Nuclear safety

As pointed out in Chapter 1, the threats posed by the nuclear complex of Northwestern Russia have attracted no little attention in recent years, not least from neighbouring Western countries. Thus, the issue of nuclear safety stands forth as the most highly profiled problem area among the three we have chosen to focus on in this study. It also differs from the other two by way of being far more heterogeneous in nature: some of the activities under scrutiny are of a civilian nature; others take place within the military sphere. Partly, the focus is on ‘actual’ polluting activities, such as the dumping of waste; partly it is on the risk of accidents in connection with activities that do not result in contamination under normal circumstances. Moreover, in the area of nuclear safety, environmental and security concerns tend to be closely intertwined. As will be shown in this chapter, the complexity of the problem area itself tends to be mirrored both in the multitude of international efforts undertaken to address it and in the related implementation processes.

Background: the ‘nuclear complex’ and radiological hazards

The build-up of the ‘nuclear complex’ in Northwestern Russia was linked partly with the nuclearisation of the Soviet Armed Forces, and also with civilian needs in transportation and energy production. Its history dates back to the late 1950s, when the Soviet Union’s first nuclear-powered submarines and icebreakers were constructed and stationed on the Kola Peninsula. Well over a decade later, in 1972, the construction of the largest nuclear installation in the area, the Kola Nuclear Power Plant, was completed. Thus, the

nuclear-powered vessels of the Northern Fleet, the icebreaker fleet of Murmansk Shipping Company and the Kola Nuclear Power Plant, together with their service and storage facilities, constitute the main elements of the Northwest Russian nuclear complex. A brief description of the development of each of these elements and their state today is given in the first sub-section below.

Perhaps contrary to popular belief, the extent of radioactive contamination in the region is relatively low and mainly due to external sources and practices that have been permanently or temporarily discontinued, e.g. atmospheric nuclear tests and the dumping at sea of radioactive waste (Bergman and Baklanov 1998; Lønne *et al.* 1997). The issue of contamination and its sources is elaborated in the second sub-section. While the release of radioactive substances is negligible in the normal operations of the nuclear installations in Northwestern Russia, an accident or other unforeseen incident at one of the installations, service or storage facilities could have very serious implications. The risks posed by the nuclear complex are addressed in the third sub-section below.

The 'nuclear complex' of Northwestern Russia

The Soviet Northern Fleet was officially established as late as in 1933, despite the fact that the strategic potential of the Kola Peninsula, with its year-round ice-free harbours, had been recognised in Russian naval circles as early as in the second half of the nineteenth century (Skogan 1986). The fleet headquarters were originally based in Polyarnyy on the western shore of the Kola Fjord, but subsequently moved to Severomorsk across the fjord. For more than two decades, the Northern Fleet remained the smallest of the Soviet Navy's four fleets. In the 1950s, however, a period of expansion set in, which coincided with the onset of the Soviet Union's struggle to achieve nuclear parity with the United States. The country's first nuclear-powered submarine was completed at a submarine construction facility in Severodvinsk in Arkhangelsk Oblast in 1957 and stationed at Zapadnaya Litsa on the Kola Peninsula in 1958. The Northern Fleet's expansion continued in the following decades, and the fleet acquired a large number of nuclear-powered submarines.

The fleet's prize possessions are its strategic submarines. They are armed with long-range ballistic missiles able to reach targets on the American continent from the Russian coast. The strategic submarines are protected by multi-purpose submarines, which

are also nuclear-powered. The tactical missiles of these submarines may be equipped either with nuclear or with conventional warheads. Russia has declared that the multi-purpose submarines will not carry nuclear warheads in peacetime. In addition to the submarines, the Northern Fleet has a large number of surface vessels, many of which are armed with nuclear weapons and three of which are nuclear-powered.

The Northern Fleet reached the height of its power in the mid-1980s. Since 1988, the number of ships taken out of service has exceeded the number of new ships acquired, a tendency that has intensified since 1991 (see Table 5.1). This was due to the combined effect of a climate of economic downturn and the need to implement obligations laid down by the START I treaty. In addition, the nuclear submarines of the first generation started to reach the end of their service life from the late 1980s. A total of about seventy nuclear-powered submarines were removed from service in the Northern Fleet during the period 1991–98. This gave the Northern Fleet a new challenge: to dismantle a huge number of nuclear-powered submarines in a very short period of time. The process is very costly, and so far only a fraction of the submarines removed from service have actually been dismantled. The majority are stored afloat awaiting dismantlement, and many have not even been de-fuelled, i.e. the spent nuclear fuel has not been removed from the reactors. Some of these submarines are in a poor condition, and some observers claim there is a real danger of them sinking. Moreover, international co-operative programmes so far only cover the dismantlement of strategic submarines. Hence, there is no dismantlement capacity left for multi-purpose submarines, which are mostly at the end or have passed far beyond their service life.¹

Table 5.1 *Number of ships in the Northern Fleet in 1991 and 1998*

<i>Category</i>	<i>1991</i>	<i>1998</i>
Strategic submarines	36	13
Other submarines	90	43
Large combatants	83	45
Smaller combatants	73	27
Landing- and amphibious vessels	20	12

Source: Hønneland and Jørgensen (1999a).

