



Nuclear safety in Northwest Russia



UTENRIKSDEPARTEMENTET

Norwegian Ministry of Foreign Affairs

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FOREWORD

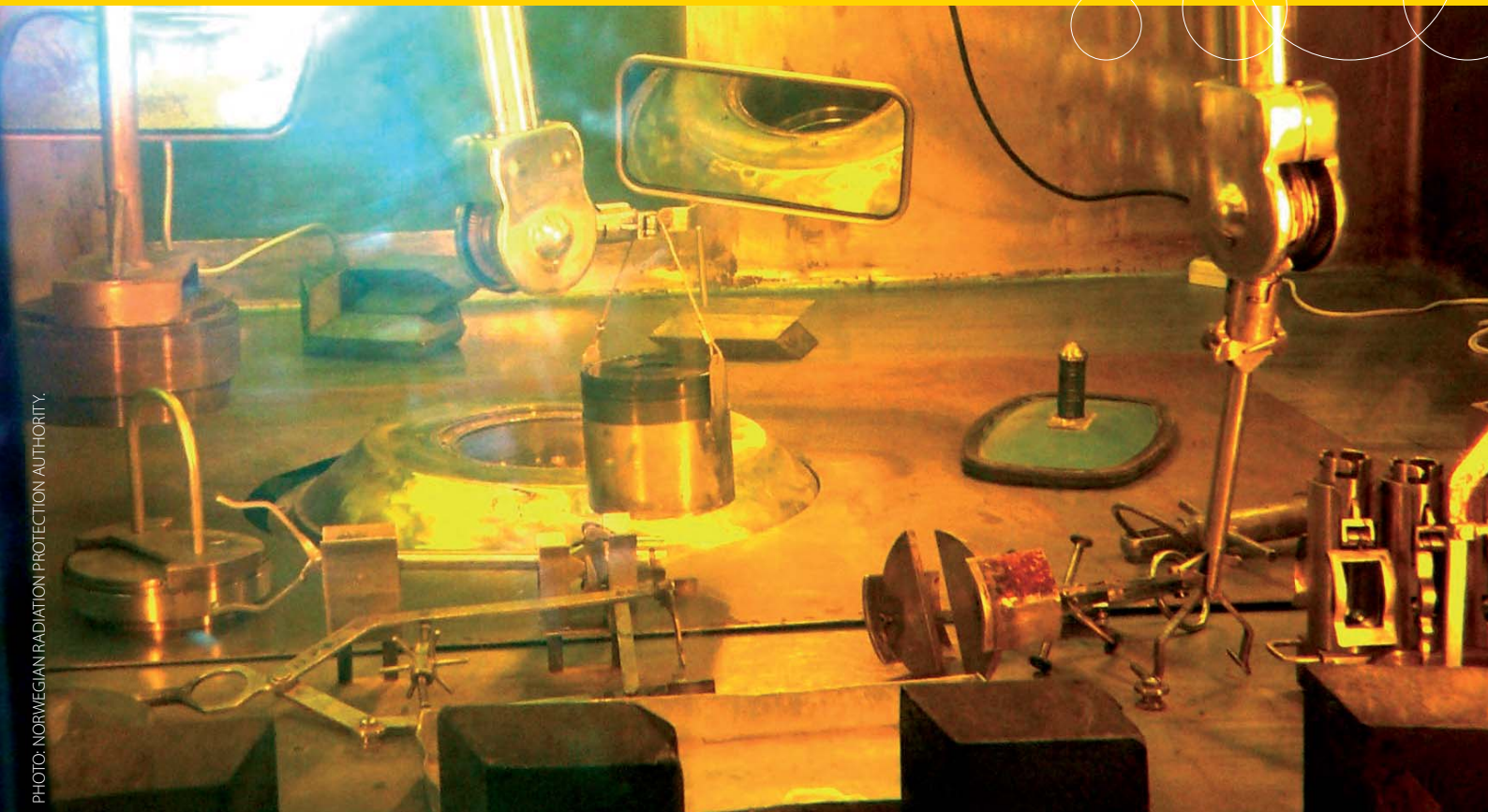


PHOTO: NORWEGIAN RADIATION PROTECTION AUTHORITY

Nuclear safety has become an increasingly important area of focus for Norway, both internationally and in our bilateral relations with Russia. The challenges facing us are above all related to the fact that the world's largest concentration of nuclear reactors is on the Kola Peninsula, not far from the Norwegian border.

The potential impact of radioactive discharges on health and the environment in the North was one of several reasons why initiatives for Norwegian-Soviet environmental cooperation were taken as early as the 1980s. As the extent of the problems became clear, the need for a prioritised and systematic effort became apparent. Since 1995, the action plan for Nuclear Safety has formed the basis for Norway's efforts in the area of nuclear safety. Since then, more than NOK 1 billion has been allocated to this important work.

The Russian authorities are themselves making a significant effort to improve

nuclear safety at their nuclear installations and stocks. However, the tasks at hand are greater and more critical than the Russian authorities can handle on their own. For a long time, Norway was alone in assisting Russian authorities in solving the nuclear problems in Northwest Russia. During these years, we acquired useful experience, developed a broad network of contacts both at the central government and local level, and, above all, we built up trust and facilitated openness and cooperation.

In recent years, much international attention has been given to the need to safeguard/secure weapons and materials that can be used for purposes of mass destruction, including sources of radioactivity. Norwegian experiences in cooperating with Russia have been useful and have served to inspire other parties. In 2003, Norway was the first country outside of the G8 that was invited to participate in the G8 countries' Global partnership against the spread of weapons and materials of mass destruction.

I am pleased that more and more countries are now assisting Russia in solving the country's nuclear safety problems, not least in the North. Coordinating the international work will become even more important in the future. Another important objective is to help make the need for assistance disappear in due time. We hope to attain this through cooperation with Russian supervisory and administrative authorities.

This brochure provides an overview of the problems we are facing; what Norway has done to solve them; and which focus areas we envisage in the future. The work is extensive, complex, and expensive – and it must be done now.



Jan Petersen
Minister of
Foreign Affairs



The map shows the Arctic region, including parts of Norway, Sweden, Finland, and Russia. Yellow dots mark the following locations: La Hague, Sellafield, Komsomolets, Andreyev Bay, K-159, Kola, Novaya Zemlya (multiple dots), Leningrad, Smolensk, Chernobyl, Kursk, and Mayak. The title 'INCREASING environmental and safety COOPERATION' is overlaid on the map, with 'environmental and safety' in a larger, bold, pink font.

INCREASING environmental and safety COOPERATION

Environmental cooperation between Norway and Russia has increased contact and understanding between the two countries. Networks have been built up that are important for information exchange and establishing environment-related agreements. Since environmental cooperation started, new economic driving forces and technological progress have also opened the way for new developments. Contamination levels in water, atmosphere and terrestrial ecosystems have largely been identified and their associated consequences assessed. Competence raising measures have been initiated that promote the effort for a cleaner environment. In addition, pollution monitoring stations have been set up to provide an overview of contamination levels and provide a basis for information exchange.

