Norwegian government action plan for nuclear activities and the environment in northern areas

Report
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NORWEGIAN MINISTRY
OF FOREIGN AFFAIRS

Statens strålevern
Norwegian Radiation Protection Authority

Reactor sections ready for transport to Saida Bay. Photo: Norwegian Radiation Protection Authority
Cover photo: Submarine 291 being loaded onboard the transport vessel Transshelf on 4 September 2006 before transport to Shipyard 10. Photo: The Norwegian Defence Research Establishment (FFI).

The work with nuclear safety is producing results

Nuclear safety in the north is an important part of our collaboration with Russia. For quite some time, we have been contributing to projects for the dismantling of scrapped nuclear submarines, handling of spent reactor fuel from the submarine and nuclear icebreaker fleets, as well as other solid and liquid radioactive wastes. In particular, the safety of the ageing Kola nuclear power plant continues to be an important part of our long-term co-operation. Norway's efforts and collaboration with Russia over fifteen years have yielded good results.

It has been crucial that broad international commitments have been established to contribute to the resolution of these issues. Many countries are participating in the work and good co-ordination and collaboration arrangements have been formed. In 2002, the G8 countries established a partnership against the spread of weapons and materials of mass destruction. Norway is participating in this partnership. One of it's primary goals is to prevent such materials going astray and being used in terrorist attacks. However the G8 countries are also, like Norway, heavily involved in the environmental aspects of the work too.

Collaboration involving the Northern Dimension's Environmental Partnership has established a fund for increasing nuclear safety in Northwest Russia. Money from this fund has made it possible to perform a comprehensive amount of planning for the challenges being faced concerning nuclear safety in Northwest Russia, creating a so-called master plan. The fund will finance a number of important measures in the region in the years to come, including important work such as the safe decommissioning of the cargo ship Lepse.

The Norwegian-Russian collaboration takes place today within a framework different from that of only just a few years ago. A number of new countries have joined the co-operation, in which Russia's own efforts have increased substantially in recent years to the point where they are now quite comprehensive. A number of Norwegian and international NGOs have also become involved in the work concerning nuclear safety with Russia, and are making valuable contributions.

The problem concerning nearly 200 scrapped nuclear-powered submarines, mostly in Northwest Russia, is well on the way to being solved with substantial efforts by the Russians themselves as well as assistance from donor countries; according to the plan, by around 2010 in fact. Along the Russian coast of the Barents Sea, Norway is involved with the removal of the radiation hazards posed by the use of strontium batteries in 180 lighthouses and navigational beacons. Our expectations are that the last of the remaining strontium sources will be removed and replaced with environmentally friendly energy sources during the course of 2009.

Safe handling and deposition of spent nuclear fuel and radioactive waste is the primary activity at Andreyev Bay, around 45 kilometres from the Norwegian border. We have been working at Andreyev Bay since 1997. Since then, Norway has established large-scale international co-operation in order to solve the problems there, however a great deal still remains to be done before we can put these problems behind us.

The increased efforts in the northern regions also poses some requirements. Closer Norwegian-Russian co-operation brings with it the need for information about potential threats as well as of level of Norwegian nuclear preparedness.

Our activities during 2006, 2007 and 2008 are described in further detail in this publication. They show that the pace of the co-operation has intensified and that some important tasks are drawing near to completion.

Several of the items upon which Norway has been placing a primary emphasis will be completed around 2010. This is extremely encouraging. Therefore the strategy for our further work, our so-called action plan, has been reviewed and revised. In the plan, it is firmly established that it is important to have close and long-term co-operation with Russia concerning nuclear safety as long as there are nuclear activities and sources of pollution in areas nearby us. The clean-up at Andreyev Bay is being highlighted as the most important area for us to focus on in the near future. The work is characterised by continuity and stability, and will continue to have a long timeframe.

Elisabeth Walaas,
State Secretary,
Norwegian Ministry of Foreign Affairs

Action Plan for Nuclear Safety

Both photos: from an exercise at the Leningrad Nuclear Power Plant in September 2007. Photo: Norwegian Radiation Protection Authority.

The concentration of nuclear installations and the accumulation of radioactive waste and spent nuclear fuel in Northwest Russia represent a potential danger in the form of radioactive pollution. Events involving these sources may also impact stakeholders situated outside Russia's borders. A serious accident at the Kola nuclear power plant could result in serious health-related problems as well as long-term consequences in nearby areas. Accidents or leaks from other types of installations or deposition sites may also result in serious injuries nearby the individual facility and pollute the external environment. Experiences have shown that suspicions and rumours concerning radioactive contamination would be able to inflict substantial damages on Norwegian economic interests. The handling of radioactive material also involves a risk that highly radioactive or fissionable material could go astray.

Report No. 34 (1993-94) to the Norwegian Parliament entitled "Nuclear activities and chemical weapons in areas adjacent to our northern borders" provided a good overview of risks associated with nuclear activities in northern areas. The Norwegian parliament then recommended that the government draw up an action plan containing concrete follow-up measures. The action plan was initiated in 1995 and revised in 1997, 2005 and 2008.

The government's Nuclear Action Plan emphasises that co-operation with Russia on nuclear safety must be long-term in nature. It must contribute to reducing the risk of accidents and pollution from nuclear installations in Northwest Russia and preventing radioactive and fissionable material from going astray. The collaboration must also contribute to strengthening the Russian administrative and supervisory authorities in the areas of nuclear safety, radiation protection, preparedness and environmental monitoring.

The government's action plan for nuclear activities and the environment in northern areas, known as the Nuclear Action Plan, is the most important management tool of the Norwegian authorities in their nuclear safety work with Russia.

