Chapter 6

Nuclear Safety Initiatives

6.1. Introduction

This chapter considers nuclear safety initiatives relating to the eight Arctic countries. However, as many of the practices that impact upon or present a hazard to the Arctic environment are sited in northwest Russia, the emphasis of this chapter is on that region. Safety initiatives mostly relate to safety assessments of nuclear installations, particularly nuclear power plants (NPPs); other initiatives address regulatory improvements, arrangements for physical protection, and nuclear safeguards.

Production of weapons-grade nuclear materials, operation of NPPs, nuclear fuel cycle facilities, nuclear-powered ships, and other activities involving the use of nuclear energy and radioactive materials in the territory of the Russian Federation have resulted in the accumulation of significant amounts of radioactive waste and spent nuclear fuel in Arctic Russia. Their management presents a major challenge.

Nuclear safety support programs are designed to contribute to the prevention of serious nuclear accidents at nuclear facilities. Their purpose is to provide assistance to the operators of nuclear facilities and the national safety bodies that regulate these facilities. Other international programs address risks associated with nuclear waste, illicit trafficking, and terrorism involving nuclear materials. While terrorism has always been of concern to bodies such as the International Atomic Energy Agency (IAEA), interest in the wider community has been renewed following the 11 September 2001 attacks (Lubenau and Strom, 2002). The initiatives are not specific to the Arctic; however, the break-up of the former Soviet Union has meant that administrative controls and competence require strengthening to prevent terrorists obtaining nuclear material (Webb, 2002).

6.2. The purpose of risk management

Risk management is a process designed to assess, prioritize, and control risks with the specific goal of reducing risks in a manner that optimizes the use of resources and achieves the greatest reductions in risk for a given resource investment. A major fundamental underlying risk management is to ensure that planned activities, including monitoring and assessment, are formulated within the context of comparative risk. Thus, resource investments are justified on the basis of their relevance to the predominant risks or to improving the characterization of risks. The characterization of absolute and relative risks should consider both the risks posed by exposures from the planned operation of existing sources and practices and the hazards associated with proposed future sources and practices.

Owing to the stochastic nature of effects associated with low-level exposures, risk management within the context of radiological protection must deal with a number of categories of risk. The basis for radiological protection in low dose regimes is the assumption that the *risk* of effects on humans is proportional to radiation dose without the assumption of any threshold. While there is ongoing debate on the validity of this assumption (Koblinger, 2000) and on the approaches to its practical application in situations of very low level exposure (Clarke, 1999), this is the primary type of risk addressed and is of immediate relevance to existing exposures to radiation from anthropogenic sources and activities, i.e., *practices* in International Commission on Radiological Protection (ICRP) terminology (ICRP, 1991). The principles of radiological protection require that sources and practices are optimized to reduce doses to the extent achievable under the prevailing technical, social, and economic climate. Thus, optimization addresses the reduction of risks associated with operational and accidental exposures. Risk management involves the assessment of potential consequences of events at nuclear facilities that could result in additional exposure to radiation and the probability that any such event occurs. Here, the emphasis is on potential risks of exposure associated with exceptional events such as accidents at existing nuclear facilities within, or near, the Arctic.

While the risk management approach outlined in Section 6.3 concerns radioactivity from nuclear operations and activities, this approach can be used for all types of contaminants.

6.3. The approach to risk management

The first AMAP assessment identified known sources of radioactivity in the Arctic. These range from atmospheric fallout from nuclear weapons tests, past and present nuclear power reactor operations, nuclear-powered vessels, spent nuclear fuel management, and the Chernobyl accident. The presence of radionuclides in the Arctic from some of these sources will diminish with time. Nevertheless, spent nuclear fuel management and potential nuclear accidents present risks of additional exposure to Arctic populations and the environment.

In its most basic form, the risk management process consists of a sequence of steps. Namely:

- identification of hazards (in this case, current or proposed sources and practices);
- initial assessment of the risks presented by these hazards;
- identification and analysis of options for risk reduction through the imposition of preventive measures to abate risks;
- design and application of preparedness and response measures to reduce the consequences to society; and
- refinement of the selection of associated performance evaluation measures and the corresponding risk assessment.