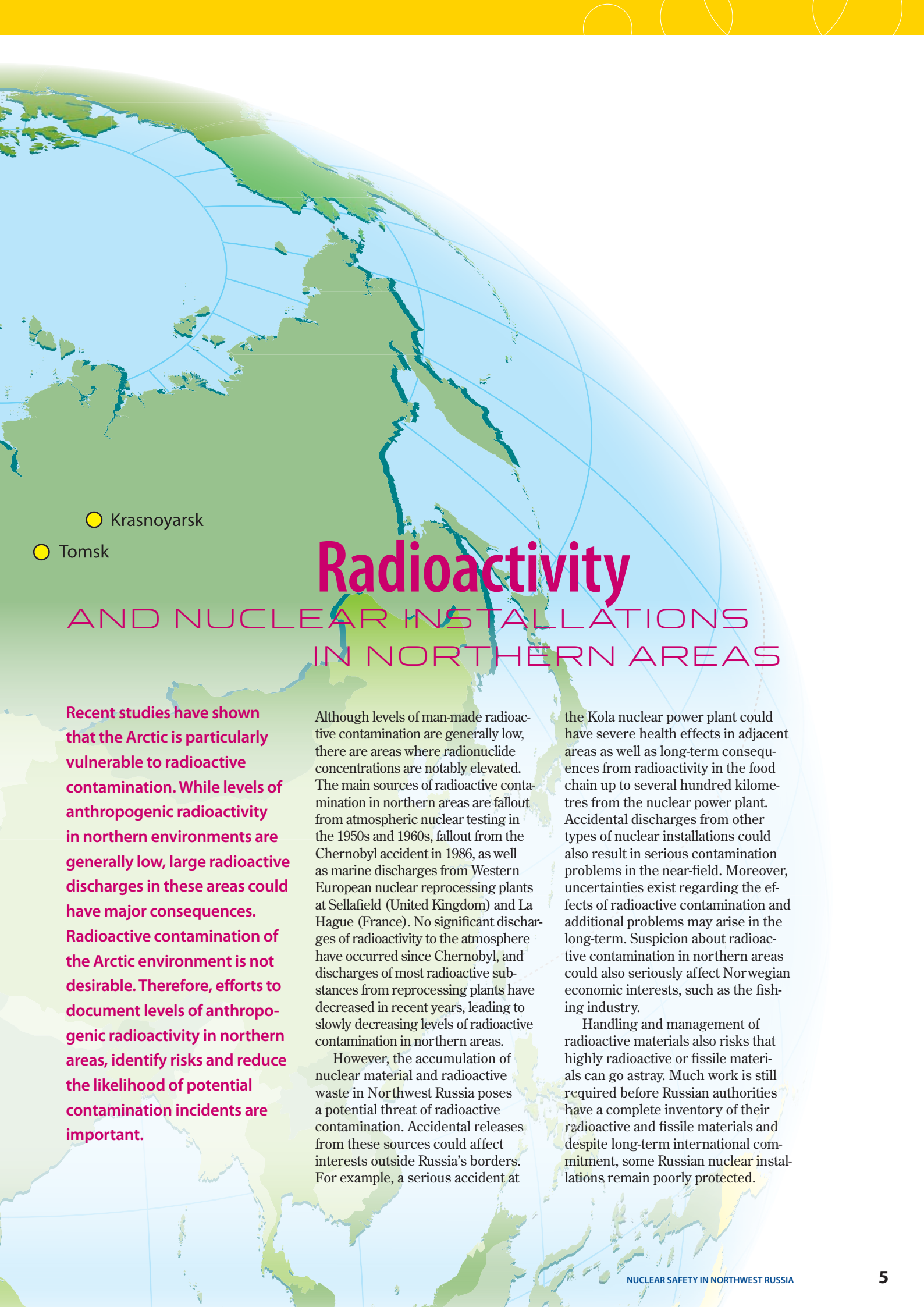
This bilateral environmental cooperation gathered real momentum in the 1980s. Regional and circumpolar

collaborations were also established in due course. A Norwegian-Soviet agreement on environmental cooperation was signed in 1988 and renegotiated in 1992. The Arctic countries inaugurated their environmental protection collaboration in 1991 with the Rovaniemi Declaration on a joint Arctic Environment Protection Strategy (AEPS). Later, in 1993, the Barents Cooperation was established with environmental protection as a focal area. Collaboration on environmental protection has also improved awareness of pollution threats such as dumped nuclear waste, military bases and installations containing nuclear material.

The G8 countries and the EU have recently adopted new security strategies in which international terrorism, weapons of mass destruction, collapsed states and organised crime are the most important elements in a new threat picture. Although the military strategic significance of northern re-

gions has diminished, their geographical position remains important. The accumulation of significant amounts of nuclear waste in Northwest Russia deserves special attention as this represents a potential security problem in addition to generating environmental concerns.

Norwegian funding has helped a series of measures designed to reduce the risk of radioactive discharges and our continuing collaborative projects have given us a good overview of the environmental situation and risk picture associated with industrial and military activity in Northwest Russia.



Radioactivity

AND NUCLEAR INSTALLATIONS IN NORTHERN AREAS

Recent studies have shown that the Arctic is particularly vulnerable to radioactive contamination. While levels of anthropogenic radioactivity in northern environments are generally low, large radioactive discharges in these areas could have major consequences. Radioactive contamination of the Arctic environment is not desirable. Therefore, efforts to document levels of anthropogenic radioactivity in northern areas, identify risks and reduce the likelihood of potential contamination incidents are important.

Although levels of man-made radioactive contamination are generally low, there are areas where radionuclide concentrations are notably elevated. The main sources of radioactive contamination in northern areas are fallout from atmospheric nuclear testing in the 1950s and 1960s, fallout from the Chernobyl accident in 1986, as well as marine discharges from Western European nuclear reprocessing plants at Sellafield (United Kingdom) and La Hague (France). No significant discharges of radioactivity to the atmosphere have occurred since Chernobyl, and discharges of most radioactive substances from reprocessing plants have decreased in recent years, leading to slowly decreasing levels of radioactive contamination in northern areas.

However, the accumulation of nuclear material and radioactive waste in Northwest Russia poses a potential threat of radioactive contamination. Accidental releases from these sources could affect interests outside Russia's borders. For example, a serious accident at

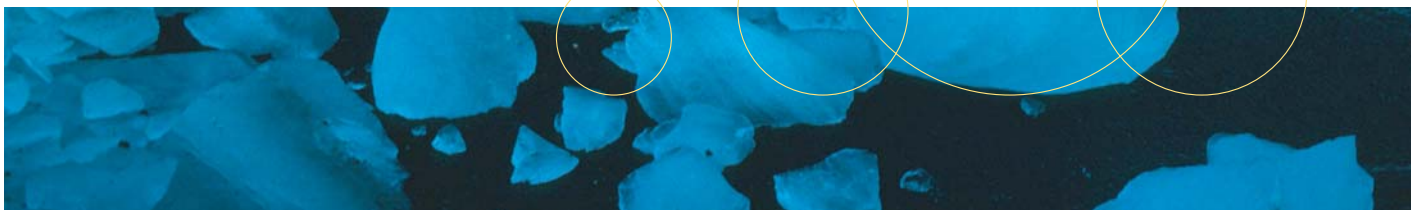
the Kola nuclear power plant could have severe health effects in adjacent areas as well as long-term consequences from radioactivity in the food chain up to several hundred kilometres from the nuclear power plant. Accidental discharges from other types of nuclear installations could also result in serious contamination problems in the near-field. Moreover, uncertainties exist regarding the effects of radioactive contamination and additional problems may arise in the long-term. Suspicion about radioactive contamination in northern areas could also seriously affect Norwegian economic interests, such as the fishing industry.

Handling and management of radioactive materials also risks that highly radioactive or fissile materials can go astray. Much work is still required before Russian authorities have a complete inventory of their radioactive and fissile materials and despite long-term international commitment, some Russian nuclear installations remain poorly protected.



Action Plan

FOR NUCLEAR SAFETY



The Action Plan for Nuclear Safety is the Norwegian authorities' most important instrument for cooperation with Russia. The overall goal of the action plan is to protect health, the environment and commercial activities from radioactive pollution.

Report No. 34 (1993-94) to the Norwegian parliament entitled "Nuclear activities and chemical weapons in areas adjacent to our northern borders" provided an overview of risks associated with nuclear activities in northern areas. The Norwegian parliament then recommended that the government drew up an action plan containing concrete follow-up measures. The Action Plan for Nuclear Safety was drafted in close cooperation between the Ministry of Foreign Affairs, Ministry of the Environment, Ministry of Defence, Ministry of Health and Social Affairs, Ministry of Fisheries and the Norwegian Radiation Protection Authority. The plan was initiated in 1995 and revised in 1997,

and forms the basis for our nuclear safety collaboration with Russia. In 2005, a new action plan was established in order to replace the plan from 1997. Report No. 30 (2004-2005) to the Norwegian parliament entitled "Possibilities and challenges in the north" provides an updated basis for new guidance for the collaboration concerning nuclear management and safety in northern areas.

Norway's interest is that Russian nuclear power plants and radioactive substances are managed in accordance with the highest international standards, and that nuclear materials are properly protected and do not go astray. Norway's support helps to strengthen control and supervision by improving safety at waste storage facilities and nuclear installations and reducing the risk of future accidental discharges of radioactivity. In addition, Norway wishes to contribute to the transfer of relevant expertise that can put Russia in a position to handle these challenges itself, using the best available knowledge and technology.

Norway has been proactive in its effort to strengthen nuclear safety in Russia and such activities are also increasing internationally. Collaborative work is wide-ranging and costly and

therefore depends on a broad-based international commitment. In many cases activities are based on major projects in which the participation of other Western countries, multi-lateral organisations and financial institutions is necessary. Awareness of nuclear problems and commitment to resolving them has increased. An outcome of this is the comprehensive international rules and guidelines for nuclear activities.

The United Kingdom, Germany, France, Canada, Japan, Italy and the USA have allocated substantial funds to resolving Russia's nuclear waste and safety problems, giving hope of rapid progress. However, the new international situation also brings new challenges. Increased activity augments the demand for a systematic, well-coordinated effort.



Photo: Norwegian Ministry of Foreign Affairs

NORWEGIAN ACTORS IN the nuclear safety effort

A wide variety of actors are involved on the Norwegian side under the Action Plan for Nuclear Safety Issues. Public sector involvement ranges from the highest political level to regional authorities. Other private organisations, foundations and companies also make important contributions.