The Norwegian-financed measures under the action plan are multifaceted and vary in their structure and composition. They have also changed in character, from a bilateral assistance project to a partnership between co-operating partners, as Russia's economic situation has improved quite considerably in recent years. At the same time, the activities have become multilateral, as a consequence of other Western actors having become heavily involved in the work with improving nuclear safety in Northwest Russia. This has created possibilities for the commitment of greater resources, while at the same time imposing increased requirements for international co-ordination.

As of January 2009, Norway has granted just over NOK 1.4 billion for nuclear safety work in Northwest Russia. The intent is to reduce the risk of accidents at Russian nuclear power plants in areas

adjacent to our borders and to ensure the safe handling and deposition of radioactive material and spent nuclear fuel. During the period spanning 2006-2008, a total of NOK 305 million was granted for new measures.

An important part of the quality assurance for projects under the auspices of the action plan is to have risk and impact assessments made during the planning phase. This allows measures to be carried out with the least possible risk. These processes also contribute to strengthening the contact and collaboration between the respective technical and administrative agencies in Norway, Russia and other countries.

Co-operation between authorities

Norwegian and Russian radiation protection authorities on a visit to the Idaho National Laboratories, USA, in 2007. Photo: Idaho National Laboratories.

Nuclear safety co-operation with Russia is built on bilateral collaboration agreements between Norway and Russia. The Norwegian Ministry of Foreign Affairs is the responsible ministry. The collaboration agreement between the Norwegian Ministry of Foreign Affairs and Rosatom of 5 December 2006 comprises the present basis. The parties meet every year in the Bilateral Commission for Nuclear Safety in order to review the status of the collaboration and to discuss future strategies. The commission is managed at the State Secretary/Deputy Director General level at the Ministry of Foreign Affairs and Rosatom respectively.

The Norwegian Radiation Protection Authority (NRPA) is Norway's authority in the fields of radiation protection and nuclear safety. It is a subordinate entity of the Norwegian Ministry of Health and Care Services. For the execution of the government's Nuclear Action Plan, the Norwegian Radiation Protection Authority serves as the directorate for the Ministry of Foreign Affairs. The Norwegian Radiation Protection Authority also serves as the directorate for the Norwegian Ministry of the Environment in the field of radioactive contamination of the external environment. The Norwegian Radiation Protection Authority conducts extensive collaboration with a number of Russian governmental agencies and supervisory authorities. See page 18 for an overview of the agreements.

Norway desires, through active collaboration with Russian supervisory authorities, to contribute to strengthening their role, thereby contributing to improved administration in the fields of environmental protection, radiation protection and nuclear safety in Russia. The collaboration must address considerations involving health, safety and the environment. A significant part of the collaboration involves an underlying understanding of and a contribution to a heightened culture of safety, which is built upon risk and impact assessments. This has great significance to Norwegian emergency preparedness. Activities under the Norwegian-Russian Environmental Protection Commission are at the core of the collaboration between the respective authorities.

The following are important actors in the collaboration:

The Russian Federal service on ecological, technological and nuclear supervision (Rostekhnadzor)

The NRPA has collaborated with Rostekhnadzor since 1997. The collaboration has involved regulation, safety assessments, inspections and preparedness, including in connection with the removal of strontium batteries posing a radiation hazard. Supervision and inspection are important themes of the collaboration.

The Russian Federal Medical-Biological Agency (FMBA)

A co-operation agreement was signed in Moscow between the

Signing of the agreement between the Norwegian and the Russian Ministries of Health in November 2008. Signing are, from the left, Ole Harbitz and Vladimir Uiba. Photo: Norwegian Radiation Protection Authority.

Norwegian Ministry of Health and Care Services and the Russian Ministry of Health and Social Development in November 2008. The signing was performed by the NRPA and the FMBA on behalf of the respective health ministries. The agreement lays a good foundation for the established collaboration between the FMBA and the NRPA, which began in 2002. The primary focus up to now has been on radiation protection of workers and the population in connection with clean-ups at Andreyev Bay and Gremikha, with an emphasis on protecting health and the environment. The collaboration agreement provides a greater possibility for broad co-operation concerning the health-related effects of radiation, a technical field in which Russia is among the world leaders.

Rosatom (previously the Ministry for Atomic Energy of the Russian Federation)

Rosatom is the contracting counterparty in Russia to the Norwegian Ministry of Foreign Affairs. The NRPA is collaborating with Rosatom on aspects of preparedness, where further development of early warning procedures is one area of interest. Norway has had comprehensive co-operation with Rosatom on environmental projects at the Mayak nuclear plant in the Southern Urals. In the future, Norway wishes to focus on precisely which consequences the current activities have for health and the environment, with an emphasis on emissions of radioactive substances and environmental contamination.

The Russian Ministry of Defence, Departement of the State Supervision for Nuclear and Radiation Safety

A collaboration agreement between the NRPA and the Department of Radiation Safety of the Ministry of Defence was entered into in December 2007. Via this co-operation, knowledge has been accumulated about Russian regulations and the manner in which they are implemented at decommissioned Russian military installations. A continuous dialogue with various Russian authorities contributes to increased knowledge of the rules and requirements in both Russia as well as internationally.

Regional authorities in Northwest Russia are a part of the comprehensive co-operation on the part of governmental authorities. There is particularly close co-operation between the Norwegian County Governor in Finnmark and the Russian County Administration in Murmansk.

Co-operation on emergency preparedness

The work on emergency preparedness focuses on implementation of the bilateral agreement for early warning that Norway has with Russia. During the course of 2006-2008, the NRPA made visits to Rosatom's crisis centre in St. Petersburg as well as the crisis centre for the Governor in Murmansk. The NRPA has participated in preparedness exercises at the Leningrad nuclear power plant, at the Zvezdochka shipyard in Severodvinsk and in Energoatom's annual nuclear power exercise.

