive upgrading of Russia's nuclear reactors (45,55).

European Union's nuclear assistance program

For the past two years, the European Union's assistance to Russia in the nuclear field has focused primarily on improving the operational safety of older Soviet-designed reactors in use at the nuclear power plant in the Kola Peninsula. The European Union (EU) established a Program Implementation Unit as the body responsible for overseeing the project and for providing onsite technical assistance and training. At a funding level of $12 million per year, EU assistance has been focused primarily on the purchase of specialized equipment from France and Germany to replace equipment that is obsolete and unsafe. According to a EU official in Brussels, this nuclear safety assistance program might be short-lived, extending for only about two more years (26,128).

[36] The vicinity of this facility to the Arctic and its radioactive contamination potential makes upgrading the operational safety of this plant crucial to those concerned with protecting the Arctic environment.

[37] The Leningrad facility employs aging nuclear reactors similar in design to those associated with the 1986 Chernobyl accident; the Novovoronezh and the Kola plants use reactors similar in design to Western pressurized-water reactors.

[38] Because of the relative proximity of the Leningrad and Kola Nuclear Power Plants to its territory, the Government of Finland has provided financial assistance (nearly $6 million since 1992) to supported safety upgrades at these plants (102).

International Nuclear Safety Convention

As a result of increasing concern by the international community in preventing a Chernobyl-type nuclear accident, in 1991 the International Atomic Energy Agency proposed to establish an international Nuclear Safety Convention (NSC). A technical working group had been established two years earlier to draft the elements of the convention. Following an invitation by the NSC Secretariat, representatives from 54 nations met informally in Vienna in March 1995 to discuss the range of possible options or approaches on how to implement this international reactor safety effort.

The Nuclear Safety Convention requires that within the first six months it enters into force, contracting parties must hold a "preparatory meeting" for the purpose of adopting the convention's procedural and financial guidelines. Parties attending the March meeting discussed the agenda for the preparatory meeting, including draft guidelines, reporting mechanisms, and the possible types of nuclear facilities that will be subject to the convention. A second meeting might be necessary to give member countries the opportunity to be better prepared for the ratification and implementation phases of the convention.

Although about 30 nations have already approved the text of the convention, IAEA officials do not expect to have the number of ratifications needed to implement it until late 1995 or early 1996. Once ratified, the international Nuclear Safety Convention will be responsible for coordination with countries having unsafe nuclear facilities in an attempt to bring them into compliance with existing internationally acceptable safety standards and practices. One of the current concerns among IAEA officials is the limited information on the level of country assistance that would be required to successfully implement the convention (31,49,74,148).

CURRENT RUSSIAN INSTITUTIONAL STRUCTURE

Environmental Protection Law in Russia

The former Soviet Union maintained a multitude of laws and codes that, in principle, provided for environmental protection and for the conservation and rational use of the country's natural resources. These legislative efforts included statutes designed to regulate air quality (1960), land use (1970), mineral resource development (1976), water quality (1972), and protection of forest resources (1977). Despite these laws, the lack of enforcement—due largely to Soviet economic policies and programs—resulted in inadequate environmental protection.

Considerable legal changes began to occur in the fSU by the late 1980s as a result of *perestroika*. The 1988 Law on State Enterprises, for example, allowed enterprises to become profit-making entities for the first time in the country's history. In principle, this law also made enterprises accountable for the adverse environmental implications of their economic development projects. These changes, although radical for the time, proved insufficient, having only a temporary impact on the environmental management system of the fSU.

The first step in creating a national framework for environmental protection was taken with enactment of the State Law on Environmental Protection in 1991 (124). This broad mandate not only contains the basic principles and institutional authorities for environmental protection at the federal and local levels, but introduces unprecedented concepts of environmental protection (e.g., payment for use of natural resources, pollution fees, environmental quality standards, and environmental assessment of major federal projects). The principal Russian Federation agency responsible for administering this law is the Ministry of Environmental Protection and Natural Resources discussed below.