Initial estimates of risk can be based on simple assumptions and relatively simple analyses. These warrant further refinement through more detailed assessments if the scoping approach ranks a given risk as a major one among the various risks considered in relation to existing and potential sources and practices. Thus, substantial risks (from the various sources and practices) may require improved assessments, especially if the outstanding uncertainties are large or the scoping assessment suggests that a specific source or practice exceeds risk targets and/or regulatory protection objectives. More importantly, they may warrant intervention, or direct action, to reduce risks (either the probability of accidents or the magnitude of consequences), or other measures, such as monitoring, to provide early warning or detection of unplanned releases.

Estimation of overall risk is a convenient way of identifying those sources and activities deserving priority consideration from the perspective of risk reduction. However, risk reduction measures can never obviate the entire risk associated with a given source or practice. Commonly available options merely reduce the risk rather than removing it entirely. Accordingly, a more appropriate measure of the benefit of risk reduction measures is not the overall risk but the proportion of risk that is potentially averted by the action (i.e., the averted risk). It follows that, in setting priorities among risk reduction options, it is necessary to consider the degree to which they avert or reduce risk.

Environmental impact assessment (EIA) is also an important tool for evaluating the options for reducing risk. EIAs of the 'no action' scenario as well as options for risk reduction should be conducted prior to any decision to implement risk reduction measures. This provides a means of determining that there is an overall net benefit associated with any measure adopted and also of determining that the measure, when implemented, has the desired consequences by helping to identify and select measures of performance. EIA within the context of nuclear facilities in Norway and Russia is discussed by JNREG (2001).

6.3.1. Risk analysis

The risk management process represents an analysis of the probability and consequences of events associated with sources and practices. The elements of a risk analysis are:

- defining the facility and operation;
- identifying the hazards and determining the associated levels of risk (screening);
- characterizing the hazards that present the greatest risks;
- postulating and analyzing possible event scenarios; and
- estimating the consequences of the postulated scenarios.

A risk analysis leads to a plan for the development of risk management programs that are commensurate with each specific activity. The results of the risk analysis process are used to consider and analyze options for prevention, preparedness, and response strategies to minimize the consequences of releases of radionuclides.

6.3.2. Identification of hazards

The potential sources of radionuclides in the Arctic were identified in the first AMAP assessment. The following hazard prioritization is a ranking based on the magnitude of the potential consequences that could ensue from accidents at nuclear facilities. Namely, accidents resulting from the operation of:

- NPPs in the Arctic;
- NPPs within 1000 km of the Arctic;
- nuclear-powered vessels in the Arctic; and
- interim storage of spent nuclear fuel including improperly stored fuel elements and decommissioned vessels containing spent fuel.

For context, it should be noted that global fallout from atmospheric nuclear weapons tests, fallout from the Chernobyl accident, and previous underground nuclear device detonations continue to pose minor risks to man, plants, and animals in the Arctic through continuing exposure to radiation but that these risks are diminishing. Risks related to storage and handling of nuclear weapons have not been assessed, as no information on these issues has been made available.

Measurable, but in practice insignificant, releases of radionuclides to the environment occur during normal operation of NPPs, nuclear-fuel reprocessing plants, and nuclear-powered vessels.

6.3.3. Need for closer links between risk assessment and risk reduction activities

Risk management can only be effective when risk reduction measures are based on risk assessments. Prevention, preparedness, emergency response, and contingency strategies and plans, when based on a well-developed and well-considered risk management program, provide a basis for the optimization of risk reduction measures and options for intervention, if these are deemed necessary. Furthermore, risk management ensures that the consequences of contemplated actions are fully assessed and validated independently and against other impact assessments to provide the most appropriate measures of benefit and options for averting risk (see Figure 6·1). Communication and interaction between existing risk and impact assessment programs and programs leading