Ministry of Foreign Affairs: The Ministry of Foreign Affairs finances Norway's involvement in the Action Plan for Nuclear Safety. Responsibility for the action plan is assigned to the Ministry of Foreign Affairs' Security Policy Department which is responsible for bilateral relations with Russia. A new Section for the Northern Areas, Polar Affairs and Nuclear Safety was established in this department in 2004. Topical issues and applications for project support are discussed by the Ministry of Foreign Affairs' Advisory Committee for Nuclear Safety Issues to secure a broad basis for decisions on priorities and initiatives before the Ministry decides to support individual projects. The committee includes participants from the Ministries of Defence, Health and care services, the Environment, Fisheries and Coastal affairs, Trade and Industry, as well as the Norwegian Radiation Protection Authority, the Institute for Energy Technology and the Norwegian Defence and Research Establishment.

Ministry of the Environment: The Ministry of the Environment started the bilateral Norwegian-Russian environmental collaboration at the end of the 1980s. The ministry heads the Joint Norwegian-Russian Commission on

Environment Protection. It also participates in the Commission's expert group, set up in 1992, to investigate radioactive contamination in northern areas.

Ministry of Defence: Norwegian participation in the defence-related environmental collaboration between the US, UK, Norway and Russia (Arctic Military Environmental Cooperation – AMEC) is headed and coordinated by the Ministry of Defence.

Norwegian Radiation Protection Authority (NRPA): The NRPA has become a specialist directorate that will assist the Ministry of Foreign Affairs in implementing the action plan, in order to separate the Ministry's responsibility for overall control and policy formulation from technical radiation protection follow-up. The NRPA heads the expert group investigating radioactive contamination in northern areas.

County Governor in Finnmark: The County Governor in Finnmark has been project leader for several projects, including improving infrastructure in Andreyev Bay, replacing strontium batteries in lighthouse lamps and rehabilitating the Murmansk Radon storage facility. This ensures an active

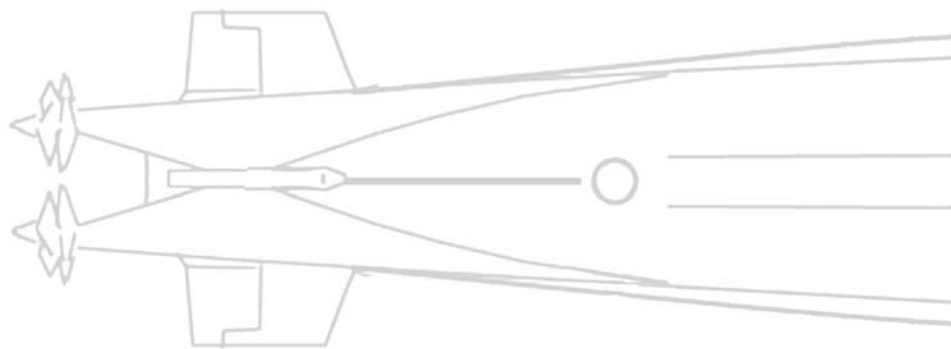
local involvement and a firm basis for regional collaboration in the area.

Institute for Energy Technology (IFE): IFE has headed projects to upgrade safety at the Kola nuclear power plant and has played an active role in the AMEC collaboration.

Norwegian Defence and Research Establishment: This establishment manages a number of AMEC projects.

Voluntary organisations and foundations: Organisations and foundations such as Bellona and the Norwegian Society for the Conservation of Nature have made substantial efforts to spread awareness of the nuclear challenges in Russia for many years, and to strengthen sister organisations in Russia. Their work, which receives financial support from the action plan, helps to meet information requirements of the national and international media, population and political community.

Other Norwegian actors involved in nuclear safety projects at the present time or in the past include: the Norwegian Meteorological Institute, the Norwegian Trade Union Centre for Social Science and Research (FAFO), the Norwegian Defence Construction Service, the Fridtjof Nansen Institute, Gaustad Hospital, Kværner Maritime as, The Research Council of Norway, the Norwegian Geotechnical Institute, the Agricultural University of Norway/Norwegian University of Life Sciences, the Institute of Marine Research, the Norwegian Polar Institute, the Centre for Occupational and Environmental Medicine, the Foundation for Scientific and Industrial Research at the University of Trondheim (SINTEF), the Norwegian Pollution Control Authority, Storvik & Co., Studsvik Scandpower, Telenor International as, Norwegian Customs and Excise and the University of Oslo. Other ministries have also been involved in various projects.



International

COOPERATION FORUMS

Norway contributes significantly to resolving the nuclear safety problems in Northwest Russia. However, the scale of the problems is such that effective solutions are only possible with a broad-based international commitment. That is why Norway attaches great importance to encouraging other countries to play their part. Multilateral forums of special significance for nuclear safety collaboration in Northwest Russia are:

Contact Expert Group (CEG): After a Nordic countries initiative, a seminar was arranged in 1995 under the auspices of the International Atomic Energy Agency (IAEA) in Vienna to clarify the problems of radioactive waste and spent nuclear fuel in Russia. The CEG was an important outcome of the seminar. The group's mission is to increase awareness and promote international collaboration on the challenges associated with radioactive waste and spent nuclear fuel in Russia. The CEG is a contact forum for representatives of government authorities, technical experts, operators and commercial companies. Emphasis is placed on information exchange, identification of partners, consultation and project cooperation.

Arctic Military Environmental Cooperation (AMEC): AMEC was the first formalised multilateral collabora-

tion that Norway entered to secure proper handling and storage of spent military nuclear fuel and radioactive waste in Northwest Russia. AMEC was established in 1996 when defence ministers from Norway, Russia and the US signed a joint declaration on defence-related collaboration for environmental protection in the Arctic. The UK joined AMEC in 2003. To date, priority has been given to projects for safer handling, transport and storage of spent nuclear fuel and solid radioactive waste, as well as for improved radiation safety. AMEC plays an important role in engaging Russian military authorities in the nuclear safety effort.

International funds: The European Bank for Reconstruction and Development (EBRD) administers various funds designed inter alia to improve safety at the oldest and most



Chernobyl nuclear power plant in Ukraine. Photo: Norwegian Radiation Protection Authority.

hazardous nuclear power plants in former Soviet republics. Norway has also contributed funds to the Nuclear Safety Fund, the Chernobyl Fund, the Ignalina Fund and to the construction of a concrete shelter around the destroyed No. 4 reactor at the Chernobyl nuclear power plant.

Northern Dimension's Environment Partnership (NDEP): The NDEP originates from the EU Northern Dimension Action Plan, adopted in 2000. A separate fund – the NDEP Support Fund – was established in 2001 to coordinate environmental efforts in northern areas. The Support Fund has two programmes, one for environmental initiatives and one for nuclear safety initiatives. The EBRD manages the Support Fund's capital and is in charge of its project work. Norway has contributed towards nuclear safety initiatives and has a

seat both on the Support Fund's top decision-making body and on its nuclear operating committee.

The G8 Global Partnership against the Spread of Weapons and Materials of Mass Destruction: At the Canadian summit meeting in 2002 the G8 countries established a global partnership against the spread of weapons and materials of mass destruction. The partnership aims to raise USD 20 billion over the next ten years towards non-proliferation measures, disarmament, anti-terrorism and nuclear safety, especially in Russia. Dismantling nuclear submarines and protection of nuclear materials are prioritised areas. Norway was invited to join the partnership in 2003. The partnership mission is not to establish special funds, but to maintain an overview of participating countries' contributions, whether bilateral or through other funds.

Multilateral Nuclear Environmental Programme in the Russian Federation (MNEPR Committee): After signing a multilateral, legally binding framework agreement for assisting Russia, the participating countries set up a committee to discuss issues related to the functioning of the agreement. Key points of the MNEPR Agreement refer to exemption from tax, customs and excise duties and exemption from liability in the event of a nuclear accident during implementation of the projects. The agreement also includes the right to visit project sites, oversee implementation of projects and covers usage of assistance funds. It is the cornerstone of the G8 partnership implementation of nuclear safety projects. The MNEPR agreement came into force as of May 2004.

Norway's cooperation

WITH RUSSIAN AUTHORITIES

Norway's nuclear safety cooperation with Russia originates from their bilateral environmental collaboration. An expert group was established in 1992 under the Joint Norwegian-Russian Commission on Environment Protection to investigate allegations that radioactive waste had been dumped in the Barents and Kara Seas. Since then, the expert group has played a central role in studies of radioactive pollution and the development of cooperation between authorities in the northern areas. Bilateral cooperation between Norway and Russia in the field of nuclear safety could be established in 1992 after the far-reaching political changes in the former Soviet Union. Upon the initiative of the then Norwegian government, Norway established a wide-ranging programme to improve protection against accidents at the Kola nuclear power plants.

Norway and Russia signed a bilateral agreement in 1993 for early warning of nuclear accidents at nuclear installations and exchange of information about installations, which has since formed the basis for practical cooperation on nuclear accident preparedness between the two countries. The agreement is anchored in the IAEA Convention on Early Notification of a Nuclear Accident. A Norwegian-Russian protocol concerning strengthened cooperation on preparedness and early warning was signed in October 2003.