Although the State Law on Environmental Protection represents an important first step, it does not specify the programs and goals required to ensure the development of a more effective environmental regulatory framework in Russia (110). Effective implementation of this law is further precluded by Russia's current inadequacies with regard to its institutional infrastructure for environmental protection, monitoring, and enforcement. These inadequacies, in the view of experts, are rooted primarily in the country's "severe economic and social upheaval" (86), as well as in the bureaucratic legacy inherited from the Soviet era, which did not favor environmental protection (109). Therefore, Russian efforts to enact additional legislation might result in little actual environmental protection unless Russia first overcomes its current socioeconomic problems, makes all government agencies accountable to environmental laws, and strengthens its environmental regulatory agencies.

Another current trend in Russian environmental management practices is decentralization of responsibility from Moscow to the regions. This strategy attempts to make regional governments responsible for, and aggressive in, implementing environmental protection programs. And even though many regions lack the regulatory and policy capacity to implement effective environmental reform, the slow pace with which democratic reform has progressed in many regions of Russia has adversely impacted regional efforts to improve environmental protection. Furthermore, key institutional concepts, such as property rights and a stable judicial system, have yet to be clearly defined or established and serve as additional limiting factors in the successful implementation of Russian environmental policies.

Ministry of Environmental Protection and Natural Resources

The Ministry of Environmental Protection and Natural Resource (MEPNR) is the primary federal agency responsible for promulgating and enforcing environmental regulations and for reviewing the environmental impacts of major development projects. MEPNR also coordinates national and regional activities relating to environmental protection and natural resource management. The agency's enforcement and environmental impact review functions are carried out through its regional offices.[39] These regional offices are also responsible for conducting environmental reviews of projects and for approving or denying operating permits to activities that might harm the environment (111).

In the area of nuclear safety regulations, MEPNR has little or no enforcement authority. Article 50 of the 1991 State Law on Environmental Protection states that all private and government agencies or activities with nuclear programs are obligated to comply with radiation safety regulations and exposure standards governing the production, management, and disposal of radioactive substances and materials. Article 50 also bans the import of radioactive materials into Russia. However, MEPNR has received little government support in enforcing this law. For example, although the law bans the import of radioactive waste, Russia continues to import spent fuel from Eastern Europe and Finland for reprocessing at its Mayak facility. And in January 1995, President Yeltsin signed a decree to continue construction of the RT-2 plant in Zheleznogorsk (Krasnoyarsk-26) in the hopes of further developing Russia's capability for reprocessing foreign spent fuel (47). Some believe that these steps taken by the highest levels of the Russian government are in contradiction to the state environmental protection law and to the mission of MEPNR. Others in the Russian government claim it is not a contradiction because spent fuel is *not* a waste.

Overall, MEPNR's regulatory effectiveness is questioned both by the general public and by circles within the Russian government (23). Several factors contribute to MEPNR's apparent lack of effectiveness including: 1) its relatively short

[39] There are approximately 90 regional offices and several dozen special offices with limited responsibilities (111).

history; 2) the limited financial support provided by the Russian government; 3) the limited reliability of data available to the agency for making environmental protection decisions; and 4) the poorly defined management and organizational responsibilities among agencies.

MEPNR is a relatively new ministry, with its original predecessor *Goskompriroda* established only in 1988 during *perestroika*. Prior to this, the former Soviet Union lacked a centralized body capable of enforcing environmental protection laws and regulations. MEPNR's lack of extensive institutional experience has limited its ability to influence other more established ministries. Since ministerial and bureaucratic interests remain powerful forces in Russian politics, MEPNR is at a distinct disadvantage in terms of influencing the political process. Furthermore, several internal reorganizations that have occurred in MEPNR's short history have also disrupted its overall continuity and effectiveness.

The inadequate financial support provided by the Russian government is considered another major reason for MEPNR's limited success. Despite the number of ecological protection programs established in Russia since the dissolution of the former Soviet Union, little funding has been provided for actual implementation. The possibility of improving MEPNR's budget appears unlikely at present in light of Russia's difficult economic conditions. The agency's budgetary hardship is also of concern because qualified personnel may seek employment in other areas, thereby depleting the pool of competent workers.