The full dismantlement of a nuclear-powered submarine involves several steps. The first step – and the most important from an environmental point of view – is the de-fuelling of spent nuclear fuel from the submarine's reactor. Afterwards, the reactor compartment is removed, and subsequently the rest of the hull can be cut up for scrap. The process generates a certain amount of spent nuclear fuel and other liquid and solid waste (including the reactor compartment itself) which has to be transported to special facilities for further treatment and/or intermediate storage. Spent nuclear fuel may either be stored as it is or reprocessed. The Russian policy with regard to spent nuclear fuel favours reprocessing, if possible. Reprocessing generates large amounts of high-level liquid waste. Liquid waste is usually solidified before storage, and some forms of solid waste can be compressed.

The Northern Fleet has limited capacity in all stages of the dismantlement process. First, the existing infrastructure has only allowed for the de-fuelling of a handful of submarines a year. Second, existing intermediate storage facilities for spent nuclear fuel and for liquid and solid waste are long since filled to capacity, which means that large amounts of spent nuclear fuel and radioactive waste are stored under unsatisfactory conditions. Third, the spent nuclear fuel that is supposed to be reprocessed is leaving the region very slowly, partly because Russia only has two special train carriers for spent nuclear fuel transportation, partly due to constraints at the reprocessing facility, Mayak in Siberia, and to the Northern Fleet's limited capability to pay for such shipment.

Up to 1992, although the situation was less critical then, the Northern Fleet disposed of large amounts of radioactive waste by dumping it at sea. Since 1993, Russia has observed a voluntary moratorium on such dumping, but the lack of capacity to deal with spent nuclear fuel and nuclear waste has, according to Russian authorities, rendered it impossible for Russia to ratify the parts of the London Convention that deal with the dumping of radioactive substances. The problems related to the decommissioning of nuclear-powered submarines is the most urgent nuclear safety issue in the military sector. However, as demonstrated by the Kursk and Komsomolets accidents, there are risks associated with nuclear-powered submarines in operation as well. Moreover, nuclear-powered submarines normally have to have their reactors refuelled twice in the course of their service life; thus, active submarines also

contribute to the accumulation of spent nuclear fuel and to binding up de-fuelling infrastructure. These issues will be discussed further towards the end of the section.

In 1959, the Soviet Union's first nuclear-powered icebreaker – the *Lenin* – was stationed in Murmansk. Over the following years, a whole fleet of nuclear icebreakers was built.² The main task of the icebreakers was to escort vessels navigating the Northern Sea Route (i.e. the Northeast Passage), which stretches along the northern shores of the Eurasian continent from the Barents to the Bering Sea. Thus, the icebreaker fleet played an important role – and to some extent still does – in securing the *severnnyy zavozy*, i.e. the transportation of foodstuffs and other important goods to outlying northern areas, as well as the transportation of various raw materials out of these areas, mainly from Siberia.

The icebreaker fleet is a subsidiary of Murmansk Shipping Company, one of the largest enterprises in Murmansk Oblast. This fleet, which in 1998 counted seven icebreakers and one nuclear-powered container ship, was needed less and less during the 1990s because transport volumes on the Northern Sea Route fell significantly. The remaining ships are approaching the end of their service life. Like the nuclear-powered submarines, the icebreakers have to have spent nuclear fuel removed and the reactors refuelled at regular intervals. Murmansk Shipping Company has three service ships of its own, *Imandra*, *Lotta* and *Lepse*. Spent nuclear fuel from the icebreakers used to be stored for an initial six months on board the *Imandra* and then moved to one of the other ships for further storage. However, by 1993 all three ships were filled to capacity. As for *Lepse*, the whole ship is now considered nuclear waste, since a large portion of the spent nuclear fuel on board is classified as 'damaged' and the ship itself is also contaminated. This damaged fuel stems mainly from the nuclear-powered icebreaker *Lenin*, which suffered a reactor accident in 1966.

The Kola Nuclear Power Plant, located in the town of Polyarny Zori in the southern central part of the Kola Peninsula, was put into operation in 1972. The plant is by far the largest employer in Polyarny Zori with approximately 6,000 employees (out of a population of some 18,000). As was customary in the Soviet Union, the company provided a large share of the local social and technical infrastructure, and many of these functions have been retained. The Kola Nuclear Power Plant and the eight other nuclear power plants

currently in operation in Russia are joined together under the Rosenergoatom umbrella. Rosenergoatom is a subsidiary of Minatom, the Russian Ministry of Atomic Energy, which reportedly wants to see closer integration of the enterprises of the Russian nuclear energy sector. In June 1999, then Minister of Atomic Energy Yevgeniy Adamov decided to let Rosenergoatom have direct control of the revenue generated by all nuclear power plants. Plans to continue the reorganisation of the nuclear power sector towards full integration have met with considerable opposition at the regional and local levels. Workers at the Kola Nuclear Power Plant fear that both their pay cheques and general industrial rights will suffer, while local as well as regional authorities expect the merger process to result in significant cuts in revenue from the Kola Nuclear Power Plant to the local and regional coffers.

The Kola Nuclear Power Plant plays a significant role in the total supply of energy in Murmansk Oblast. Total yearly output is approximately 12 TWH. Altogether, the Kola Nuclear Power Plant provides some 60 per cent of the electric power consumed annually in the oblast (Hansen and Tønnessen 1998). Most of this is consumed by the industry, since electric power accounts for only a marginal share of the energy consumed by private households. In addition, the Kola Nuclear Power Plant exports energy to the Republic of Karelia. The plant has four nuclear reactors, each of which yields an effect of 440 MW. The two oldest ones, contained in one building, came on line in 1973 and 1974, respectively, while the two reactors contained in the other building have been in operation since 1981 and 1984. The two oldest reactors in particular are viewed with concern by the international community. The locations of some important nuclear safety sites in Northwestern Russia are displayed in Figure 5.1.