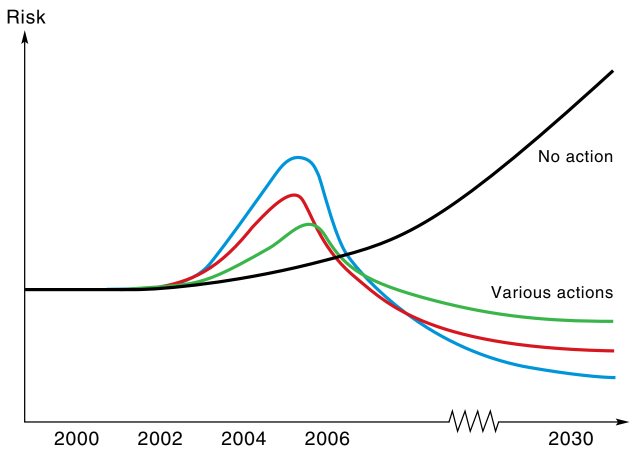

Figure 6·1. Potential risks and benefits connected with risk reduction actions.

to the formulation of actions and/or interventions to prevent accidental releases and/or to minimize their consequences is essential for decision makers in scoping and implementing risk reduction measures. This is vital to ensuring that risk reduction actions and/or interventions provide overall net benefits in terms of protection of the health and safety of workers, the public and the environment.

6.4. Nuclear power plants

Although challenges remain, especially related to the age and basic construction principles of some of the reactors, considerable progress has been made since the first AMAP assessment was completed in 1997 in improving safety assessments and introducing additional safety measures for nuclear power reactors, especially those in Russia and other eastern countries such as Lithuania (Ignalina NPP). This progress is, in large part, due to cooperation between the Russian Federation and the other Arctic countries (particularly Finland, Sweden, and the United States). This section reports progress in safety assessments and additional safety measures for NPP operations relevant to the Arctic; with links made to section 7.2 dealing with accident scenarios at land-based NPPs.

Tables 6.1 and 6.2 present an overview of the training and equipment improvements that have been made at the Bilibino, Kola, and Leningrad NPPs since the first AMAP assessment.

6.4.1. Bilibino

Bilibino NPP is located in the Chukotka region of Russia, and consists of four small (12 MW) light-water cooled, graphite-moderated reactors. Efforts at Bilibino have focused on improving the safety of day-to-day operations. This has been achieved through specific training events such as a workshop for plant engineers on the unique aspects of corrosion in cold weather environments; a training course on testing and repairing circuit boards; training on the use of ultrasonic, x-ray, and eddy-current equipment; training on the software packages SCALE and MCNP/Visual Editor (the former being a suite of criticality, neutronics, and heat-transfer codes used by the nuclear industry to support licensing submittals and the latter involving codes for criticality and shielding calculations); and provision of safety maintenance equipment, including thermography, vibration analysis, and alignment equipment.

6.4.2. Kola

The Kola NPP, in Murmansk, consists of four VVER-440 pressurized water reactors that produce 411 MW(e) each. Efforts at the Kola plant are directed primarily toward improving the safety of day-to-day operations in addition to upgrading critical plant safety systems. Projects focus on developing emergency operating instructions, upgrading the confinement system and improving other engineered safety systems. Projects are also in place to perform safety assessments, transfer capabilities for performing plant safety analyses, and provide a full-scope simulator to enhance staff training. There have also been a number of engineering upgrades specific to the plant, their purpose being to limit the spread of radioactive material in the event of an accident in Unit 2, to reduce leaks in the Unit 2 confinement system, and the installation of post-accident confinement radiation monitors. Plant safety evaluations were also carried out for internal events as well as probabilistic risk assessments and design basis accident analysis (NRPA, 2002). Safety improvements are planned until 2005.

Table 6·1. Training improvements.

	Bilibino	Kola	Leningrad
Completion of operator exchanges to train plant personnel to develop improved operating safety procedures and practices.	×	×	×
Plant instructors now trained in the ‘systematic approach to training methodology’ and in instructor skills.	×	×	×
A full set of emergency operating instructions that promote safety through improved accident mitigation strategies now available.		×	×
Transfer of the systematic approach to training methodology and training material developed at the Balakovo Training center to the NPPs.	×	×	×

Table 6·2. Equipment improvements.