The NRPA chairs the NCACG (the National Competent Authority Co-ordinating Group), which together with the IAEA Secretariat has the responsibility for implementing the international action plan for emergency preparedness. This work will be concluded at the end of 2009, and will form a foundation for better international preparedness for potential nuclear events, both accidents as well as terrorist attacks.

Co-operation on environmental monitoring

The NRPA has entered into a collaboration agreement with the Russian state research institute Roshydromet concerning investigation of radioactive contamination in the Barents Sea.
The agreement, which lasts for three years (2005-2008), covers measurements and exchanges of data describing the degree of radioactive contamination in the marine environment in the open Barents Sea and along the coast. Work is being done on proposals for extending the collaboration agreement beyond 2008.

Fire fighting exercise at Leningrad nuclear power plant.
Photo: Norwegian Radiation Protection Authority.

Removal and safe deposition of strontium batteries posing radiation hazards

The radioactive sources from RTGs are sent to the facility at Mayak for final deposition. Photo: County Governor of Finnmark.

RTG is an abbreviation for "radioisotope thermoelectric generator". The radioactive part of the generator contains the substance strontium-90. This strontium isotope functions as a heat source; the temperature difference with its surroundings is exploited to create an electrical current in a thermoelectric element. RTGs have been utilised for a number of purposes where other energy sources have not been available.

In the former Soviet Union, approximately 1000 such energy sources were installed, most of them in lighthouses and navigational beacons. Around two-thirds of them have now been removed. A lack of physical security for the energy sources makes them easily accessible to intruders. A number of attempted thefts in recent years have shown that the radioactive sources can go astray. By removing the sources and replacing them with solar cell technology, the danger of contaminating the environment as well as of them going astray is reduced.

Since 1998 Norway has, in consultation with the Russian authorities, financed the removal of RTGs and replaced them with environmentally friendly solar cell technology. The project manager on the Norwegian side is the County Governor of Finnmark. In 2005, Norway and Russia entered into a Memorandum of Understanding in which Norway declared its intention to assist Russia in removing all 180 RTGs along the coast of the Barents Sea to the Kara Passage, including the western side of Novaya Zemlya. The work is on schedule to be completed during the course of 2009.

At inaccessible locations, the RTGs must be shipped out using helicopters. Photo: County Governor of Finnmark.

Reloading RTGs from ships onto special trains at RTP Atomflot in Murmansk. Photo: County Governor of Finnmark.

Lighthouse with solar cell panels. Photo: County Governor of Finnmark.

As of 1 January 2006, there were 84 RTGs in the Murmansk, Arkangelsk and Nenets regions, including Novaya Zemlya. During the autumn of 2006, six RTGs were removed from the area by the White Sea and shipped to Moscow for dismantling and subsequent shipment of the heat sources to the waste depository in Mayak. All of the lighthouses were subsequently equipped with solar cell panels. In 2007, the final 21 RTGs from Archangel as well as some from Novaya Zemlya were removed. Most of them were replaced with solar cells during the autumn of 2008. In 2008, a total of 46 RTGs in the county of Nenets and on Novaya Zemlya were removed. These will be replaced with solar cell technology during 2009. The plan is to remove and replace the remaining 11 RTGs on Novaya Zemlya during 2009. This will result in the RTG replacement work in Northwest Russia being concluded in 2009, with a total of 180 RTGs having been removed.

The objectives of the RTG replacement work have been to

- avoid radioactive contamination of the marine and terrestrial environments
- replace RTGs with environmentally friendly solar energy panels
- prevent unwanted access to sources of radioactivity

There is substantial international interest in contributing to the removal of these strontium sources in Russia and an international co-ordinating group has been established, chaired by Rosatom. The objectives of the co-ordination work include promoting collaboration where such is possible and avoiding any duplication of efforts. The co-ordinating group meets regularly.

In addition to Norway, the US, France and Canada have also contributed to the work. Furthermore, Canada and France have contributed to the financing of Norwegian projects in order to gain experience before they have further developed their own commitments. Damaged RTGs have also been included in the replacement work. The handling of damaged RTGs is complicated. It has been necessary to manufacture special containers, developed with Norwegian financing, that will also be of benefit to the commitments of other countries.

Regulatory co-operation

One important objective has been to upgrade the existing body of regulations in Russia concerning RTGs, with an emphasis on the following prioritised areas:

- development of requirements and regulatory codes
- risk assessment in relation to licensing of the activity and authorisation of involved personnel
- supervision for radiation protection and safety
- supervision for emergency preparedness
- physical protection during the decommissioning of RTGs
- impact assessment of the removal, transport, interim storage and dismantling of RTGs

Reloading RTGs from ships onto special trains at RTP Atomflot in Murmansk. Photo: County Governor of Finnmark.

One tangible result of the work with the governmental authorities, has been the introduction of legal requirements in Russian federal norms and rules concerning emergency preparedness during transport of radioactive sources.

Increased safety at Andreyev Bay

Guard post, entrance to the Andreyev Bay facility. Photo: Norwegian Ministry of Foreign Affairs.

Andreyev Bay, approx. 45 km from the Norwegian-Russian border, was a base established in the 1960s for the extraction and deposition of spent nuclear fuel from the nuclear-powered ships and submarines of the Russian navy. The facility houses large quantities of spent nuclear fuel from approx. 100 nuclear submarines, as well as solid and liquid radioactive waste. After its active operation was ended in the 1980s largely due to accidents and leaks, there has been minimum maintenance. The area is extremely contaminated. From the Norwegian side, a large number of measures have been carried out since 1997 in order to improve the situation. Norway has financed measures so far totalling around NOK 130 million. The measures are co-ordinated contributions to an international partnership to clean up the site. The most important objective is to safely remove the large quantities of spent nuclear fuel.