Radioactive contamination of the environment

The level of radioactive contamination of the terrestrial environment in Northwestern Russia is relatively low and comparable to that of neighbouring countries (AMAP 1997, 1998; Bergman and Baklanov 1998; Lønne *et al.* 1997). As in Norway, Sweden and Finland, the main sources of contamination are fallout from atmospheric nuclear tests and the Chernobyl accident. A total of 87 atmospheric tests were carried out on the Novaya Zemlya archipelago between 1955 and 1963 (Stortinget 1994, p. 31). Since 1963, subsequent to the conclusion of the partial test ban treaty prohibiting atmospheric

Figure 5.1 Important Northwest Russian sites in a nuclear safety context

and underwater nuclear tests, all nuclear tests have been carried out underground.³

Despite the low contribution to the average level of contamination by regional sources, the localised character of such contamination must be taken into consideration. While fallout both from the nuclear tests and Chernobyl was dispersed over vast areas, more recent activities – particularly inadequate storage of waste – have

resulted in a number of delimited areas where contamination levels are significant. On the Kola Peninsula as a whole, though, the main anthropogenic source of radiation affecting the population is radiotherapy, followed by radiation from construction materials. By contrast, production of nuclear energy and fallout from weapons testing and the Chernobyl accident make up less than 3 per cent of the average yearly individual doses to the population (State Committee for Environmental Protection 1998).

Compared to the Baltic Sea and the North Sea, the Barents and Kara Seas are very clean. This goes for radioactive contamination as well as for pollution in general. Besides fallout from atmospheric nuclear tests, the main sources of radioactive substances in these waters are routine releases from European reprocessing plants, first and foremost Sellafield in Great Britain. In recent years, contamination levels have been reduced, primarily due to a sharp reduction in releases from Sellafield. Releases from Russian facilities are also believed to have contributed to contamination increases via the Ob and Yenisey rivers. The total radioactivity of materials dumped by the Northern Fleet (until 1992) and Atomflot (until 1986) is comparable to the accumulated radioactivity of the Sellafield releases. However, all investigations carried out thus far have concluded that very little of this has actually leaked out. Moreover, even in the event of a worst-case scenario, with a simultaneous and rapid release of the remaining radioactivity to the environment, radiological consequences would be relatively low (Bergman 1997).

Radiological hazards associated with the nuclear complex

The principal radiological hazards to the region as well as to areas beyond it are posed not by previous activities but by potential future accidents or incidents. The risks posed by a release of radioactive substances to the life and health of humans fall into two main categories, depending on the distance to the site where the accident or incident takes place. Persons at or near the site will probably be in acute danger from intense radiation, as well as from other effects of the accident, such as fires and explosions. At greater distances from the site, the main dangers are usually related to long-range effects of more moderate exposure, for instance increased frequencies of certain forms of cancer in the exposed population.

It is problematic to distinguish between environmental risks and health risks where radioactive pollution is concerned. For a nuclear

accident to constitute a real threat to the environment as such – that is, to the continued existence of various species of flora and fauna in a given area – the accident would have to have almost unimaginable dimensions. Usually, the main problem is that the presence of radioactive pollutants in the natural environment may pose a risk to people's life and health. The most seriously affected areas may be rendered uninhabitable. Moreover, as demonstrated by the Chernobyl accident, the problem of radioactive pollutants entering and accumulating in the food chain may affect vast areas, making certain foodstuffs – typically the meat of grazing animals – unfit for human consumption. Thus, in addition to the risks to life and health, radioactive contamination of the environment may have grave economic consequences, and it may even threaten the culture and way of life of certain people, notably those of indigenous peoples and fishers.

One study (Bergman and Baklanov 1998) substantiates the Kola Nuclear Power Plant's position as the most hazardous industry in the Kola–Barents region. Several operational incidents have taken place since the plant was put into operation, among them a loss-of-cooling incident in 1993, which might have resulted in a meltdown incident in the oldest reactor. The International Atomic Energy Agency (IAEA) has calculated the probability of a serious meltdown in the oldest reactors to be 25 per cent over a period of twenty-three years. Such an accident would not have Chernobyl dimensions, since the reactors are of a different and less dangerous design. Nevertheless, the local effects would be grave, and deposits of radioactive matter in parts of Russia and neighbouring countries would probably be high enough to influence both cancer statistics and patterns of food consumption.

Bergman and Baklanov (1998) identify submarines during refuelling as another high-risk possibility, although the consequences of an accident would be less far-reaching. In 1985, radionuclides were released to the atmosphere and ten people were killed following an explosion during refuelling of a submarine in Chazma Bay in the Far East. For submarines in operation, submarines under decommissioning or scrapping, and stored spent nuclear fuel and radioactive waste, the risks are less certain. These are all classified by Bergman and Baklanov (1998) as sources of potential high risk.⁴ Where the submarines are concerned, the main dangers are linked to criticality accidents (i.e. uncontrolled chain reactions) in reactors with releases of radionuclides to air. De-fuelling of decommissioned submarines

may involve the same risks as refuelling. Accidents involving inadequately stored spent nuclear fuel and radioactive waste may ensue as a result of fire breaking out at a storage facility and/or a criticality accident if spent nuclear fuel elements are stored in too close proximity to one another and without sufficient barriers between them.