	Bilibino	Kola	Leningrad
Analytical simulator.	×	×	
Inmarsat satellite phones.	×		
Safety maintenance equipment.	×		
Non-destructive examination equipment for evaluating pipes.	×	×	
Basic equipment such as computers, video and overhead projector facilities.	×		×
Valve-seat resurfacing equipment, a pipe lathe/welding preparation machine, and a vibration monitoring and shaft alignment system for improving safety maintenance activities			×

6.4.3. Leningrad

The Leningrad NPP is located just outside St. Petersburg and consists of four RBMK-1000 reactors of 925 MW output. At the Leningrad NPP, the focus is on improving the safety of day-to-day operations and upgrading critical plant safety systems. Specific projects include developing emergency operating instructions, providing modern safety maintenance tools and techniques, and performing in-depth safety assessments. In addition, projects are underway to provide fire detection and alarm systems in Units 1 and 2 (NRPA, 2002). Plant safety evaluations have been carried out to support the probabilistic safety assessment and full-scope in-depth safety assessment with a view to meeting Russian regulatory requirements.

6.5. Regulatory cooperation

Responsibility for nuclear safety in the Russian Federation is with the Russian regulators and operators. However, support from other Arctic countries is welcome to ensure application of best international practice and the continuous development of safety culture, as well as to satisfy international obligations, such as those resulting from the London Convention 1972 (Smith and Amundsen, 2002). Norway, Sweden, Finland, and the United States are the main contributors to regulatory improvement projects initiated by Russia.

Each of these countries has framework agreements with the Russian Federation concerning the development of protocols for regulatory and industrial projects. These help to reduce the time taken for projects to gain approval. The Joint Russian–Norwegian Working Group on Environmental Impact Assessment, the Murmansk Initiative trilateral agreement between Russia, the United States, and Norway, and the Collaboration Agreement between the Norwegian Radiation Protection Authority and Gosatomnadzor, have all been particularly prolific. Such regulatory cooperation encourages interaction between different regulatory bodies, and between the regulatory bodies and the operators; both Russian and western European (Sneve *et al.*, 2001).

A major step forward occurred with the adoption of the program 'Nuclear and Radiation Safety of Russia' for the period 2000 to 2006 (Government of the Russian Federation, 2000). This was commissioned and is coordinated by the Ministry of Atomic Energy of the Russian Federation.

The program aims at ensuring nuclear and radiation safety in an integrated manner. The primary objectives of the program include:

- dealing with the management of radioactive waste and spent nuclear material in an integrated manner;
- ensuring nuclear and radiation safety of nuclear fuel cycle facilities;
- ensuring safety in the operation and decommissioning of NPPs;
- ensuring nuclear and radiation safety during the construction, repair, and dismantling of nuclear-powered naval vessels, as well as nuclear-powered vessels and ships of the nuclear technical servicing infrastructure of the Ministry of Transport of the Russian Federation; and
- improving state radiation monitoring in the territory of the Russian Federation.

The program comprises 20 sub-programs, and includes protection of the public and the environment from the consequences of potential radiation accidents. The program will be implemented through the following activities:

- development and application of state-of-the-art technology for the safe handling of radioactive waste and spent nuclear fuel, their storage, and disposal;
- development and adoption of nuclear, radiation, explosion, and fire safety technology;
- preparation of design documentation and procedures to ensure nuclear and radiation safety during the dismantling of reactor compartments of submarines and ships, as well as in the handling of spent nuclear fuel and radioactive wastes at ship-building facilities; and
- design and establishment of a state-of-the-art and automated national system for radiation monitoring.

Social and economic benefits from the implementation of this program will arise from the improved radiation and environmental situation in and around nuclear facilities, minimization of direct and indirect economic losses caused by severe radiation accidents, and the prevention and minimization of economic losses from environmental and human exposures to radiation by taking prompt action to contain and mitigate contamination and its consequence.

6.6. Emergency preparedness

A national Emergency Response Center has been developed in St. Petersburg in addition to the Situation and Crisis Center at the headquarters of Minatom (the Ministry of Atomic Energy of the Russian Federation). All Russian NPPs, with the exception of Bilibino NPP, have direct emergency communication links to these crisis centers (see section 6.8).

NRPA has reported on the emergency response procedures in place in the Nordic and Baltic countries (NRPA, 1996). An updated report is currently in preparation. Several of the Arctic countries have well-developed regulations and emergency preparedness procedures that can be implemented should an accident or incident occur. These include methods to disseminate information, monitoring systems, and training exercises.