The unreliability of environmental data on which to formulate and oversee environmental programs also affects the limited success of MEPNR. Prior to its dissolution, the Soviet Union supported environmental research activities at more than 1,000 institutions under the auspices of 70 different ministries and agencies (108). In addition to making information gathering and dissemination more difficult, the reluctance of most agencies to adopt uniform nationwide approaches has resulted in the production of an extensive collection of environmental data that is generally inconsistent and, more importantly, of suspect quality and reliability. Furthermore, MEPNR has not gained access to all pertinent information since some valuable environmental data are still controlled by ministries related to the military and nuclear spheres.

The last major contributing factor in MEPNR's limited success to date relates to its poorly defined management and organizational responsibilities. There is a great deal of overlap and redundancy in the mission and responsibility of the different Russian organizations involved in environmental protection. MEPNR is responsible for coordinating environmental protection programs among a variety of government agencies, but thus far, interagency coordination has been inadequate. Historically, Soviet institutions were primarily linked vertically to Moscow, and there were few horizontal links between individual institutions, which would have enabled them to better coordinate efforts. This Soviet legacy has yet to be effectively overcome as the institutional arrangements between the various ministries and organizations are being developed and refined. Therefore, intraministerial and organizational conflicts exist today not only concerning jurisdiction but also for an extremely limited pool of federal funding. Furthermore, the devolution of authority from the center to the regions has not necessarily streamlined MEPNR's activities due in part to the fluid and often idiosyncratic dynamics involved in center-periphery politics.

Ministry of Atomic Power

The Ministry for Atomic Power (MINATOM) is a key player in Russia's nuclear activities relating to operation of nuclear reactors and sources of Arctic radioactive contamination. The mission of MINATOM involves a variety of functions. The most relevant are to: 1) oversee the functioning of enterprises and organizations within the nuclear complex; 2) conduct national scientific-technical investigations; 3) coordinate programs in the areas of nuclear arms and radioactive waste management; and 4) ensure nuclear and radiation safety at its nuclear facilities (23).

MINATOM is a large government agency with functions somewhat analogous to both the commercial nuclear industry and the Department of Energy of the United States (e.g., nuclear energy research and production, high energy physics, lasers, and other civilian programs).

MINATOM was established in its present form by presidential decree in January 1992. It succeeded the former Ministry of Atomic Power and Industry (MAPI), which was responsible for all aspects of the nuclear industry, from uranium mining and processing to research, development and the design and manufacture of nuclear bombs, warheads, and other devices (28). MAPI, in turn, had been formed in mid-1989 by merging the Ministry for Medium Machine Building,[40] previously responsible for nuclear weapons, with the Ministry for Nuclear Power, which regulated the country's civilian nuclear power plants. As a result, MINATOM now has management and oversight responsibilities for activities at civilian nuclear power plants as well as the Russian military nuclear complex.

In addition to its military[41] and civilian[42] operational departments, MINATOM also contains a number of highly specialized research institutes and production associations. The Khlopin Radium Institute in St. Petersburg and the Research Institute of Inorganic Materials (VNIINM) in Moscow are among the best known. There are also nearly 20 "quasi-private companies" affiliated with MINATOM. Examples of these include *Rosenergoatom*, which is responsible for the design, reconstruction, and operation of nuclear power stations, and *Atomstroy*, the Russian group responsible for building nuclear power stations (125).

Overall, MINATOM is an extremely large and powerful ministry. MINATOM garners support not only in Moscow but in many of the regions where it maintains operations. Entire towns and cities such as Chelyabinsk-65 and Arzamas-16 are basically dedicated to serving the nuclear-military complex and the interests of MINATOM. Furthermore, in July 1995, Viktor Mikhailov, Minister of MINATOM, was appointed to the Russian Federation Security Council, thereby increasing his role in national politics. It is still unclear how this translates in terms of MINATOM's future, but the past several years have shown that Russian politics is increasingly shaped by the individual tendencies of its leaders, which suggests that Mikhailov's appointment may have strengthened MINATOM's position relative to other ministries and organizations.

State Committee for Oversight of Nuclear and Radiation Safety

The Russian State Committee for Oversight of Nuclear and Radiation Safety (GOSATOMNADZOR or GAN) was organized in its present form at the end of 1991 by presidential decree.[43] GAN reports directly to the President and operates independently of the Russian Council of Ministers. GAN's responsibilities include: 1) establishing criteria and promulgating regulations for nuclear radiation safety; 2) overseeing and licensing all nuclear activities performed by government, nongovernment, and private institutions in Russia; 3) organizing and overseeing the training of workers at nuclear facilities; and 4) reporting to the government and general public about safety practices at nuclear facilities (106).