Spent nuclear fuel and other waste dumped at sea, as well as the sunken submarine Komsomolets and leakage from underground test sites, are all categorised as low-risk sources by Bergman and Baklanov (1998). Finally, their study identifies some potential risks where the consequences are as yet undetermined due to insufficient research of the problem. They include transportation of spent nuclear fuel and waste, accidental nuclear explosions and releases from underwater test sites.

Premises for implementation

The nature of the problem

At first glance, the problem of nuclear safety in Northwestern Russia appears to be relatively complex, with respect to the prospects of solving it. The activities that give rise to radiological threats in the region are linked to crucial sectors of society: defence, energy production and transportation. The 'nuclear objects' themselves are controlled by two very powerful agencies, the Ministry of Defence and the Ministry of Atomic Energy (see discussion below). Moreover, the costs related to problem-solving are generally high. For instance, the economic cost of transporting a reactor with damaged spent nuclear fuel to Novaya Zemlya and dumping it there is next to nothing compared to the cost of safe removal, transportation and storage of the spent nuclear fuel. In some cases, intervention is hardly feasible at all if this is taken to mean a reduction of risk to an acceptable level. This would certainly seem to apply to the prospect of securing the safe functioning of the two oldest reactors at the Kola Nuclear Power Plant.

On the other hand, the consequences of a large nuclear accident would be devastating, both in terms of life and health and economically. The dramatic progress of a nuclear accident and the arbitrariness and sneaking nature of the long-term health effects make the public much more sensitive to radiological threats than to 'classic' environmental problems. The sensitivity of people to these issues may not be as high in Russia as in Western countries, but the 'Chernobyl effect' is

nevertheless thought to have contributed significantly to postponing the finalisation of at least one Russian nuclear power plant (Darst 2001). One must assume, then, that even the most cynical Moscow-based decision-maker will be interested in reducing radiological threats in the region as much as possible. Still, we must keep in mind that while down-scaling costs are large and sure to occur, it is, after all, less probable that an accident will occur than not. The attitude towards risk-taking is decisive in this respect; one might assume that more people are more willing to take risks in the uncertain political situation of contemporary Russia than is the case in Western countries.

This general discussion does not capture the full complexity of the nuclear safety issue, which, as demonstrated in the preceding section, involves a number of more or less interrelated problems that may well differ among each other with respect to their 'malignity'. Consequently, a brief examination of each problem area seems to be warranted.

The military sphere As follows from the preceding section, the threats that emanate from the day-to-day operations of Russian nuclear submarines are difficult to evaluate. The responsibility for the safe functioning of the submarines rests with the military authorities,⁵ and this issue is not addressed by the international arrangements discussed in this book. However, threats in this category are likely to fall off in the years to come, since Russia is committed to further cuts in the number of submarines. The flip-side of the coin is, of course, the accumulation of even larger stockpiles of spent nuclear fuel and other radioactive waste that will result from the continued decommissioning of vessels. No one is presumably interested in a further aggravation of this situation, but nevertheless the problem is a tough one to solve. As described in the preceding section, the dismantlement chain consists of a number of operations, from de-fuelling of submarines to final storage of the waste, and a bottleneck at one stage may frustrate the whole process. Moreover, the debates on where to locate temporary and permanent storage facilities have proven difficult and time consuming. Finally, large investments in infrastructure are necessary to solve the waste problem, and the operations involved are costly to run.

The nuclear icebreakers The categories of risks related to the nuclear icebreaker fleet are the same as for the nuclear submarines.

Accidents may occur during day-to-day operation of the vessels, during refuelling/de-fuelling or in connection with inadequately stored spent fuel or radioactive waste. The most serious accidents known to have happened with Russian civil nuclear vessels affected the icebreaker Lenin in 1966 and 1967.⁶ The largest risk of radioactive contamination from the icebreaker fleet is probably that posed by the storage vessel *Lepse*, not least because of its location in the Murmansk harbour in the immediate vicinity of a city of some 380,000 inhabitants.

The icebreaker fleet has played an important role in the Russian North for decades since they make the Northern Sea Route navigable outside the short summer season. They also seem to have an important symbolical function: they are considered by many as the ultimate symbol of the conquering of the north as well as the pride of the city of Murmansk. Even in today's constrained economic conditions, it is likely that the Murmansk Shipping Company will try to keep as many of them in operation as long as possible.

The Kola Nuclear Power Plant As pointed out above, the Kola Nuclear Power Plant is considered the most dangerous component of the Northwest Russian nuclear complex. In the opinion of the neighbouring countries, it should be shut down as soon as possible. At the same time, the plant is of great importance to the region, both as an energy provider,⁷ as an employer and as a contributor to the regional and local budgets. Those who stand to gain most by a closing of the enterprise – e.g. the inhabitants of Polyarnye Zori – are the same people whose daily existence is most directly dependent on its continued operation. Moreover, the most important energy customers are large industrial complexes with great influence – if not direct, then at least indirect – on regional politics, partly with company leadership in Moscow.