6.7. Waste management and risk reduction measures

There are a large number of risk reduction measures currently in place, or due to be implemented, in relation to sources of radioactive material in the Arctic. They have all been justified or supported, to a greater or lesser degree, by the type of risk analyses referred to in Section 6.3.

As a consequence of monitoring and assessments on the state of the environment in northwest Russia in 1995, five major projects relating to the prevention of radioactive contamination and a number of actions to address existing problems have been identified (NEFCO, 1996).

Since 1996, several sub-projects have resulted in significant risk reductions to the population and the environment. Some have been undertaken through the Nordic Environment Finance Corporation, while others have been addressed and funded by other international bodies and collaborations. The Contact Expert Group, set up under sponsorship by the IAEA, has facilitated international collaboration (CEG, 2002). The remainder of section 6.7 details some of the major projects that involve facilities other than NPPs.

6.7.1. Rehabilitation of the Murmansk RADON center

The Russian RADON interim storage for low and intermediate level radioactive waste located in the Murmansk area ceased operation in 1993 because it did not meet Russian quality requirements. Decommissioning of this facility with European Union assistance is now being considered. Recently, a proposal for a regional interim storage facility sited at the NERPA dockyard with the capacity to store all conditioned low and intermediate level waste from the Murmansk region, including that from the RADON facility, has been completed.

6.7.2. Submarine spent fuel management in northwest Russia

Under a bilateral assistance program to help tackle nuclear related clean-up in northwest Russia announced by the United Kingdom in February 1999, assistance is being provided for the management and interim storage on land of spent nuclear fuel from decommissioned nuclear submarines. This involves the creation of an interim storage facility for spent nuclear fuel comprising a storage pad for up to 50 casks and a number of certified Russian 40 t dual-purpose casks at either NERPA or Polyarnyi, two Russian shipyards.

6.7.3. Improved reprocessing facilities at Mayak

All reprocessable naval spent fuel should be sent to the Mayak reprocessing facility. However, current storage facilities are full and the lack of interim facilities has created a bottleneck in the decommissioning program. The European Commission, France, Norway, Sweden, Russia, and the United Kingdom collaborated in a study to investigate three possible interim storage options. The chosen option was a new dry store and additional interim storage for the spent nuclear fuel casks on-site. The project is due to be funded solely by the United States as part of the Co-operative Threat Reduction program. Other projects relating to improvements at Mayak are being funded by European countries and the European Commission.

6.7.4. Treatment of liquid radioactive waste

This project involves the construction and deployment of mobile processing facilities to decontaminate and reduce the volume of liquid radioactive wastes. The intention is to site treatment plants at Severodvinsk and in Snezhnogorsk (NERPA). These plants are based on a cementation process and are intended to be mobile and transportable by sea. Particular emphasis is placed on the processing of liquid wastes from the decommissioning of nuclear-powered submarines.

6.7.5. Atomflot

There are three consortium projects with Atomflot and the Russian Northern Fleet for the treatment of liquid radioactive waste with permanently-sited and moveable equipment. Trilateral collaboration between Norway, the United States, and Russia has been particularly successful in the expansion and upgrading of facilities at Atomflot. A notable success is the inclusion of quality assurance procedures in Russian methods and the use of environmentally friendly technology during implementation. The start of operation of the purification plant, however, has been seriously delayed, and in 2003 it was still not operational.

In addition, the Finnish NURES system for purifying liquid radioactive wastes has been successfully used at Atomflot. It has been proposed for use in a Norwegian–U.S.–Russian project to deal with military wastes in Murmansk although progress has been delayed by access restrictions.

6.7.6. Repository at Novaya Zemlya

A Russian-lead project developed designs for a low to medium level waste repository in the permafrost of Novaya Zemlya. The technical designs were peer reviewed by several international organizations, under the coordination of the European Commission. There was widespread support for the facility although more detailed safety assessments were required. Early in 2002, Russian designs for the repository were approved by the Ecological Expert Commission and are currently awaiting approval from the State Committee for Environmental Protection (Goscomecology). Following approval, detailed design and construction plans can be made. Large-scale international finance is required to implement the project as the estimated cost of such a facility is US$ 70 to 90 million.