The restoration of Andreyev Bay is important to Norwegian health, environment and commercial interests. The comprehensive safeguarding and restoration of Andreyev Bay, which has now been commenced, will in the long run reduce the risk of radioactive contamination and of radioactive material falling into the wrong hands. From a radiation-related viewpoint, this is most important and a primary reason that Norway is making these commitments at Andreyev Bay.

Protection of the external environment against contamination from the facility was an early problem to be addressed, which led to Norway financing a drainage project in order to prevent radioactive contamination of the marine environment. Surveying of the contamination in the soil at the facility has been extremely important to being able to plan suitable measures as well as the use of the areas. Securing the area externally and improving the access controls have also been a central focus of our involvement.

One of the objectives of the infrastructure development has been to establish the necessary infrastructure to prepare for further remediation measures, expand technical installations, remove the fuel and clean up the waste at Andreyev Bay. Many of these measures were carried out while solutions for

Dry storage tanks for spent fuel. Photo: Norwegian Radiation Protection Authority.

the actual fuel and waste handling were being assessed.

In recent years, a broad international partnership led by Russia has been developed to manage the comprehensive and expensive challenges the facility poses. It has thus been necessary to divide the work between the countries involved. Norway's efforts concerning infrastructure are co-ordinated with the commitments of other countries in other specialised areas at Andreyev Bay.

In this collaborative effort, the UK is focusing on solutions removing the spent fuel, including the erection of buildings for handling the fuel. Italy and Sweden are concentrating on the handling of solid and liquid radioactive waste at the facility, including the upgrading of buildings and other necessary structures. Italy is also financing a new specialised ship for transporting the spent fuel and waste out of Andreyev Bay. The environmental fund under the Northern Dimension's Environmental Partnership (NDEP) is financing cranes and a number of technical installations. The fund is also financing the demolition of building No. 5, which previously housed the spent nuclear fuel.

During the period spanning 2006-2008, Norway has financed measures that have secured the area with fences and alarm systems. This has led to a significant reduction in the risk of radioactive material going astray. Norway has also financed upgrades to roads, water supplies and drainage, and erected buildings, for example guard booths and dressing room facilities, that are necessary in order for the clean-up to be performed under secure conditions for those who work there. The quay facility has been repaired in 2007-2008, and documentation and planning have been performed for the supply of electrical power. The County Governor of Finnmark, who is the Norwegian project manager, has performed the projects together with the Russian unit responsible for waste clean-up (SevRAO) and the County Administration of Murmansk.

After the quay facility has been completed, the Norwegian commitment will focus on the planning and expansion of the water supply, drainage, run-off and surface water systems, the supply of

Erection of administration building. Photo: County Governor of Finnmark.

Measurement of radioactivity at Andreyev Bay. Photo: SevRao.

The quay facility at Andreyev Bay was repaired in 2007-2008. Photo: County Governor of Finnmark.

Dressing room for the employees. Photo: County Governor of Finnmark.

From an emergency preparedness exercise at Andreyev Bay. Photo: SevRAO.

electrical power and its distribution in the part of the facility where the clean-up work itself is to be performed. The plans are to erect a number of buildings and installations here that will be extremely important to being able to carry out the work of removing the spent nuclear fuel.

Regulatory co-operation

During 2006-2008, the collaboration between the Norwegian Radiation Protection Authority and the FMBA (the Russian medical authority) has increased. The FMBA is the responsible regulatory authority in Russia for radiation protection and radioactive contamination in Andreyev Bay.

Various projects have been carried out to improve radiation protection for the workers, the population and the environment, to improve preparedness and to prepare criteria for the deposition of low-level radioactive waste at the site.

One of the projects currently underway is the so-called DATAMAP project, which will develop a database for radioecological data at Andreyev Bay. This extends the project that the Norwegian Radiation Protection Authority has been involved in to establish a map of the contamination.

In conjunction with a visualisation program, this will be used as a basis for the clean-up work in the near future. Together with the FMBA, a project has been launched with the intent of establishing a new category of waste: "very low-level radioactive" waste at Andreyev Bay. The development of such a category will contribute to more efficient handling of waste at the site. In 2007, a brochure was prepared in Russian in order to provide better information on the problems at Andreyev Bay and on the challenges the regulatory authorities are facing.

Meetings of the international co-ordinating group for Andreyev Bay, which is chaired by Rosatom, are held regularly. Countries and organisations with actual projects at Andreyev Bay participate in the group: The UK, Sweden, Italy, Norway, the EU and the EBRD (The European Bank for Reconstruction and Development).

Norway has financed measures that have secured Andreyev Bay with fences and an alarm system. Photo: County Governor of Finnmark.

Scrapping nuclear submarines

Unloading of spent fuel from Victor-III class submarine, No. 297. Photo: Nerpa shipyard.

At the end of the 1980s and into the 1990s, continually increasing numbers of Russian nuclear submarines were taken out of service due to their age and reduced activity. In total, 198 submarines were taken out of service, with 120 of these being in Northwest Russia. The submarines represented a danger of accidents and shipwrecks, and constituted a threat to the marine environment, in addition to representing a risk for the abuse and proliferation of radioactive material. No immediate solution existed to the problem of how the submarines should be handled. The problem received increasingly greater attention throughout the 1990s. It involves complicated and demanding projects for securing and handling spent fuel and radioactive waste. The dismantling of nuclear submarines has had a high priority in international work on nuclear safety, something that resulted in a large international clean-up action. As at September 2008, there were only 5 submarines that had not had financing commitments and been included in a schedule for dismantling in the near future.

A number of countries have contributed to solving this problem, which seemed enormous at the end of the 1990s. The US in particular has contributed to the decommissioning of strategic submarines. Canada, the UK, Italy, Japan, South Korea and the EBRD have, along with Norway, provided significant contributions to the dismantling. Regardless, it is Russia itself that has provided by far the greatest contribution. Norway has as of January 2009 financed the dismantling of four nuclear submarines of the Victor class. The fifth and last Norwegian financed dismantling project started in 2008 and is projected to be completed during the summer of 2009.