The nuclear complex in Northwestern Russia is viewed with great concern by a number of Western countries. This enhances the prospects of practical problem-solving since these countries are willing to contribute money and expertise in order to alleviate the situation. At the same time, the active involvement of other states implies that they would probably want to have a say in defining and grading the threats, and to influence priorities where implementation of international commitments is concerned. Thus, for the USA the military threat from the nuclear submarines and possible proliferation

threats are the main issues. For the European countries, and for the Nordic countries in particular, the Kola Nuclear Power Plant is seen as the most pressing problem, although the focus on nuclear waste has been higher. For Norway, a large exporter of fish, it has been an important goal to ensure that the Barents Sea remains free of radioactive pollution. Even the slightest rumour of radioactivity in fish could have grave economic consequences for the country.

The nature of the commitments

The picture of international agreements and other co-operative measures that Russia participates in, pertaining in some way or other to nuclear safety, is highly fragmented (see Chapter 1). While fairly strict commitments exist in the adjacent areas of disarmament and non-proliferation, commitments aimed at enhancing nuclear safety and protection of the environment are generally ‘softer’.

Under the IAEA regime, a comprehensive framework for international co-operation on nuclear safety has been set up. The agency has worked out a detailed set of internationally recognised safety norms and standards (Nuclear Safety Standards – NUSS), which are continuously reviewed and updated. The IAEA’s International Nuclear Event Scale (INES) is used to classify nuclear events and accidents according to seriousness. Upon request, the IAEA sends advisory and review teams to member states to observe and help improve safety standards and activities. Within the IAEA regime, ‘hard’ mechanisms have largely been avoided. The agency has been oriented mainly towards recommendatory norms and standards, rather than binding ones. Inspections are carried out on a voluntary basis, and enforcement procedures are generally non-existent. The safety obligations under the Convention of Nuclear Safety, which are legally binding upon the parties, are mostly of a very basic and general nature. For instance, parties are required to maintain a legislative and regulatory framework, including specific national safety requirements, a licensing procedure and inspection, assessment and enforcement policies.

In the course of the last decade, Russia has concluded a number of bilateral and multilateral agreements with Western states in the area of nuclear safety and security. Many of these are framework agreements aimed at facilitating co-operation with and assistance to Russia, e.g. by removing obstacles linked to issues like liability, taxes and access to sites and installations. The agreement on Co-operative

Threat Reduction (CTR) between Russia and the USA was set up in order to help Russia fulfil its disarmament obligations under the START I treaty. However, CTR also has environmental implications: since the problems with removal and storage of spent nuclear fuel threaten the speedy dismantlement of strategic submarines, some projects specifically addressing these issues have been included under CTR. Article I of the CTR agreement (US Department of State 1992) specifies that the parties shall co-operate in order to assist Russia in destroying nuclear and other weapons, in ensuring their secure transportation and storage, and in establishing measures against proliferation. Under the agreement, the US is exempted from liability (Article VII) and taxes (Article XI). Immunity is granted to government personnel (Article X), and the US has a right to 'examine the use of any material, training, or other services provided [. . .], if possible at sites of their location or use' (Article XIII).

The AMEC declaration – as the word 'declaration' implies – does not specify any such obligations for any of the parties. The document itself is simply a confirmation of the parties' intentions to co-operate in solving a rather broad and non-specific set of environmental problems, i.e. those resulting from military activities. In practice, AMEC has been directed first and foremost towards the issue of military nuclear waste in Northwestern Russia. Like CTR, AMEC is supposed to provide a framework for co-operation on concrete projects. However, since the parties have not yet been able to negotiate a set of legal protections for the non-Russian participants similar to those provided for in the CTR agreement, AMEC has not functioned as intended (Sawhill 2000; Sawhill and Jørgensen 2001).

BEAR is a non-binding co-operative framework, directed, *inter alia*, towards assisting implementation of other international environmental accords in Russia. Concrete assistance is provided by Western countries under various bilateral arrangements, notably the Joint Russian–Norwegian Commission on Nuclear Safety.

As follows from the above, a meaningful analysis of Russia's implementation of its international commitments in the area of nuclear safety requires a broad approach to the concept of 'commitments', i.e. one that includes more than the formal obligations laid down by treaties and conventions. Only within the IAEA regime, and only in recent years, have formal obligations been included as a mechanism in international efforts to enhance nuclear safety. At the same time, international co-operative arrangements directed towards capacity-

building and assistance play a very important part in Russia. Thus, in the subsequent sections on implementation activities and performance, we include in the discussion Russian actors' will and ability to facilitate co-operation and assistance under CTR, AMEC and the bilateral arrangements, as well as their part in implementing concrete projects initiated under these framework arrangements.

Public authorities' implementation activities

According to the Russian Constitution, protection of the environment as well as implementation of international agreements belong to the category of issue areas that are subject to the joint jurisdiction of federal and regional authorities (see Chapter 3). However, the Constitution also states that nuclear energy and fissile materials are subject to exclusive federal jurisdiction (Para. 72, Article 1, section i). Naturally, the same applies to the armed forces. In practice, this means that federal authorities and their representative bodies in the regions according to the Constitution should have a greater say relative to regional authorities in matters concerning nuclear safety than in more general environmental matters. This extends also to the implementation of international agreements. Moreover, the Ministry of Atomic Energy and the Ministry of Defence are both bureaucratic 'heavyweights', also compared to other federal bodies of governance.