[40] The Ministry for Medium Machine Building (MMB) was the highly secretive ministry that controlled the nuclear-military complex in the Soviet Union. MMB operated a network of secret cities across the country that was, until recently, unknown to foreigners as well as citizens of the Soviet Union. MMB was thought to be a primary claimant of economic resources and exercised a good deal of autonomy within the rigid political structure of the Soviet Union.

[41] The military branch contains primarily the Departments of Fuel Cycle and Nuclear Weapons Production; Security; International Relations; and Design and Testing of Nuclear Weapons.

[42] The civilian branch is composed, among others, of the Departments of Radioactive Waste; Nuclear Power Plants; Operation/Maintenance/Safety; and Construction and Development.

[43] President Yeltsin issued decree No. 249 of the RSFSR "On the reorganization of the state committee on oversight of nuclear and radiation in safety of the RSFSR" on December 3, 1991. GAN's institutional predecessor, Gospromatomnadzor, was by and large an ineffective regulatory agency whose authority extended only to civilian industries, not to the military or to enterprises of the military-industrial complex.

GAN's responsibilities vary between the national and regional levels. GAN headquarters is responsible for the organization and implementation of national policy on nuclear and radiation safety (19). Its regional offices are entrusted with the actual monitoring and oversight of nuclear installations and facilities. The regional offices are intended to ensure that the planning, construction, operation, and decommissioning of installations and facilities do not violate established norms and to oversee safety requirements for the treatment, storage, and disposition of radioactive wastes and radioactive materials, as well as the management of licensing activities as established by its headquarters.

Although GAN has the legal authority to regulate and inspect all types of nuclear activities, it has not gained full and complete access to certain military-nuclear sites (31,138,148). The agency's authority originates principally from a number of presidential decrees and executive orders. A decree introduced into law on January 18, 1993, for example, gives GAN the authority to license and inspect military nuclear operations (113). A presidential directive enacted in December 1993 calls for GAN to oversee safety practices at MINATOM's nuclear fuel cycle enterprises (114). After the accident at Tomsk-7 in April 1993, the Russian President issued presidential directive 224 granting GAN the authority to inspect all nuclear installations regardless of affiliation. Despite these directives, GAN's access to nuclear facilities managed by MINATOM and the Ministry of Defense is reported to be limited (138).

Overall, GAN's activities to date have focused primarily on establishing a set of rules and regulations for ensuring operational safety at nuclear facilities. The actual implementation of inspection and monitoring by its regional offices has been unsuccessful in some cases because the Ministry of Atomic Energy and the Ministry of Defense continue to limit GAN's access to certain nuclear facilities.

Other Ministries and Organizations

Several other institutional structures in Russia are involved in the regulation of nuclear power. The Department of Radiation Safety of the Russian Navy is chiefly responsible for regulating the use of nuclear reactors within the Russian Navy. During the Soviet period, the Navy was essentially self-regulatory in its nuclear activities, with its Department of Radiation Safety carrying out regulatory functions. Presently, it appears that the Russian Navy prefers to maintain its self-regulatory nature as evidenced by its continual refusal to allow GAN access to some of its nuclear facilities.

Two other Russian institutions that play a role in the development of rules and regulations for nuclear-related matters are the Ministry of Health and the State Committee for Hydro-Meteorology (Rosgidromet). These two organizations do not regulate nuclear activities directly, but they do maintain some independent responsibilities in terms of the drafting of regulations that relate to the nuclear industry.

Proposed Radioactive Waste Management Legislation

Russia today lacks a comprehensive set of laws needed to effectively regulate the use of nuclear materials and manage radioactive waste. Currently, three pieces of legislation (On the State Policy of Radioactive Waste Management, On the Use of Nuclear Energy, and On the Population's Radiation Safety) are being drafted in the Russian State Duma (Parliament) that would, in principle, help regulate the use of nuclear energy and waste.