In May 2003, the Norwegian Ministry of Foreign Affairs entered into negotiations with the Zvezdochka shipyard in Severodvinsk and the Nerpa shipyard in Murmansk about the dismantling of two Victor-II submarines, No. 627 and No. 625 respectively. Contracts were signed with the shipyards in the autumn of 2003. An external environmental impact assessment of the projects was performed at the same time. The work of the shipyards with the dismantling itself and the radiation protection was followed up by regular inspections of the shipyards, performed by the Ministry of Foreign Affairs. The projects were concluded in the summer of 2004, with conventional floating storage of the reactor sections at Saida Bay.

The Ministry of Foreign Affairs decided in the autumn of 2004 to dismantle a Victor-III submarine, No. 297 at the Nerpa shipyard in parallel with a corresponding Victor-III, No. 296, being financed by the British Department of Trade and Industry. The Ministry of Foreign Affairs decided at the same time that the project management should be assigned to an external contractor. Rambøll Storvik entered into a framework agreement with the Ministry of Foreign Affairs, and has had the project management for all the subsequent projects. Norway and the UK collaborated on preparing joint documentation for the projects with submarines 296 and 297, while the dismantling work itself was performed as two independent projects. The contract for the work was signed in the spring of 2005, and the project was concluded with the placement of the reactor section in floating storage at Saida Bay in the spring of 2006.

After consultations with

Viktor-I class submarine 609 in the dismantling hall. Photo: Nerpa shipyard.

Rosatom, Norway entered into a contract with Nerpa in March 2006 on dismantling a fourth nuclear-powered submarine, Victor-I class No. 609. It was decided that the submarine should be dismantled for direct storage on land at Saida Bay. Submarine 609 was thus the first foreign-financed dismantling where the reactor was prepared for this new type of land-based storage. The reactor was transferred to the land-based facility during the summer of 2007. South Korea contributed to the financing of this project, providing approx. 10 % of the contracted costs.

On the basis of an event in 2003 in which the Russian submarine K-159 sank while being towed on pontoons, AMEC (the Arctic Military Environmental Cooperation, in which Russia, Norway, the UK and the US are participants) committed itself to developing more secure methods for transporting scrapped submarines. The collaboration resulted in submarine No. 291 being transported in September 2006 with the heavy lifting vessel Transshelf from Gremikha to naval shipyard No. 10 at Polyarny in the Murmansk region. The transport was financed by Norway. The Norwegian project manager was the Norwegian Defence Research Establishment (FFI). The submarine was subsequently transferred to Rosatom's responsibility, and it was decided that the dismantling be performed under civilian auspices. This is the only dismantling of November-class submarines that was performed with Western financing.

The spent nuclear fuel in the submarine was removed in the autumn of 2008, while submarine 291 lay at shipyard No. 10 in Polyarny. The submarine was then towed in October 2008 to the Nerpa shipyard for dismantling. During the towing operation, new towing pontoons developed under the AMEC collaboration were used. The dismantling will be concluded in the summer of 2009, with the reactor section being stored at the land-based facility at Saida Bay. The UK and Norway are sharing the dismantling expenses and are managing the project jointly. The UK is the contracting party for the Nerpa shipyard.

In Norway's commitment connected with the dismantling, it is an important principle that the projects be completed in the most responsible manner possible. This involves spent nuclear fuel that is taken out of the reactor sections being handled responsibly, such that neither the fuel nor the sections pose any danger of radioactive contamination. Dismantling of nuclear submarines also produces large quantities of waste that is not radioactive, including PCB, which comprises a significant threat to the environment.

The reactor sections that originated from three submarines previously dismantled with Norwegian financing in 2003

Storage of reactor sections in land-based facility at Saida Bay. Photo: Norwegian Radiation Protection Authority.

Submarine 291 moored with pontoons mounted at Nerpa shipyard. Photo: Nerpa shipyard.

Storage of reactor sections at Saida Bay.
Photo: Norwegian Radiation Protection Authority.

Submarine 291 on the deck of the Transshelf, ready to be secured.
Photo: The Norwegian Defence Research Establishment (FFI).

through 2005 continued to be stored in 2008 in storage facilities floating on the sea at Saida Bay in Kola Fjord. Together with corresponding sections from a large number of other dismantled vessels, these comprised a threat to the marine environment of the Barents Sea. The sections consist of the submarine's reactor room and adjacent rooms, necessary for the ability to float in a stable manner. The section also contains the solid radioactive waste produced during the dismantling. Russia desired assistance in the construction of a suitable facility on land at Saida Bay, where the reactor sections could be stored instead. Germany financed this facility.

After the facility was opened, Russia asked for assistance in getting additional floating sections converted to land-based storage. As part of the conversion, the adjacent rooms and remaining ballast tanks are removed. They are then fitted with permanent shielding around the reactors and foundations, before they are moved to land at Saida Bay. Norway decided to finance the conversion of the three sections from our three earliest projects. Project Manager Rambøll Storvik and the Nerpa shipyard signed a contract in June 2008 on converting these three reactor sections. These will be transferred during the summer of 2009 to land-based storage, such that all the reactors from the dismantling of the five submarines that Norway has participated in will be safely stored on land when we conclude this chapter of the collaboration in 2009.

Regulatory co-operation

In connection with these projects, requirements have been set to of the project manager concerning performance of risk and environmental impact assessments. On the Russian side, documentation has been submitted to the Norwegian project management concerning risk and impact assessments. These assessments focus on measures for reducing the possibility of accidents and emissions. This concerns in particular the handling of spent nuclear fuel as well as the handling of radioactive and other environmentally hazardous waste. This documentation has been reviewed by the Norwegian Radiation Protection Authority, which has also requested supplemental information where necessary. In this work, there has been a close dialogue with the Russian supervisory authorities. In connection with the work, documentation on risk assessments that had not previously been publicly available was released. This has been important for Norway, but also for other nations that are assisting Russia in the work of dismantling submarines. As a follow-up to the contract, the Norwegian project manager has periodically conducted inspections of the shipyard focusing on the radiation protection aspects. This has also contributed to reducing the risk of accidents and emissions.