Implementation in national legislation

Unlike in the case of fisheries management (see Chapter 4), Russian authorities have succeeded in putting in place a legislative framework for nuclear safety at the level of law. A law on the use of nuclear energy (Russian Federation 1995a) was adopted by the State Duma, 20 October 1995, and signed by President Boris Yeltsin on 21 November of the same year. The law is a large framework document, consisting of seventy articles. Its Preamble states that:

The present Federal law defines the legal basis and principles for regulating issues arising in the use of nuclear energy. It is aimed at protection of the health and life of people, the environment and property in relation to use of nuclear energy. It shall contribute to the development of nuclear science and technology and to *the strengthening of the international regime for safe use of nuclear energy*. (Our emphasis.)

Article 3 defines the objects of nuclear energy use as, among other things, nuclear installations, radiation sources, storage points for nuclear materials and radioactive substances, storage facilities for radioactive waste, nuclear materials, radioactive substances and radioactive waste. Article 4 lists the range of activities covered by the law:

- siting, design, construction, operation and decommissioning of nuclear installations, radiation sources and storage points;
- development, production, testing, transportation, storage, disposition and use of nuclear charges for peaceful purposes and their handling;
- handling of nuclear materials and radioactive substances, including handling in exploration and mining of materials containing those materials and substances, in production, use, reprocessing and storage of nuclear materials and radioactive substances;
- safety assurance in the use of nuclear energy;
- oversight of assurance of nuclear and technical safety, radiation and fire protection of nuclear installations, radiation sources and storage points, of the sanitary-epidemiological well-being of citizens in the use of nuclear energy;
- physical protection of nuclear installations, radiation sources, storage points, nuclear materials and radioactive substances;
- control of and accounting for nuclear materials and radioactive substances;
- export and import of nuclear installations, equipment, technologies, nuclear materials, radioactive substances, special non-nuclear materials and services in the use of nuclear energy;
- state radiation monitoring within the territory of the Russian Federation;
- training of specialists for the use of nuclear installations, radiation sources, storage points, nuclear materials and radioactive substances;
- performance of other activities in the use of nuclear energy (Russian Federation 1995a, Article 4).

A law on radiation safety of the population (Russian Federation 1995b) was adopted by the State Duma on 5 December 1995 and signed by President Boris Yeltsin on 9 January 1996. Radiation safety is here defined as conditions under which present and future generations are protected against ionising radiation harmful to their

health (Article 1). The law establishes principles for standardisation, grounding and optimisation in radiation protection assurance (Article 3) and basic hygienic standards for exposure caused by the use of ionising radiation sources on Russian territory (Article 9). Other important federal laws and normative acts in the sphere of nuclear safety include the laws on certification of production and services (Russian Federation 1993) and on the administrative liability of organisations for the violation of legislation in the use of nuclear energy (Russian Federation 2000) as well as the provision on licensing of activities in the use of nuclear energy (Government of the Russian Federation 1997b).

As the first among Russia's federal subjects, Murmansk Oblast acquired its own regional law on nuclear safety in 1997 (Murmansk Oblast 1997c). Referring to the federal laws on the use of nuclear energy and on radiation safety of the population, the regional law specifies, among other things, the authority of the regional дума (Article 8) and the regional administration (Article 9), and the rights and obligations of citizens and public organisations in matters of nuclear safety. The law states the major responsibility of various federal agencies to perform regulation and monitoring in the field, but lists a range of activities in which regional authorities can participate (Articles 8 and 9). Among these are the elaboration and implementation of federal nuclear safety programmes, monitoring of the radiological situation in the oblast, the location of nuclear objects (including storage of nuclear waste) and decision-making in the event of a nuclear accident.

It is difficult to judge precisely to what extent the legislative framework related to nuclear safety has evolved in response to the Russian Federation's international obligations in the field, and to what extent it is the result of internal political processes. However, one can assume that the international obligations of the state at least to some extent have influenced developments. The specific reference to the international nuclear safety regime in the preamble to the law on the use of nuclear energy speaks to this effect.

The role of federal authorities

The most important among the federal executive agencies participating in the implementation of nuclear safety measures and of international commitments in that area are the Ministry of Atomic Energy, Gosatomnadzor and the Department for Environmental

Protection under the Ministry of Natural Resources. In some co-operative arrangements, notably AMEC, the Ministry of Defence plays an important role.

The Ministry of Atomic Energy (Minatom) was established in 1986 as a Soviet ministry and merged in 1989 with the powerful Ministry of Medium Machine-Building, responsible for development and construction of nuclear weapons and reactors in the Soviet Union. Minatom was assigned responsibility for all aspects – civilian and military – of the nuclear energy industry and had about a million employees within its structure. This set-up continued when Minatom was reorganised into a Russian ministry in 1992. In 1998, responsibility for nuclear waste from military establishments was also transferred to Minatom. Minatom is a gigantic organisation and in many ways still epitomises a soviet-type industrial sector ministry. Far from being a mere regulatory body, it controls and co-ordinates the work of a large number of state enterprises, including nuclear power plants, weapons production facilities and research institutes. By participating in legislative processes and working out policy concepts and programmes, Minatom plays a key role in carving out the federal policy in the field of nuclear energy. At the same time, at least in principle, the ministry is in a position to implement this policy directly by issuing the necessary orders to its own subsidiary organisations.