If enacted, these legislative proposals would provide a legal framework under which all Russian nuclear energy users, including MINATOM, the Ministry of Defense, and numerous nuclear research institutes, would be accountable. Passage of these laws, however, faces considerable opposition. The draft law On the State Policy of Radioactive Waste Management, for example, is a potentially important piece of legislation because it attempts to build the environmental

legislative framework first laid out by the 1991 Law on Environmental Protection. According to its stated objectives, the proposed legislation seeks to: 1) define the concept of radioactive waste; 2) establish national and international policy and agency responsibilities regarding radioactive waste management and treatment; and 3) develop liability guidelines to compensate for risk and damage to health and property from radioactive contamination. In addition to establishing that radioactive waste is "exclusively federal property," proponents of the legislation call for creation of an independent federal agency to manage all radioactive wastes. However, this piece of legislation has failed repeatedly in hearings before the State Duma and most recently in the Federation Council in June 1995.[44] Legislators have cited as weaknesses of the bill its incompleteness in the technological policies for handling radioactive waste and the lack of specified funding sources to finance envisioned programs (46).

In its present form, the draft law prohibits the disposal of any radioactive material or waste, including contaminated equipment, in soils, rivers, and oceans. In the past, MINATOM used Lake Karachai and the Techa River as dumping sites for radioactive waste. If passed, the proposed legislation would also place regulatory controls on, and possibly eliminate, MINATOM's spent fuel reprocessing activities. Another objective considered adverse to MINATOM's plans is the proposed creation of a independent Russian agency for management of radioactive waste. If created, this new agency could end MINATOM's decades-long self-regulation in this area. Currently, in the absence of comprehensive nuclear legislation, MINATOM exercises coordinating and executive authority for radioactive waste handling.[45] However, even if the law is passed, there are no guarantees that its implementation and enforcement would be successful.

Summary of Russia's Institutional Efforts and Programs

The overall institutional framework guiding the use of nuclear power and nuclear and radiation safety is complex and involves elements from the Soviet past as well as emerging trends in Russia today. Since the disintegration of the Soviet Union, Russia finds itself in the midst of a difficult transition having neither fully shed itself of its Soviet legacy nor fully transformed itself into a market-based economy.

In the past, the use of nuclear power, especially in the military sector, was shrouded in secrecy. Secret cities, which designed and manufactured nuclear weapons, were dotted across the Soviet Union unknown to the outside world. These facilities (enterprises and installations affiliated with the Ministry of Medium Machine Building, which was responsible for the design and production of nuclear weapons) received priority funding within the Soviet command economy. Production targets served as the primary goal, and environmental concerns were given little to no attention throughout most of the Soviet period. Not until *perestroika* in the late 1980s, and public opinion's increased role in national politics, did environmental issues finally make their way onto the Russian government's agenda. Since then, both the public and the government have increasingly recognized the need to support environmental protection efforts.

Since the disintegration of the Soviet Union, the Russian government has made official its intent to improve environmental protection and nuclear safety on a number of occasions. In 1991, Russia adopted the Law of the Environment establishing, for the first time, a comprehensive framework for environmental management (124). In 1993, Article 42 of the

[44] A Russian draft law must pass both hearings in the State Duma and a hearing in the Federation Council before it is signed into law by the President.

[45] A situation that appears to be legitimized further by the Council of Ministers' decree "On the Primary Measures in the Field of Handling Radioactive Wastes and Spent Nuclear Materials" of August 1993.

newly adopted Russian Constitution stipulated that every citizen in Russia has the right to a favorable environment, reliable information about its state, and compensation in case of body and property losses inflicted by environmental polluting activities (27). And in 1991, GAN was created by President Yeltsin to oversee the control of nuclear safety and radioactive waste management. GAN is an independent executive agency empowered with the authority to inspect every nuclear facility in Russia, including military sites.

However, the management of radioactive waste and spent nuclear materials is a complex problem requiring many ministries and agencies.[46] Despite the Russian government's approval of decrees to ensure interagency coordination, MINATOM and the Russian military continue to make key decisions concerning radioactive waste management without coordinating with regulatory agencies such as GAN. As a result, the implementation of approaches to solving radioactive waste contamination problems in the Arctic region continues to be determined by the military and MINATOM with little regulatory oversight. Although considerable progress has been made in the environmental regulatory sector, many aspects of the old system have yet to be fully dismantled and replaced by more effective approaches.

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