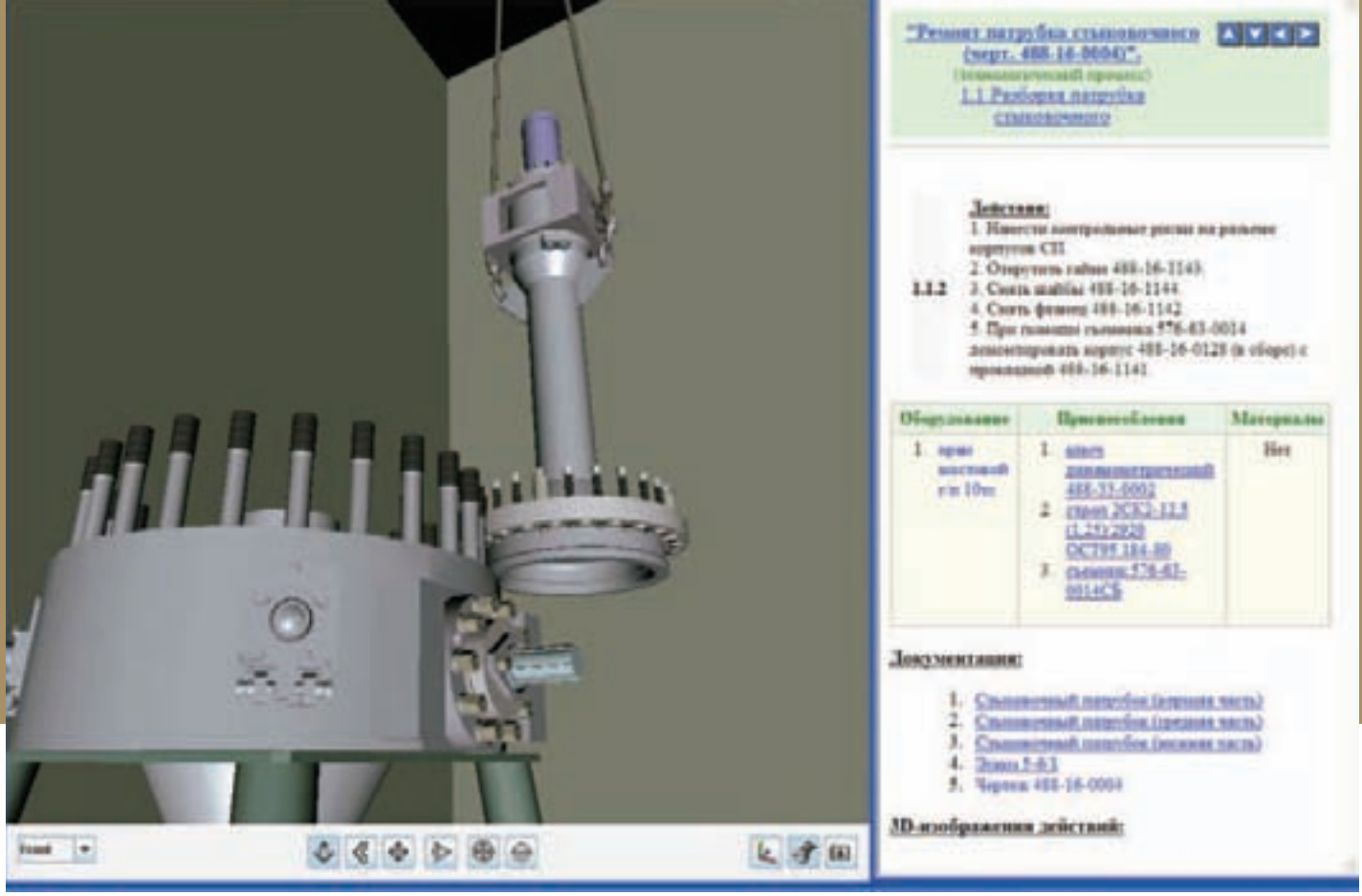
Safety at nuclear power plants

Simulator at Leningrad nuclear power plant. Photo: Institute for Energy Technology (IFE).

Of the nuclear installations in areas adjacent to our borders, the Russian nuclear power plants Leningrad, Kola, Kursk and Smolensk pose the greatest potential dangers of radioactive contamination and hazards to health in Norway. The two oldest reactors at the Kola nuclear power plant are first-generation VVER reactors (pressurised water type), whereas the reactors at the Leningrad, Kursk and Smolensk nuclear power plants are of the RBMK type (as at Chernobyl). The RBMK reactors have design-related characteristics that make them inadequate in terms of safety. Such is also the case for the two oldest of the Kola VVER reactors. Norway's view in principle is that such reactors ought to be shut down. Since 1992, Norway has been granting funds for measures at the Kola and Leningrad nuclear power plants in Russia and the Ignalina nuclear power plant in Lithuania, so that they can be operated with the greatest possible degree of safety up until they are shut down. Safety analyses and statistics document that Norwegian and other Western assistance, as well as significant efforts by the Russians themselves, has contributed to substantially improved safety. Russia has decided to extend the operating permits for all reactors beyond 30 years, which was the original operating life. The EU is posing requirements of new member states that reactors of these types are to be shut down. It has thus been decided to shut down the RBMK reactors at the Ignalina plant in Lithuania. The collaboration on safety at nuclear power plants is anchored in a separate substrategy under the Nuclear Action Plan. The substrategy was revised in 2008 and now focuses to a greater degree on co-operative projects that are able to support the long-term preparations for decommissioning of old reactors, in line with the government's inaugural statement in 2005.