6.7.7. Andreyeva Bay

At Andreyeva Bay there are 21000 spent fuel elements from the Northern Fleet's decommissioned submarines stored in three concrete tanks. These tanks are in very poor condition and the spent fuel elements need to be recovered. In 2001, a Norwegian–Russian bilateral agreement resulted in the initiation of several projects. Engineering infrastructure improvements and feasibility studies have been established and the main tasks planned involve the stabilization of current spent nuclear fuel storage units, treatment or removal of liquid radioactive waste, conditioning of solid wastes and their removal to a regional store, and decontamination and final remediation of the site.

6.7.8. The *Lepse*

The *Lepse* is a decommissioned service vessel of the Russian icebreaker fleet that is docked in Murmansk and used as a storage facility for spent nuclear fuel and other radioactive wastes. The ship is in a very poor state of repair and there has long been a desire to offload and transfer the radioactive wastes and damaged spent fuel to land-based storage.

Since the first AMAP assessment, there has been little progress in the work to decommission the *Lepse*. However, the Murmansk 80 t Cask Project, which will provide transport and interim storage for spent nuclear fuel from Russian nuclear submarines and icebreakers currently stored on barges and service vessels, and in a low-level radioactive waste treatment facility in Murmansk, is addressing the transfer to storage of the spent fuel that is not suitable for processing owing to its damaged state. A cooperative venture between Norway, Sweden, and Gosatomnadzor (Russia's State Committee for Supervision of the Safety of Work in Nuclear Power Engineering) is tasked with identifying means of dealing with the wastes stored on the *Lepse*.

The results of Phase 1 of the Lepse Regulatory Project were published in April 2001 (Sneve *et al.*, 2001). The main results were a set of three regulatory guidance documents and increased mutual understanding of the differences in the regulatory systems and processes for licensing nuclear activities in the Russian Federation compared to other western countries, notably Sweden, Norway, and the United Kingdom. The guidance documents provide specifications for:

- documentation to substantiate nuclear and radiation safety assurance measures for submission by operators when applying for a license from Gosatomnadzor to implement the *Lepse* Project, as described by the NRPA (2001);
- the quality assurance program for unloading spent fuel assemblies from the *Lepse*; and
- the safety analysis report required to support a license application for unloading spent fuel assemblies from the *Lepse*.

This regulatory guidance is intended to help focus on safe implementation. In addition, considerable emphasis is being given to EIAs and their role in determining the suitability of specific mechanisms for unloading spent fuel from the *Lepse*. Phase 2 of the Lepse Regulatory Project will comprise the review of license application documents submitted to the appropriate Russian authorities, primarily the Gosatomnadzor.

6.7.9. Environmental impact assessments of other hazardous Russian facilities

A working group under the Joint Norwegian–Russian Expert Group for the Investigation of Radioactive Contamination of Northern Areas compared EIA systems in Russia with those in Norway and other western countries (JNREG, 2001) and concluded that the principles and methods used in Norway and Russia are broadly similar. They are based on the common principles of prevention, openness, and obligation to conduct EIAs for all projects likely to significantly influence the environment. Concerns have been expressed however about the degree to which transboundary impacts are considered under Russian procedures and the lack of attention to the effects of ionizing radiation on fauna and flora.

The working group also noted that, in the planning phase of projects having potential radiation hazards, close contact between the developer and the government bodies responsible for health protection, environmental protection, and nuclear safety is essential. It is important that those undertaking EIAs are well informed about the information required and the system for approving planning activities. This ensures the overall aims of EIAs are met; namely selection of the optimum location, appropriate technology, and methods for the protection of human health and the environment.

6.8. Alarm, notification, and radiation measurement systems in northwest Russia

Radiation monitoring in the Arctic is of great importance because Russia is the largest country in the region and operates many relevant sources and practices. A major area of work for AMAP involves risk and impact assessment, including monitoring systems. Much of this occurs within the context of a general Barents region environmental and human health monitoring system. There are also plans for a risk and impact assessment for workers and members of the public that may be affected by military and civilian sources; development of a monitoring system for environmental releases of radioactivity from such sources; provision of an emergency and monitoring system in the Archangelsk Oblast; and construction of a regional laboratory for surveillance and early warning systems. The first AMAP assessment provided useful input to these developments.