Wide-ranging cooperation has since been initiated with various control and supervisory authorities in Russia. These include the Natural Resources Ministry, the Health Ministry, the Federal Atomic Energy Agency (the former Atomic Energy Ministry, Minatom), the Nuclear, Industrial and Environmental Regulatory Agency (incorporating *inter alia* the former Federal Inspectorate for Nuclear and Radiation Safety, formerly known as GAN, along with Russian military radiation protection authorities.

A bilateral agreement on nuclear

safety initiatives cooperation was signed by the then Minatom and Norway's Ministry of Foreign Affairs in 1998. The agreement established a framework for cooperation with Rus-



Meeting of the Norwegian-Russian Commission for nuclear safety in Arkhangelsk in June 2004. The leader of the Norwegian delegation, Deputy Minister Kim Traavik, presents a gift to his Russian counterpart, Sergey Antipov, from the Russian Atomic Energy Agency. Photo: Norwegian Radiation Protection Authority

sia on nuclear safety and clean-up, regulated legal matters and established a Norwegian-Russian commission to

ensure effective implementation of the cooperation. The agreement also gave the right to verify that technical assistance is utilised as agreed. It expired in May 2003, and a revised agreement is now being negotiated. The commission is headed by Norway's Ministry of Foreign Affairs and Russia's Federal Atomic Energy Agency. It reviews the status of specific projects and the cooperation in general. The meetings have also been used by the Norwegian side to raise issues such as closing down the Kola nuclear power plant, reprocessing spent nuclear fuel at the Mayak Production Association (Mayak PA) and Russia's accession to the London Convention limiting the dumping of radioactive waste.

The nuclear safety cooperation with Russia brings together authorities and specialists from Russia and Western countries. This is important in the effort to assist Russia in its continuing development of independent and highly qualified supervisory and administrative authorities.



The Nuclear Power plant "Leningrad" near St. Petersburg. Photo: Norwegian Radiation Protection Authority



The operations at the Leningrad nuclear power plant are monitored in the control room. Photo: Norwegian Radiation Protection Authority

NORWAY'S CONTRIBUTION TO nuclear safety projects

Since 1995, most projects have been implemented in North-west Russia. About two-thirds of the Norwegian funds have been used to reduce the risk of accidents at Russian nuclear power plants adjacent to our national borders and improve the safe handling and storage of radioactive materials and spent nuclear fuel. Focus areas to date are summarised below.

Nuclear power plants

Since the 1986 Chernobyl accident a substantial effort has been made to identify possible flaws in Soviet-designed reactors. Norway has allocated funds since 1992 to programmes at the Kola and Leningrad nuclear power plant in Russia and the Ignalina nuclear power plant in Lithuania to enable them to operate as safely as

possible in the period remaining before they are decommissioned. Norway has stressed that these measures should not contribute to prolonging the nuclear power plants lifetime.

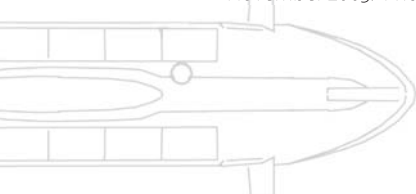
The Kola nuclear power plant has received much attention due to its original safety situation and proximity to Norway. In recent years, projects have concentrated on the two newest reactors at this facility. For the most part, work has addressed significant security-related flaws at the reactors. The number of shutdowns and unplanned events has since decreased to a level similar to that experienced at Western nuclear power plants. The transfer of Western safety and work culture has been an important element of all projects. The most important individual projects have targeted diesel generators that provide emergency cooling in the event of failures in external electricity supply, process control systems designed to prevent an accident due to operator error along with fire protection and control of early warning parameters that can detect serious flaws in the cooling system.

Norway has also collaborated with Sweden and Finland on various initiatives at the Leningrad nuclear power plant in Russia and the Ignalina nuclear power plant in Lithuania, involving fire protection, protection against terrorism and protection against accidents during particularly hazardous operations such as the replacement of reactor fuel.

Accidents at the Kola, Kursk, Smolensk and Leningrad nuclear power plants in Russia along with the Ignalina plant in Lithuania probably represent the greatest risk of radioactive contamination being spread over Norwegian territory. This is because these facilities have older reactors, lower safety standards and a weaker safety culture than in Western countries. The potential damage to Norwegian interests as a result of accidents at these nuclear power plants is far more extensive than in the case of accidents at other types of nuclear installation situated close to Norway. That is why the Norwegian authorities have repeatedly called for Russian nuclear power plants to be



A ceremony directed by AMEC signifying that the automatic radiation monitoring system PICASSO had been set in operation at Atomflot, Murmansk, in November 2003. Photo: Norwegian Defence Research Establishment



The nuclear ice-breaker "Sovietski Soyuz".
Photo: Norwegian Radiation Protection Authority.



In order to secure electricity supplies at the Kola NPP, Norway financed the emplacement of a diesel generator. Photo: Norwegian Radiation Protection Authority.



closed down at the end of the reactors' intended lifetime of 30 years. Norway's short term objective has been to increase nuclear power plant safety up to the closure date without thereby prolonging the facilities' lifetime.

Safety analyses and statistics provide documentary evidence that the most acute safety problems have now been resolved thanks to Norwegian and other Western assistance. Funding and other contributions to safety measures at Russian nuclear power plants have therefore been reduced. Some future level of contributions will remain necessary, however, in order to maintain the safety measures that have already been implemented and to adapt them to possible changes at the different facilities. This will also ensure that Norwegian supervisory authorities and specialists continue their close contact with the nuclear power plants in question. This is important for nuclear safety and preparedness and because contact between Russian nuclear power plants and Western specialists will promote the

further development of an improved safety culture at these facilities.

Safer transport, handling and storage of radioactive waste and spent nuclear fuel

In order to avoid accumulating spent nuclear fuel on the Kola Peninsula, Norway has funded the construction of four specially designed goods wagons to transport spent nuclear fuel to Mayak PA for final treatment and storage. The Mayak plant has a reprocessing facility for spent nuclear fuel and storage sites for radioactive waste. In addition, an upgrading of two liquid radioactive waste storage tanks at the Zvezdochka shipyard in Severodvinsk was done to enable Russian authorities to dismantle decommissioned nuclear submarines. Installation of modern control systems in these storage tanks has made dismantling operations at the shipyard safer. Within the AMEC cooperation, Norway has also assisted the production of special containers for temporary storage and safe rail transport of spent nuclear fuel.

Norway has also, within AMEC, helped fund the construction of a transit storage facility at the Atomflot nuclear icebreaker base in Murmansk, where containers carrying spent nuclear fuel are transferred for onward transport. Moreover, radiation monitoring has been installed at Atomflot to promote safer operations and safer transshipment of radioactive waste and spent nuclear fuel. A treatment and storage facility for solid radioactive waste has also been built at the naval shipyard in Polyarny.

Large quantities of spent nuclear fuel from the Northern Fleet's nuclear powered submarines are stored at the Andreyev Bay base. The infrastructure at this base is not satisfactory and needs to be overhauled before the actual clean-up work can start. Norway has contributed to this by building a new access road, repairing electricity supplies, and water and drainage systems. New buildings have been erected for the plant's workforce. Norway has also granted funds for infrastructure measures and for mapping pollution levels in



Kola nuclear power plant. Photo: Ragnar Våga Pedersen/Svanhovd Environmental Centre.



Norwegian officials heading for the Kola Nuclear power plant.
Photo: Norwegian Radiation Protection Authority.



Norwegian and Russian experts taking samples in Reservoir 10 at the Mayak nuclear complex.
Photo: Norwegian Radiation Protection Authority.

the Andreyev Bay as well as digging a trench to prevent radioactive substances from entering the sea.

Protection of radioactive sources and nuclear materials

The dismantling and removal of highly radioactive energy sources (strontium batteries) from lighthouse lamps along the Kola coast is an initiative that serves several purposes. Removing the strontium batteries and installing environmentally friendly solar panels reduces the risk of radioactive contamination of the environment. It also eventually brings these highly radioactive sources under the control of the authorities at Mayak, thereby reducing the risk of them going astray. Norway has funded the removal and waste treatment of 65 such sources from the Murmansk region. So far 37 lighthouses have had solar panels fitted.

Physical protection is important to prevent the proliferation of fissile materials which can be used to produce nuclear weapons. Together with the US, UK and the other Nordic

countries, Norway has implemented several measures in recent years with the Russian icebreaker fleet in Murmansk to bring fissile material under better control and protection. In addition, accounting systems have been funded that enable the quantities of fissile material present at the base to be verified at all times.

Strengthened emergency preparedness

Cooperation on preparedness and early notification of nuclear accidents is an important aspect of Norway's bilateral nuclear safety cooperation with Russia. The IAEA Convention, which is the basis for Norway's early notification agreement with Russia, incorporates a relatively high threshold for alerting neighbouring countries and the international community of nuclear events. Norway has therefore, called for the early warning threshold to be lowered, a recommendation designed to be applicable not just to Russia, but to all other countries within the international community. A number of events, for example the loss of the

Russian K-159 nuclear submarine in August 2003, have prompted this request. A Norwegian-Russian protocol concerning strengthened collaboration on emergency preparedness and early notification was signed in 2003.