The greatest part of the Norwegian support to Russian nuclear power plants in 2006-2008 has gone into improving and maintaining the safety at the Kola nuclear power plant. The Institute for Energy Technology (IFE) supplies equipment for monitoring water chemistry and material integrity as well as for remotely-controlled inspection of critical components.
The Kola nuclear power plant staff also receives training in using the equipment. The IFE also contributes to training and instruction of reactor operators and operating personnel.

At the Leningrad nuclear power plant, projects are being carried out in collaboration with the nuclear power plant and InterDCM (the prior Russian Scientific Centre Kurchatov Institute). The results from the



Screen shot from the simulator at Leningrad nuclear power plant. Photo: Institute for Energy Technology (IFE).

project up to now are two VR (Virtual Reality) programs for training and instruction in fuel exchange and maintenance operations.

Rosenergoatom has introduced the system at other Russian nuclear power plants. So far, the fuel exchange simulator has been used at the Kursk nuclear power plant (2006) and the Smolensk nuclear power plant (2007). These projects are financed by Rosenergoatom which owns the Russian nuclear power plants.

At the closed Chernobyl nuclear power plant, the Norwegian collaboration has continued during the period spanning 2006-2008. The results from the use of the fuel exchange simulator at the Leningrad nuclear power plant have previously been demonstrated to the management at Chernobyl. VR simulators can be an important tool in the decommissioning of the Chernobyl nuclear power plant. Norwegian authorities are currently financing the creation of a 3D-visualisation centre at the plant. The project is being carried out in close co-operation with the Leningrad nuclear power plant and InterDCM.

Commissioned by the Norwegian Radiation Protection Authority (NRPA), the Norwegian Water Resources and Energy Administration (NVE) prepared a report in 2006 on the preconditions for shutting down the Kola nuclear power plant and developing alternative sources of energy. The NRPA has followed the trends in Russia during the entire period in order to have up-to-date information on plans for extended operation and the specific basis on which such is decided. The NRPA has also kept itself informed on the plans for new nuclear power plants. In this regard, the NRPA arranged a seminar in 2007 for Nordic agencies and organisations concerning the possibilities for intensified joint Nordic collaboration with Russia involving the safety of nuclear power. This resulted in stronger Nordic coordination of the collaborative measures and the dialogues concerning them.

Russia is building its first floating nuclear power plant at St. Petersburg, with completion of a prototype planned for 2010. The power plant will consist of two reactors that in reality are a modified version of Russian icebreaker reactors, probably with lower power and lower enrichment of the fuel. The Russian plans for floating nuclear power plants have been a theme of the latest collaboration meetings between the Norwegian and Russian authorities, and Norway has been particularly concerned with being given insight into precisely what type of technology and safety systems these reactors have, and how the spent fuel will be stored and removed. It is not clear whether any final decision has been made concerning where these plants will be situated and how many of them are being planned to be built.

Screen shot from the simulator at Leningrad nuclear power plant.
Photo: Institute for Energy Technology (IFE).

International co-operation and agreements

Reactor sections in temporary floating storage at Saida Bay. Photo: Norwegian Radiation Protection Authority.

G8

After the terrorist attacks against the US on 11 September 2001, the G8 countries established a global partnership against the spread of weapons and materials of mass destruction. The countries committed to set aside USD 20 billion during the course of 10 years for tangible measures. Norway joined the partnership in June 2003 and will make a contribution of EUR 100 million over the 10-year period. Under the auspices of the partnership, a working group has been established in which Norway and a number of other countries are participating. The working group serves as an important co-ordination and discussion forum for top level issues involving the international co-operation.

CEG

Under the auspices of the International Atomic Energy Association (IAEA), a contact forum has been established for the member states that are involved with the clean-up work in Russia, called the Contact Expert Group (CEG). This is the most important meeting place for co-ordination, exchanges of experiences and on-going development for all the parties involved. The CEG has led to the establishment of thematic co-ordination groups involving Russian authorities and other participating countries with a focus on Andreyev Bay and RTGs.

The Northern Dimension's Environment Partnership

Norway also contributes to multilateral efforts through the Northern Dimension's Environment Partnership (NDEP fund), administered by the European Bank for Reconstruction and Development (EBRD). Norway has contributed EUR 10 million to the fund, which now counts over EUR 150 million. With financing from the NDEP fund, the EBRD has prepared in conjunction with Russian authorities an extremely comprehensive and detailed description of the challenges involving nuclear safety in Northwest Russia. This so-called master plan (see below) is also an important basis for the prioritisations made by the Norwegian side. Norway participates in the NDEP fund's governing bodies. The fund's prioritisations are in line with Norwegian perspectives on the most important challenges in Northwest Russia.

The strategic master plan

The handling of spent nuclear fuel and radioactive waste in Northwest Russia has been the object of substantial attention for a long time. There has been a lack of overall plans and strategies for handling and storage of radioactive wastes. Russia is now underway with a process to improve the situation. Rosatom has stated that the established Russian strategy for the handling of spent nuclear fuel is to recycle the fuel. Hence the spent nuclear fuel from Northwest Russia must be removed from the region and transported to Mayak for recycling.

Plans for the handling and storage of damaged nuclear fuel or nuclear fuel that cannot be recycled are still under preparation. Spent fuel that cannot be recycled with current technology must be stored temporarily in anticipation of new technical solutions.

The strategy for handling and storing solid radioactive waste is that it must be transported to Saida Bay at Kola Fjord, where a regional centre will be established for handling and temporary storage. Russia has not released plans for deposition of spent nuclear fuel or radioactive waste, nor for low-level and medium-level waste. Norway has, during the three-year period, contributed to the direct removal of waste, including through RTG replacement and submarine dismantling, as well as through physical securement.