Minatom participates actively in international processes related to nuclear energy management, nuclear safety, non-proliferation and disarmament, and in the implementation of international obligations in these areas. The ministry is a key Russian participant in the IAEA regime, and is responsible for fulfilling Russian obligations under the Non-Proliferation Treaty. In the Joint Russian–Norwegian Commission on Nuclear Safety, it is counterpart to the Norwegian Ministry of Foreign Affairs. Minatom is in charge of all fissile materials outside nuclear weapons, also of nuclear warheads once they are taken out of service, and of decommissioned nuclear submarines. This gives Minatom the central role in the implementation of projects under CTR, despite the programme's 'military' profile. It also means that the lack of a formal role for Minatom in AMEC may complicate the implementation of that agreement.

While Minatom represents the Russian Federation in bilateral and multilateral fora dealing with atomic installations and nuclear waste and also oversees the implementation of co-operative projects with other states, the concrete implementation of such projects is largely

delegated to subsidiary or associated bodies, one of the most important being the Interbranch Co-ordination Centre Nuklid. This body was established in 1990 to co-ordinate attempts at commercialisation within the nuclear sector of the Soviet Union. It is not formally part of the structure of Minatom, but it is part of the 'Minatom system' and is organised as a so-called state unitary enterprise (*gosudarstvennoye unitarnoye predpriyatiye*). In practice, this means that it works on contracts with the Ministry and that ties between the two are tight. Nuklid's main office is in St Petersburg; branch offices are located in Moscow, Murmansk and Vladivostok. It has a staff of 55, but approximately 1,500 people work on a contractual basis for Nuklid. The major tasks of Nuklid are technology development (mainly of containers), certification in relation to IAEA and the US Agency for International Development (USAID) and innovation. In 1995, the director of Nuklid was assigned the task of elaborating a programme for nuclear waste treatment, and in 1998 the organisation was appointed main contractor for the AMEC projects and for the majority of the ten co-operative projects with Norway identified in the Framework Agreement between the two states.

In the Soviet Union, there existed no independent control agency in the field of nuclear safety. All functions pertaining to nuclear energy and weapons construction, including both regulation and control, were performed by various divisions within Minatom and its predecessors. In 1991, however, the Federal Inspectorate for Nuclear and Radiation Safety (Gosatomnadzor) was established in the Russian Soviet Federative Socialist Republic and endowed with the task of controlling and licensing activities related to the application of nuclear energy. From then on, Russia was in compliance with a central requirement of the IAEA Convention of Nuclear Safety, which states that the body which implements the regulatory function be separate from other bodies concerned with the promotion and utilisation of nuclear energy.

Gosatomnadzor was established as an executive body under the President. It is responsible for safety regulations in the use of atomic energy. Among its most important tasks are licensing of activities that involve the use of nuclear energy and radioactive materials, the development of standards for and monitoring of such use, non-proliferation of nuclear technology and materials, physical protection of nuclear installations and control of Russian implementation of relevant international agreements. The military sector has been excluded from its

control since 1995. With the establishment of Gosatomnadzor, part of Minatom's control and licensing functions were removed from the ministry and placed with the new agency, making the latter, in effect, an outside 'watchdog' *vis-à-vis* Minatom's activities. As might be expected, this has created a lot of tension between the two agencies. Some of the conflicts have arisen around issues where the delimitation of competence between Minatom and Gosatomnadzor is unclear. In principle, as follows from the provision spelling out the functions of the agencies, Minatom is responsible for the implementation of rules and regulations in the field of nuclear safety, while Gosatomnadzor is responsible for implementation control (Ministry of Atomic Energy 1997). Thus, with regard to international obligations, one of Gosatomnadzor's main functions is to control the implementing activities of Minatom and other relevant agencies. Like Minatom, Gosatomnadzor participates in processes related to the IAEA regime, it controls implementation of requirements under the Non-Proliferation Treaty, and the agency is a participant in several projects under CTR as well as under the bilateral Russian-Norwegian regime.

The Russian environmental agency has experienced considerable ups and downs since it was first established in 1988. Until then, there had been no specialised agency responsible for environmental protection. However, as green issues came gradually to the forefront of public debate, the need arose for political responses, and a State Committee for Environmental Protection was created. In 1991, the Committee was elevated to the rank of a Ministry of Environmental and Natural Resources Protection. The agency retained this status until 1996, when it became, once more, a State Committee. Then, in 2000, came the final blow: as part of President Putin's bureaucratic spring-cleaning, which involved the reshuffling and merging of several ministries and was allegedly undertaken in order to streamline the bureaucracy, the State Committee for Environmental Protection was disbanded. The remains were incorporated into the Ministry of Natural Resources as a Department for Environmental Protection. Where nuclear safety is concerned, the main roles of the environmental agency are to carry out environmental impact assessments for facilities and installations prior to their construction, and to carry out inspections to ensure that environmental regulations pertaining to nuclear safety are observed.⁸

The most conspicuous trait in the Russian federal organisation of nuclear safety issues is the well-known Russian lack of horizontal

integration between various agencies and the high level of conflict between them. A major line of conflict seems to run between Minatom and, in particular, Nuklid, on the one hand, and the 'softer' agencies of the State Committee/Department for Environmental Protection and Gosatomnadzor on the other. The two latter have seen their status reduced in recent years, both formally and informally. The federal agency for environmental protection lost its ministerial status in 1996. Gosatomnadzor has seen its major task to issue licences threatened by new regulations that provide Minatom (in practice: Nuklid) with the right to license activities related to the use of nuclear energy for military purposes (Government of the Russian Federation 1999). Hence, the loss of status of the environmental protection and nuclear safety supervisory agencies has taken place at the same time as Minatom and Nuklid have expanded their spheres of influence.