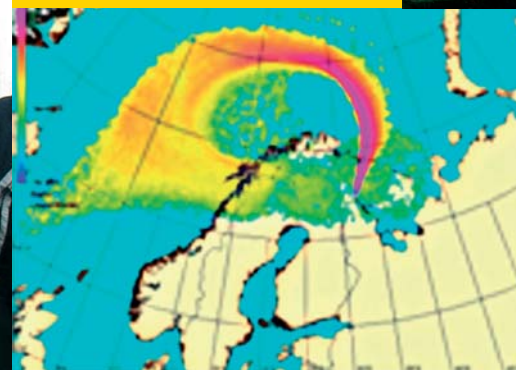
Monitoring and impact assessments

Mayak

As part of the Norwegian-Russian cooperation on environment protection, Norwegian experts and Russian nuclear authorities carried out extensive investigations of the nuclear technical facility in Mayak in the 1990s. The radioactive contamination situation was mapped, various sources were identified and dose calculations were carried out. Moreover, the spread of radioactive substances was studied in nearby river systems and impact assessments of various accident scenarios were studied. The investigations showed that the extensive contamination of land areas and river systems was essentially the result of discharges and accidents at the facility in the 1950s and 1960s.



The crew of the Russian vessel Semyon Desnov holding a memorial service for victims of the Kursk accident.
Photo: Norwegian Radiation Protection Authority.



Simulation of radioactive discharges from the reactor at the Kola NPP within NRPA's decision-support system "ARGOS".
Photo: Norwegian Radiation Protection Authority.

Impact assessments of different accident scenarios have also been made. The results showed that accidents are likely to increase radioactive contamination in the area and the spreading of radioactive substances northwards via the Ob river system. Calculations indicated that while consequences for health and the environment in our northern areas will be limited, there could be much larger consequences at the local level.

Impact assessments and accident scenarios at the Kola nuclear power plant

Several Norwegian projects have studied the potential consequences of an accident at Kola nuclear power plant. Based on various accident scenarios, assessments have been made of the atmospheric transport of pollutants and possible dose-related consequences in the short and long-term after a hypothetical accident. The studies looked at the "worst-case" accident in terms of both maximal discharges and the least favourable weather conditions. It was found that although transport times

of airborne radioactive contamination to Norway after an accident could be as little as about three hours, there would be little need for far-reaching countermeasures initially. However, a worst-case accident would produce substantial radioactive fallout and require extensive long-term measures to keep radioactivity at acceptable levels in foodstuffs. Moreover, contamination of Arctic ecosystems could create long-lasting environmental problems.

Arctic Monitoring and Assessment Programme (AMAP)

AMAP is one of five working groups under the Arctic Council in which Norway has participated since its start in 1991. AMAP's task has been to coordinate monitoring work and assess the consequences of different types of pollution in Arctic areas. In cooperation with Russia, the Norwegian Radiation Protection Authority has been in charge of work relating to radioactive pollution from the Norwegian side. In addition to providing input to the Arctic Council, AMAP has produced reports for ministerial meetings held

in 1997 and 2002. Scientific reports containing background information for the meetings have been published in the period 1998–2002. The AMAP conclusion for radioactivity is that levels of contamination in Arctic areas are generally low and are decreasing, but there is a possibility that accidents could increase contamination levels.

Norwegian-Russian expeditions

The Norwegian-Russian collaboration on environmental monitoring monitors the environmental status of the many potential sources of radioactive pollution in Northwest Russia. Clean sea areas are important, not least for both countries' fishing industries.

A number of expeditions have been undertaken in the Barents and Kara Seas, and along the Ob and Yenisei rivers. Samples of water, bottom sediments, fish and other organisms have been collected and analysed by both Norwegian and Russian research institutions and authorities. Areas in which radioactive waste has been dumped have been examined in the fjords on the west side of Novaya Zemlya. In



Power lines near the Kola nuclear power plant. Photo: Norwegian Radiation Protection Authority.

Entrance to the nuclear technology complex at Mayak. Historical discharges and accidents have contributed to significant releases of radioactivity to the environment and the area is currently considered as one of the world's most radioactively-contaminated site. Photo: Norwegian Radiation Protection Authority.



Representatives from the NRPA conducted measurements of radioactivity on the Norwegian-Russian expedition involving the Northern fleet's vessel Semyon Desnov during the lifting of the Kursk. Photo: Norwegian Radiation Protection Authority.

some areas, localised contamination resulting from dumped radioactive waste container leakages has been identified. The Norwegian-Russian expert group and the IAEA have undertaken impact assessments based on monitoring results. Their conclusion is that the dumped radioactive waste should remain where it is rather than be removed, and that a monitoring programme should be undertaken to ensure that any changes in the state of waste are immediately detected.

The nuclear submarine Kursk

In 2000 the Russian submarine Kursk sank in the Barents Sea. Water samples were collected soon after, as close as possible to the accident site, and air filter stations were made ready to record any discharges from the wreck. The Norwegian Radiation Protection Authority participated in three expeditions to the accident location. Shortly after the accident, Norway provided radiation protection expertise and took samples as close as possible to the submarine. When the wreck was salvaged one year later,

a Norwegian-Russian monitoring expedition took samples of the air, water and sediments to establish whether any leakage of radioactivity from the submarine had occurred during the salvage process. The samples taken prior to, during and after the lifting operation showed no evidence of leakage of radioactive substances from the submarine's two reactors.

Strengthened cooperation with Russia

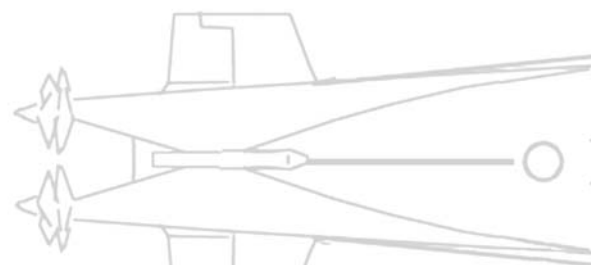
Cooperation on nuclear safety is an important instrument for developing bilateral relations between Norway and Russia. This project requires close cooperation between Norwegian and Russian authorities and institutions, both military and non-military. The networks that have been created have allowed increased openness, trust and confidence. This is important for ensuring that compliance with international demands and standards in the radiation protection field is as comprehensive as possible.

The close cooperation on nuclear safety with Russia over the past decade

has given Norway a central international position in this field, providing opportunities to encourage other countries to play their part and to address important issues during international discussions of future priorities and measures.

Knowledge and information exchange

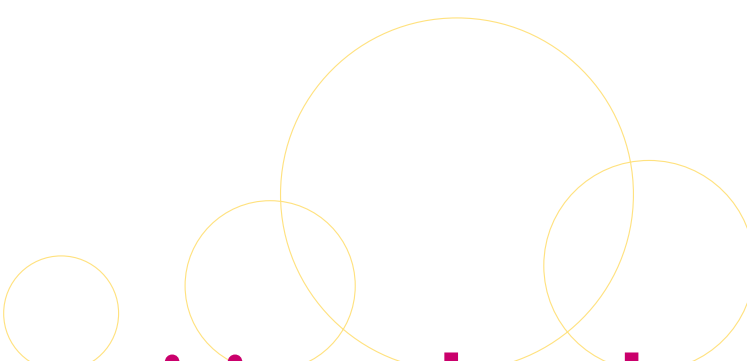
Since 1993 five conferences on radioactivity in the Arctic and Antarctic environments have been held under the auspices of Norwegian-Russian environmental cooperation. The conferences have attracted wide international participation and have formed the basis for discussions of scientific and management-related factors concerning radioactivity in the environment. This has stimulated further cooperation on research, nuclear and radiological emergency preparedness, and specifically targeted environmental protection projects and protection of the environment generally. Other organisations and foundations have also actively assisted in spreading information on the nuclear challenges faced by Russia.





*Norway's knowledge of environmental problems
and conditions at Russian nuclear installations is far better today
than when environmental cooperation started.*

IMPORTANT



prerequisites ahead

International involvement in the nuclear safety sphere in Northwest Russia will increase markedly in the years ahead. More projects will be initiated and many will be large in scope and potentially hazardous. There is broad international agreement on the necessity of precise planning and carefully selected priorities.

An overall, integrated plan will be absolutely crucial for successful efforts to resolve the wide-ranging environmental and safety challenges we face in Northwest Russia. In 2003, Russian authorities set up an expert group which began work with such a plan for dismantling of decommissioned nuclear powered submarines, ships and vessels, as well as for environmental rehabilitation of nuclear facilities in Northwest Russia. This is being undertaken for NDEP resources under the direction of EBRD. The first phase of the plan was completed by the end of 2004, and the second phase of the plan draws attention to, *inter alia*, clean-up work at Andreyev Bay and Gremikha as

being important future priorities. The second phase of the plan concerns organisational issues for the practical application of concrete projects allocated NDEP resources. This has been started early in 2005.