In 1992, the Finnish Radiation and Nuclear Safety Authority (STUK), in cooperation with Gosatomnadzor, installed push button alarm panels and satellite communication systems in the site offices of Gosatomnadzor at the Leningrad and Kola NPPs and at the Atomflot Repair Technical Plant near Murmansk. These facilitate the prompt transmission by Gosatomnadzor local safety inspectors of a selected pre-programmed emergency or incident telex message. These can be transmitted to the 24-hour emergency response systems of STUK, other Nordic countries, and the Emergency Response Center in Moscow operated by the Federal Nuclear and Radiation Safety Authority of Russia. The notification system is independent of local ground communications and has battery back-up to ensure continuous operation. It is also tested automatically each week and manually each month to all Nordic receivers and to Moscow. There has been no actual emergency use of this system since its installation.

In 1994, eight environmental monitoring stations of Finnish origin were installed on the Kola Peninsula. These operate under local supervision and without automatic connections to the central system at Roshydromet in Murmansk for their data acquisition and alarm systems. Data collection is manual and the data are transmitted by telephone and telex. Reliable automatic operation of these stations would be difficult as the local telecommunications environment is prone to interference and other disturbances. In 1998, STUK and the NRPA signed a joint agreement on the development of the Roshydromet environmental radiation measuring system. Radiation monitoring stations would be upgraded and the telecommunication connections enhanced. Progress on this project is conditional upon the conclusion and implementation of a general agreement on this work between Norway and Russia.

In 2000, the nuclear and radiation safety authorities in the Nordic countries signed a framework agreement concerning joint Nordic financing for upgrading alarm and notification systems.

6.9. Security (including physical security)

Safety and security of radiation sources has acquired a new significance since the terrorist attacks in the United States on 11 September 2001. Special security measures to protect against terrorism should be part of safety assessments (Lubenau and Strom, 2002). There are a number of orphaned sources (i.e., sources that are no longer under regular institutional control) in the Russian Federation that should be located and brought back under institutional control. The European Commission and the United States are funding programs to do this.

A 'safeguard' is generally understood to be a method for controlling fissile/fissionable material. Six of the eight Arctic countries have signed IAEA safeguard agreements to contribute to non-proliferation obligations. Safeguard support programs have constituted the primary means of bilateral Finnish assistance to the Ukraine, the Baltic States, and the Russian Federation. Their objectives are to assist in establishing and improving national systems for accounting and control of nuclear material. The relevant regulatory bodies are assisted in the development of regulations, guides, and inspection procedures. Training has also been extended to border-control authorities in the detection and control of radioactive and nuclear materials. Training courses were organized for the Russian border controls using experts from the Finnish Radiation and Nuclear Safety Authority (STUK) and from other institutes within the European Union (STUK, 2000).

A bilateral Russian–Norwegian project was started in 1998 to replace the radioisotopic power sources at four Russian lighthouses in Varanger Fjord by solar powered technology. The aim is to reduce the likelihood of radioactive contamination of the northern marine environment. When the project is complete, all radioisotopic power sources in the Russian parts of Varanger Fjord will have been replaced by solar panels. A Russian information video has been made in connection with this project. The radioisotope thermoelectric generators will be stored at Atomflot before transport to the Minatom Institute for Technical and Atomic Physics and then to Mayak for final treatment and storage.

6.10. Conclusions

The main criterion of success for a nuclear safety project is its net contribution to the improvement of nuclear safety (NRPA, 2002). Owing to the difficult economic situation in Russia, improvement initiatives in the region are often only possible through international collaboration. Lack of funds and/or difficulties in developing bilateral/multilateral agreements can delay the start of nuclear safety initiatives; nevertheless, the Arctic countries are committed to further improvements. Priorities for risk reduction are being identified through a process of risk analysis. In addition, projects are being supported only within the context of demonstrated compliance with Russian regulatory requirements. That context includes safety assessments and EIAs incorporating a variety of risk analyses to demonstrate compliance with risk objectives relating to environmental and human health protection. Risk assessments and EIAs should also be used to select and/or prioritize risk reduction projects, to optimize the use of resources. Resources and effort will continue to be focused on the areas of greatest risk and on the operations and facilities that pose the greatest potential threats.