MNEPR

Similarly to the bilateral agreements of other countries, Norway's agreements are also based upon a multilateral legal framework agreement for assisting Russia (the MNEPR Agreement). The MNEPR (Multilateral Nuclear Environmental Programme in the Russian Federation) Agreement is a framework that secures the donor country exemptions from taxes, tolls, fees and liability for accidents during the execution of the project. The agreement also regulates issues involving financial controls and inspection access.

IAEA

The Norwegian Radiation Protection Authority (NRPA) has assisted the Ministry of Foreign Affairs in connection with the governing duties in the IAEA during the period spanning 2005-2007. Among the matters that were particularly highlighted were international security and preparedness work, especially with a point of departure in

Lighthouse with solar cell panels. Photo: County Governor of Finnmark.

Norway's efforts in Russia. Norway chairs the work of "the National Competent Authority Co-ordinating Group", a group formed under the international action plan for enhancing preparedness, under the auspices of the IAEA.

Non-proliferation and disarmament

With reference to the Nuclear Non-proliferation Treaty (NPT), the NRPA has collaborated with the Ministry of Foreign Affairs on measures that can move this work forward. Work has been done in particular on increasing the focus on highly enriched uranium (HEU). This can be used directly in weapons, and is an important theme since the icebreaker fleet in Murmansk is the world's largest single civilian consumer of such material. An international symposium on HEU was arranged in Oslo during the summer of 2006 at which Russia, the US and many other countries participated. In 2008, Norway contributed USD 5 million to the IAEA's initiative for increased controls on technologies that can produce fissionable material. In the other work with disarmament, the NRPA is co-ordinating a Norwegian-British research collaboration on developing verification methods, in co-operation with the Institute for Energy Technology (IFE), the Norwegian Defence Research Establishment (FFI), the Norwegian Institute of International Affairs (NUPI) and the Norwegian National Data Centre for Verification of Compliance with the Comprehensive Nuclear Test Ban Treaty (NORSAR).

AMAP

Norway and Russia chair the work concerning radioactivity in AMAP (Arctic Monitoring and Assessment Programme) under the Arctic Council. AMAP's goal is to transmit information concerning the arctic environment, as well as to submit scientific advice to the arctic governments in the work to remove and prevent contamination of the arctic environment.

AMEC

After having participated actively in project collaborations, from the autumn of 2006 Norway only has observer status in the collaboration within AMEC (Arctic Military Environmental Cooperation).

ISTC

Norway is a member of the International Scientific and Technology Center (ISTC) in Moscow, and makes financial contributions to the centre's efforts to hire scientific personnel from the armaments industry in the former Soviet republics.

Agreements Norway has with Russia in the area of nuclear activity and the environment:

- Agreement Norway's Government and the Russian Federation's Government concerning collaboration in the area of environmental protection, of 3 September 1992
- Agreement between Norway and Russia concerning early warning of nuclear accidents and concerning exchanges of information about nuclear facilities – Bodø, 10 January 1993
- Agreement between the Norwegian Radiation Protection Authority and Russia's federal inspectorate for nuclear and radiation safety concerning technical collaboration and exchanges of information involving the safe use of nuclear energy – Moscow, 20 October 1997
- The multilateral framework agreement for project assistance for Russia (the MNEPR Agreement) – Stockholm, 21 May 2003
- Agreement between the Royal Norwegian Ministry of Foreign Affairs and the Federal Nuclear Energy Bureau concerning collaboration on nuclear physics safety and radiation safety – Moscow, December 2006
- Agreement between the Norwegian Radiation Protection Authority and the Russian Federation's Ministry of Defence concerning collaboration in nuclear physics safety and radiation safety – Oslo, 12 December 2007
- Agreement between the Russian Federation's Ministry of Health and Social Development and the Norwegian Ministry of Health and Care Services concerning collaboration in the regulation of safe use of nuclear energy in carrying out hygienic and epidemiological supervision and controls safeguarding the performance of hazardous radiation-related work – Moscow 13 November 2008

Actors

Ministry of Foreign Affairs	www.regjeringen.no/ud
Ministry of the Environment	www.regjeringen.no/md
Ministry of Defence	www.regjeringen.no/fd
Norwegian Radiation Protection Authority	www.nrpa.no
County Governor of Finnmark	www.fylkesmannen.no/finnmark
Institute for Energy Technology (IFE)	www.ife.no
Norwegian Defence Research Establishment	www.ffi.no/amec
Rambøll Storvik	www.storvik.com

NGOs

Bellona	www.bellona.no
Norwegian Society for the Conservation of Nature	www.naturvern.no
Nature and Youth	www.nu.no
Green Cross	www.gci.ch

International Co-operation Forums

CEG (Contact Expert Group)	www.iaea.org/OurWork/ST/NE/NEFW/CEG/index.html
AMEC (Arctic Military Environmental Cooperation)	www.mil.no/felles/ffi/amec

International Funds

NDEP (Northern Dimension's Environmental Partnership)	www.ebrd.com www.europa.eu.int/comm/external_relations/north_dim/ndep
The G8 countries' global partnership against the proliferation of weapons of mass destruction and material	www.g7.utoronto.ca/summit
The MNEPR Committee (The NEA under the OECD is the Secretariat for the MNEPR Agreement)	www.nea.fr
AMAP	www.amap.no

Russian actors

Rostekhnadzor	www.gosnadzor.ru
FMBA (Federal Medical-Biological Agency)	www.fmbaros.ru/news/index.php
Rosatom	www.minatom.ru
Roshydromet	www.meteorf.ru
Directorate for State Oversight of Nuclear and Radiation Safety of the Ministry of Defence	
SevRao	
Murmansk County Administration	http://gov.murman.ru/

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