The plan will contribute to improved understanding of the challenges in this field, pinpoint critical locations and show where resources should be deployed. It will therefore be an important basis for deciding priorities, selecting projects and international coordination of bilateral and multilateral initiatives. This overall plan will need to be accompanied by concrete plans for specific areas and activities, for example the Andreyev Bay.

The Norwegian authorities

consider it very important to carry out impact assessments of initiatives included in the action plan with a view to reducing the likelihood of accidents and adverse effects on health, safety and the environment. These assessments should be two-tiered and will include activities at the full programme coordination level and at the individual-project level. Overall impact assessments have played, and will continue to play, a central role in deciding priorities. In the period ahead there will be an increasing need for close collaboration with Russian authorities on overall impact assessments in order to secure the best possible basis for deciding further priorities. Norway considers it important to contribute to improved international coordination of impact assessments of this type. Furthermore, each individual project must be impact-assessed prior to implementation if environmental consequences are considered possible from their actual implementation.

The emerging broad international commitment does not reduce the



Protection of the environment in Northwest Russia is a central theme of Norway's work. Photo: Ragnar Våga Pedersen, Svanhovd Environmental Centre.

need for continued active efforts on Norway's part. Nuclear safety is an area in which resolute and coordinated international commitment is vital. That is why Norway attaches such importance to close contacts with Russia, the United States, Canada and the European Union concerning nuclear safety collaboration. This collaboration will be intensified in the future.

The terrorist attacks against the US in 2001 brought a new dimension to nuclear safety collaboration. The risk that radioactive materials and spent nuclear fuel could go astray and be used by terrorists was highlighted to the international community. Increased international efforts have created the need for coordination between donor countries. Good coordination means implementing projects subject to the same high environmental, health and safety requirements regardless of which country or institution is responsible. At the same time it is important for the various actors to coordinate their efforts with the activities of other countries in order to exploit synergies

and ensure efficient use of resources.

Norway will give high priority to the collaboration with Russian supervisory and administrative authorities in the future. This will be an important contribution to the development of sustainable Russian management and administration in this field, where increased focus on preparedness, monitoring and competence development play an important part.

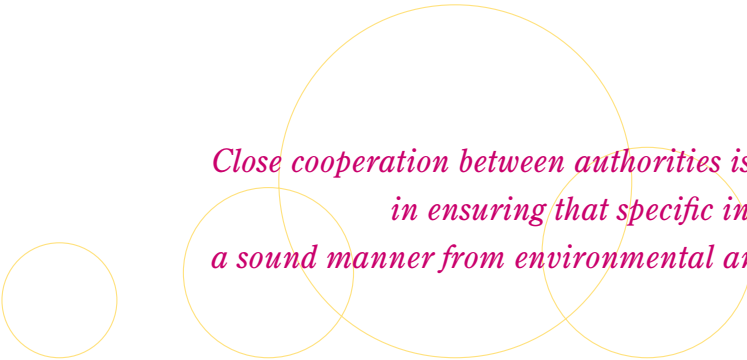
Russia's rules in the fields of radiation protection, nuclear safety and environmental protection essentially measure up to the standards and norms applied in Norway and other Western countries. However, administrative responsibilities are spread across a large number of different bodies. Moreover, Russian legislation is more complex than in Norway. This may create challenges in terms of coordination, not just domestically within Russia but also for bilateral relations.

Norway's knowledge of environmental problems and conditions at Russian nuclear installations is far better today than when environmen-



The Andreyev Bay. Photo: SevRao.

tal cooperation started. The collaboration has provided good insight into Russian management and administration and a better understanding of priorities on the Russian side. This is a prerequisite for the success of the continuing collaboration, which will increase trust and openness still further. Openness and access to closed areas is an important principle of collaboration with Russia.



*Close cooperation between authorities is of great significance
in ensuring that specific initiatives are carried out in
a sound manner from environmental and safety standpoints.*

Key focal areas

The nuclear safety challenges in Northwest Russia are numerous and complex. The most important tasks include:

- monitoring systems and impact assessments that ensure continuous information on the challenges faced
- preventive measures that reduce the risk of incidents and accidents
- preparedness that enables successful handling of incidents and accidents

Success requires thorough ongoing study and will be costly and time-consuming. Many projects initiated under the nuclear action plan include numerous dilemmas to be carefully considered and compared. In assessing measures, theoretical and ideal solutions must be viewed in relation to the practicalities of implementing them under actual conditions. This presupposes thorough impact assessments and close cooperation with the responsible Russian authorities and other donor countries.

Impact assessments and strengthened cooperation with Russian authorities

All projects seeking support through the nuclear action plan that involve the handling of radioactive waste are required to produce documentation

of, or plans for, environmental and safety assessments. The impact assessments shall ensure that health, and environmental and safety issues are considered. Norway emphasises the use of identical approaches to requirements and implementation of impact assessments for individual projects, as far as is possible. Russian legislation and guidelines regulating impact assessments are relatively well developed and in keeping with corresponding rules in Norway and other Western countries. However, experience from cooperation with Russian supervisory authorities shows that the rules are not always fully observed in practice. There has also been a heavy focus in the international arena on impact assessments as a tool in the decision-making and implementation phase of projects, which could adversely affect the environment and population.

Close cooperation between authorities is of great significance in ensuring that specific initiatives are carried out in a sound manner from environmental and safety standpoints. At the same time, cooperation puts Russia in a better position to resolve its own problems. The position of the supervisory authorities in Russia is also crucial to ensure that nuclear activities are managed in a sustainable way and that Western

assistance will ultimately, no longer be needed.

An important aspect of governmental collaboration is to review and compare Russian, Norwegian and international rules in the field of radiation protection. One of the underlying intentions here is to collaborate on preparing normative documents that are relevant to specific projects comprising the action plan and to the international effort in general.

Through the Norwegian-Russian expert group, a focus is placed on overall risk assessments carried out to clarify where the available Norwegian resources can be used most cost-effectively. Among concrete tasks, a particular focus has recently been placed improving the conditions in Andreyev Bay, dismantling nuclear submarines, and the replacement and waste treatment of strontium batteries that have been used to power Russian lighthouse lamps.

Emergency preparedness

With respect to emergency preparedness activities, the focus is on ensuring that the bilateral agreement between Norway and Russia on early notification of nuclear accidents and information exchange on nuclear facilities functions in the best possible manner. This work requires continuous cooperation on practical



The ship "Lepse", moored at a quay near Murmansk, is used as a storage vessel for spent fuel from nuclear-powered ice-breakers.
Photo: Norwegian Radiation Protection Authority

early notification routines, the early notification threshold, cooperation on exercises and regular information exchange. Closer contacts have been established between the Norwegian Radiation Protection Authority and the Federal Atomic Energy Agency (i.e. the competent authorities) with an intention to strengthen the practical implementation of the agreement. The objective is to lower the early notification threshold and to harmonise early notification routines with new international standards in this field. Norway considers it important to maintain and develop nuclear emergency preparedness in correspondence with the intentions of Report No. 17 (2001-2002) to the Norwegian parliament on the Safety and Security of Society and Report No. 39 (2003-2004) entitled "Public security and civilian-military collaboration".

Treatment of spent reactor fuel

The treatment of spent reactor fuel is the most important, but possibly also the most difficult, aspect of the nuclear safety effort in Russia. Various measures funded by Norway and other Western countries address the handling of spent nuclear fuel. They refer *inter alia* to the dismantling of decommissioned nuclear submarines. Spent reactor fuel is also the

problem onboard the Lepse, a ship used to store large quantities of spent nuclear fuel. The Lepse is berthed at Atomflot's facility in Murmansk. Once the operation to clean up the storage facility in Andreyev Bay starts, spent nuclear fuel and solid and liquid radioactive materials will be made safe and transported elsewhere. Spent reactor fuel is currently transported to the facilities in Mayak for further treatment and reprocessing.

Russia has long had plans to close its nuclear fuel cycle. In a closed cycle spent nuclear fuel is reprocessed, allowing uranium and plutonium to be recovered and remanufactured into new reactor fuel. In an open cycle the spent fuel is disposed of directly without recovery of uranium and plutonium. Russia has all stages of its nuclear fuel cycle on its own territory - including uranium extraction, enrichment, fuel manufacture, intermediate storage of spent fuel, reprocessing and use of reprocessed uranium and plutonium. The basis for Russian policy in this field is that spent nuclear fuel is a recoverable resource rather than a waste product. The aspects of the fuel cycle that are most likely to have a local impact and affect Norwegian interests in the north are reprocessing and storage, possibly also disposal of spent fuel, particularly from military activity. Reprocessing may produce emissions to the Kara Sea via Russian river systems. Intermediate storage or disposal of spent fuel could also affect Norwegian interests. In addition to its potential environmental consequences, such material may also involve safety aspects since it can be used for arms purposes.

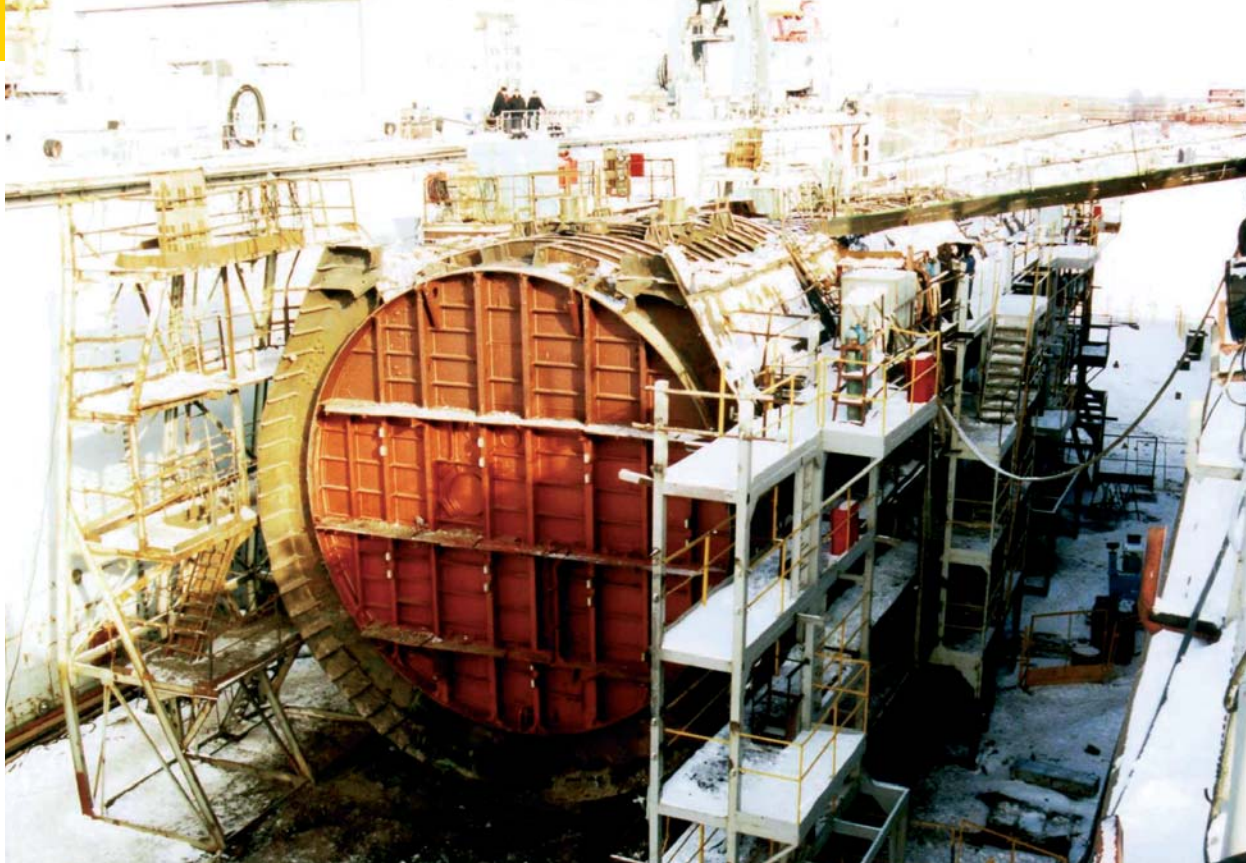
Dismantling nuclear submarines

Dismantling nuclear submarines has a high priority in the international nuclear safety effort. These submarines represent both an environmental problem and a more general security risk that nuclear materials which can be used for weapons purposes may go astray. The work programme includes complicated and demanding projects. In 2003 Norway signed contracts for the dismantling of two non-



A Viktor II submarine before the dismantling at a shipyard at Zvezdochka using Norwegian finances. Photo: Zvezdochka shipyard

strategic nuclear submarines. One was dismantled at the Nerpa shipyard on the Kola Peninsula, the other at the Zvezdochka shipyard in Severod-



The reactor section of the Victor II submarine is separated from the submarine, sealed and prepared for transport to Saida Bay for storage.
Photo: Zvezdochka shipyard.

vinsk, outside Archangel. The project was evaluated in May 2004, including an independent impact assessment, prepared by a British consultancy. In Autumn 2004 dialogue started in relation to the dismantling of a yet another nuclear submarine, namely a Victor III class submarine at Nerpa.



Saida Bay. Photo: Zvezdochka shipyard.

It is expected that the contract for this work will be signed in the spring of 2005. The planning and follow-up of this work has been conducted in close cooperation with British Authorities who are financing the dismant-

ling of a similar submarine at Nerpa.

Dismantling of submarines comprises many stages involving a variety of actors, risk levels and environmental implications. Norway was the first country to initiate collaboration with Russia on dismantling non-strategic nuclear submarines. By financing the dismantling of submarines, the Norwegian authorities are helping to remove a threat to the environment and to reduce the risk of nuclear materials going astray. Dismantling such nuclear submarines is a priority for Russia and for the G8 partnership.

Norway was also the first country to be able to report project experience from two different shipyards. The environmental impact evaluation of the above mentioned project is of key importance in this context. Exchange of experience with other countries that ultimately participate in this type of project is also very important.

Dismantling generates considerable quantities of environmentally hazardous waste including radioactive solid and liquid wastes, which is handled and stored at shipyards. Inspections of the implementation of the Norwegian submarine project in the winter of 2003-2004 brought to light improper treatment of hazardous waste. This aspect of the dismantling process was evaluated and is carefully considered in connection

with new dismantling projects.

Spent fuel from the nuclear submarines is transported to Mayak PA for reprocessing. When fuel is removed, the reactor section is separated from the submarine, sealed and transported to Saida Bay for storage. The Mayak facilities play a key role in Russia today. In addition to reprocessing spent nuclear fuel they also handle and store large radioactive sources, including radioisotope thermoelectric generators (RTGs) that are used as a power source in some Russian lighthouses. Reprocessing spent nuclear fuel at Mayak entails routine discharges of medium active waste to the heavily polluted Karachay Lake. This lake, situated within the Mayak plant site, poses a major contamination threat, especially via groundwater. There is also a steady supply of radioactivity to the river systems as a result of leakages from reservoirs and inflow from previously contaminated marsh areas and riverbanks along the River Techa.

More knowledge is required about the possible consequences of operating this facility, and of possible alternatives to reprocessing. There is also a need, internationally and domestically, for further verification of whether temporary storage could offer an alternative to reprocessing. Russia currently has insufficient



Measurement and sampling near Building 5 at Andreyev Bay which is, at the present time, heavily contaminated. Photo: SevRao.

capacity for temporary storage. Finding alternative locations, technical solutions and actual construction will take many years. Knowledge of future options regarding treatment and storage of spent nuclear fuel in Russia is in short supply. The Ministry of Foreign Affairs has therefore asked the Norwegian Radiation Protection Authority to take these issues into consideration in the context of further project collaboration with Russia.

By the start of 2004 a total of 192 nuclear submarines had been decommissioned in Russia, 116 of them in the Northern Fleet. Half of them were dismantled. Thirty-six of the remaining 58 still have spent fuel on board. Many of the non-strategic nuclear submarines are in very poor condition, and are filled with polystyrene (isopor-like beads/foam) to keep them afloat until they are dismantled. In the period 1986-1998 they were dismantled at a rate of three per year. Thanks to increased appropriations and infrastructural improvements this figure has gradually risen to a rate currently averaging 15 submarines per year. Russia is financing the major part of this effort itself.

Andreyev Bay

The largest storage sites for spent submarine fuel in Russia are located in Andreyev Bay, just 50 km from the Russian-Norwegian border. The spent nuclear fuel is stored under very poor conditions and the surrounding land,

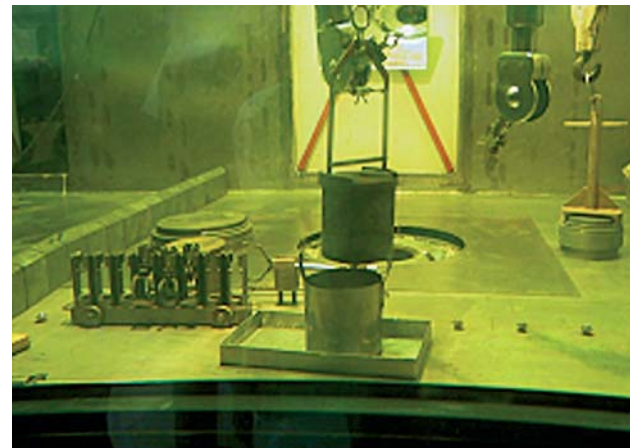
buildings and fjord are radioactively contaminated. It is important for the clean-up process to be rapidly implemented in order to prevent further pollution of the environment and to ensure that the spent nuclear fuel is handled under a controlled regime and is properly stored.



Storage tanks for spent fuel at Andreyev Bay. Photo: SevRao.

The infrastructure at the base has fallen into disrepair. Measures funded by Norway have referred to infrastructure and surveys of surface pollution in the area. The objective for the Norwegian input with regards infrastructure is to adjust the conditions so that clean-up work can be initiated. At a meeting between Head of Section Sergey Antipov from the Russian Atomic Energy Agency (Rosatom) and Norwegian Deputy

A radioactive source is removed by VNIITFA – the National Institute for Research on Technical Physics and Automation based in Moscow. Photo: County Governor of Finnmark.



Minister Kim Traavik from the Ministry of Foreign Affairs in Moscow, in February 2005, the Norwegian side expressed a willingness to take the main responsibility to finance work related to the physical security at Andreyev Bay.

Two factors are particularly important for Norway's further commitment in Andreyev Bay. First, Russia needs to draw up an overall plan for further work at the facility. The time frame and the total clean-up costs cannot be estimated until such a plan is in place. Furthermore, it will clearly take several years to remove the spent nuclear fuel since special equipment is required, along with an adequate infrastructure.

Another important factor for Norway's further commitment concerns contributions from other countries. Work pertaining to infrastructure and physical security must be conducted through close dialogue with the other actors involved in operations at Andreyev Bay, such as the UK and Sweden who are in the process of elucidating plans for spent fuel and radioactive waste respectively. Establishment of the international Coordination Group for Andreyev Bay in the Autumn of 2004 was an important measure to ensure a coordinated input. Rosatom lead the group and Norway participate with



An RTG complete with encapsulation unit and electricity supply. Photo: Norwegian Radiation Protection Authority.

other donor countries including the UK and Sweden.

Aside from international efforts, it is essentially Russia that decides the progress made in Andreyev Bay. It is important that Russia does all that is required to enable the work to be completed in a proper, open and safe manner.

Andreyev Bay, in Russia, is located 50 km from the Norwegian border on the route between Kirkenes and Murmansk. A facility for extraction and storage of spent nuclear fuel from the Russian navy's nuclear-powered ships and submarines was established here in the 1960s. The locality also contained a facility for handling and storing radioactive waste. After active operations in the area were terminated in the 1980s in the wake of accidents and leakages, maintenance has been minimal and the situation is now grim. Operational responsibility for the area is in the hands of the Atomic Energy Ministry (Minatom). In 2001 Minatom set up two bodies (SevRao and DalRao) within its organisation structure to take care of and clean up former military areas in north-west Russia and the Far East. SevRao has day-to-day responsibility for operations in Andreyev and for implementing clean-up projects.

Removal and waste treatment of radioactive sources in lighthouses

A considerable number of radioactive sources are present in Russia and in the former Soviet republics. These sources have been used for various purposes, including medicine, industry, research and agriculture. Many of them are poorly protected and represent a threat to the environment and international safety. Protection of radioactive sources is a priority of the G8 partnership.

Along the Russian Arctic coastline there are hundreds of lighthouse lamps powered by strontium batteries (RTGs) that pose a local pollution hazard. According to the Federal Atomic Energy Agency, there were more than 750 RTGs in Russia as of February 2005. The absence of physical protection makes these radio-



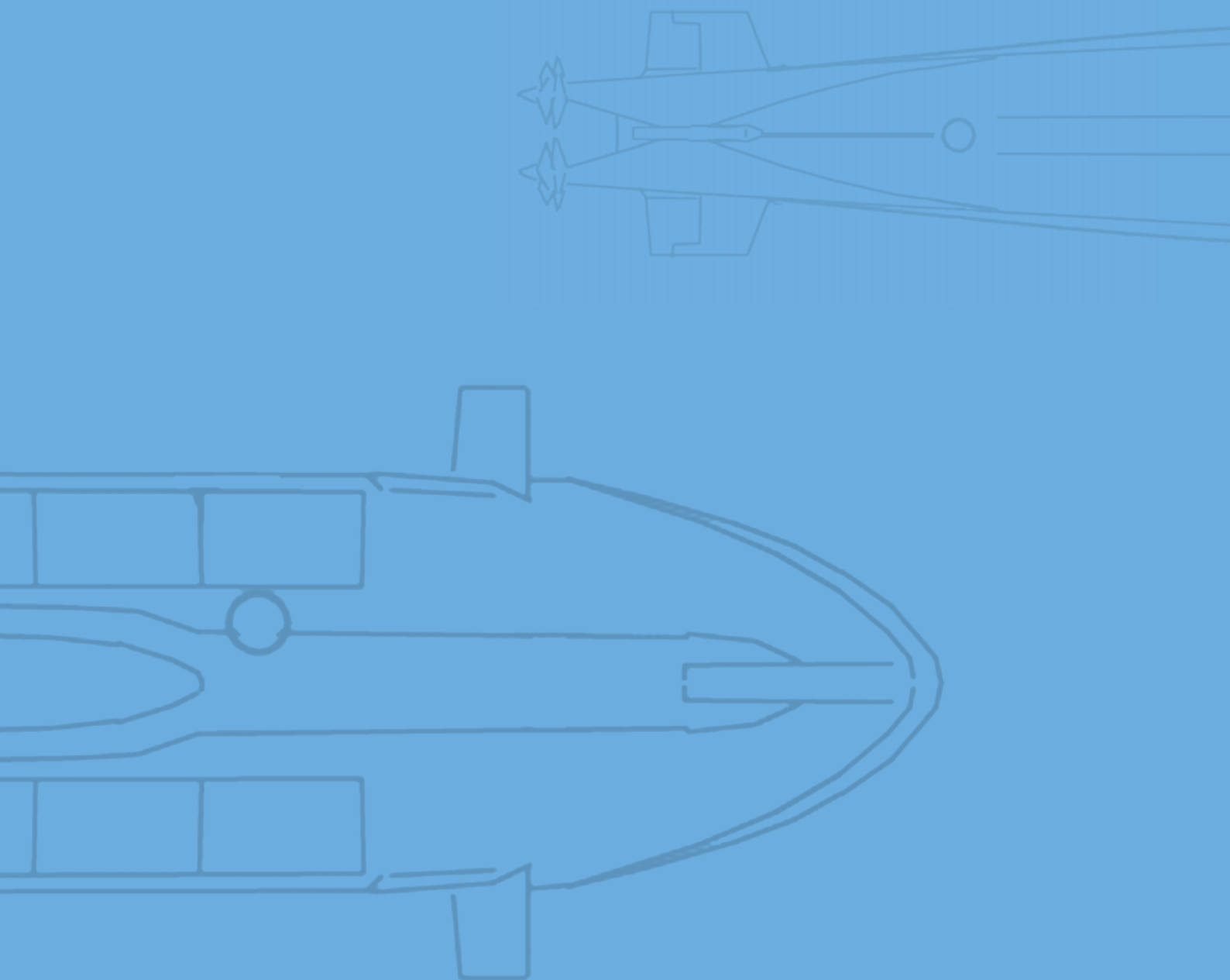
active sources readily accessible to unauthorised persons. A series of attempted thefts of the metal insulation materials surrounding the strontium sources has demonstrated this. An inspection of lighthouse lamps in eastern Siberia conducted by Russian experts revealed that many lighthouse lamps were in a poor state of repair and that no complete inventory existed of where they are located. The RTG situation needs therefore to be brought under control.

Removing the RTGs and replacing them with solar cells reduces the danger of environmental radioactive contamination and makes them more secure. So far the total number of sources removed from Murmansk county is 65, while solar panels is installed in 37 lighthouse lamps.

A necessary long-term goal is the removal of all strontium batteries in Russian lighthouse lamps close to the Norwegian border and to replace them with solar panels. At a rate of 20 units per year this will take about eight years. In February 2005, The Minister of Foreign Affairs signed an international agreement with Russia

with the goal to remove all remaining RTGs in Murmansk, Arkhangelsk and Nenets. There are plans to remove 31 RTGs in 2005 with Norwegian financial support and the County Governor in Finnmark is project leader for this work. In February of 2005, the Ministry of Foreign Affairs, in collaboration with the NRPA and Finnmark's County Governor, arranged an international CEG-workshop, on the removal of RTGs, wherein 80 individuals from 11 nations participated. There is now a great international willingness to contribute towards the removal of these radiostrontium sources in Russia and one of the results from the workshop was an initiative tabled to establish an international coordination group on this theme.

Lighthouse lamps along the coastline are powered by radioisotope thermoelectric generators (RTGs) based on radioactive strontium-90 sources. RTGs are also used as power sources for radio beacons and weather stations and are found across wide areas of Russia and other former Soviet states. The RTG-powered lighthouse lamps on the Kola Peninsula are owned and operated by Mintrans or the Northern Fleet.



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