Working relations between the 'hard' and 'soft' agencies seem to be characterised partly by a *modus vivendi* between people who have been forced – for example, for the sake of international projects – to maintain a certain level of contact with each other. This seems to characterise relations between the representatives of Minatom and the State Committee/Department of Environmental Protection that are involved in co-operation with Norway (Hønneland and Moe 2000). Between others, i.e. Nuklid and Gosatomnadzor, the schism seems more volatile. There are also signs of internal conflict inside Minatom.⁹

The role of regional authorities

The formal role of regional authorities in relation to nuclear installations on their territory, as well as nuclear safety issues, is spelt out in the federal law on the use of atomic energy (Russian Federation 1995a). The law states that the regulation and exploitation of federal nuclear installations are a federal responsibility. The same applies to the implementation of international obligations and the co-ordination of international co-operation in this area (Article 9). However, a number of functions are defined as being the joint responsibility of federal and regional authorities, including decisions on the location of nuclear installations, environmental impact assessments and protection of people and the environment. Moreover, authorities at both levels are jointly responsible for working out and implementing 'complex programmes for the social and

economic development and ecological safety of territories where nuclear energy installations are located' (Article 10). The joint responsibility of federal and regional authorities on these issues in the case of Murmansk Oblast is confirmed in the regional law on nuclear safety (Murmansk Oblast 1997b).

In practice, the vast dimensions of the nuclear-related problems as well as the bureaucratic strength of Minatom and the Ministry of Defence imply that the role of regional authorities remains essentially reactive rather than pro-active. The authorities of Murmansk Oblast have occasionally criticised the two ministries for the problems their activities have created in the region, but their main strategy has been to support federal attempts to deal with the situation and to lobby for stronger commitments in this field. The federal bodies, for their part, mostly recognise that regional support makes policy implementation an easier task. An agreement between Minatom and the regional administration of Murmansk on co-operation in the treatment of radioactive waste and spent nuclear fuel was concluded in 1998 (Murmansk Oblast 1998). A more general agreement on co-ordination of activities within the sphere of nuclear safety between Murmansk regional administration and a range of federal agencies present in the region, including Minatom, the State Committee for Environmental Protection, Gosatomnadzor and the Russian Navy (the Northern Fleet) was signed in early 2000 (Murmansk Oblast 2000). Being rather vague and non-specific, these agreements should perhaps be seen more as an expression of the parties' will to co-operate than as an operative framework for joint problem-solving. When concrete issues are to be tackled or conflicts of interest arise, representatives of the various interested parties are often invited to discuss the issue jointly. An example is the discussions of the suitability of Sayda Bay in the vicinity of the closed military town of Skalistyy as a storage site for submarine reactor compartments. The local authorities were sceptical about these plans and wanted to hold a referendum in Skalistyy on the day of the presidential election – 16 March 2000 – allowing the inhabitants to give their opinion.¹⁰ When their right to do this was questioned, they turned to the regional administration, which agreed to invite all interested parties to discuss the issue, and to act as mediator between the local authorities on the one hand and the Northern Fleet and Minatom on the other.

Among the issues discussed at the meetings concerning Sayda Bay was that of material compensation to the inhabitants of Skalistyy. This

is a question that could affect the policy of regional authorities as well. Increasing nuclear safety in the region is seen as very important, but in the current conditions economic considerations tend to take precedence over most other matters. So to the extent that regional authorities have to accept risks in the future too – for instance in the form of storage sites on their territory – they are likely to try to get as much economic mileage out of it as possible. Pushing for direct compensations is one way of achieving this. Efforts to improve nuclear safety could also spawn positive spin-off effects in the region through investments in infrastructure and increased demand for labour. In 1999, a Committee for Conversion and Nuclear Safety was set up under the regional administration to co-ordinate activities in the field of nuclear safety. The name of the committee reflects the dual objective of the administration, enhancing nuclear safety and simultaneously reviving the struggling naval shipyards.

A large share of the funds currently available for nuclear safety projects in Northwestern Russia comes in the form of assistance from abroad. As pointed out above, co-ordination of such co-operative measures are the prerogative of federal authorities. However, regional authorities are taking quite an active part in attracting and negotiating agreements of this kind. For instance, the Murmansk regional administration is represented in the Joint Russian–Norwegian Commission on Nuclear Safety.

The role of federal agencies in the region

As mentioned in Chapter 3, some forty federal agencies are represented in Murmansk Oblast and even more in Arkhangelsk Oblast. Some of them are relatively independent with regard to policy choices, including choices related to the implementation of Russia's international obligations. As noted in Chapter 4, federal agencies located in the region act as the main representatives of Russian public authorities in the efforts to manage the Northwest Russian fishing fleet, including implementing the country's international obligations. On the other hand, the autonomy of most federal agencies located in the region is probably rather limited *vis-à-vis* head offices in Moscow. This seems to be the case with the federal bodies involved in nuclear safety. Minatom and Gosatomnadzor have their representations in the region, but the 'balance of power' between federal and regional offices differs from what we found in fisheries management. While important decisions in fisheries management

are made by federal agencies located in the region and normally sanctioned by the federal offices, the latter seem to have a greater thrust in the nuclear safety area or, put differently, the agencies located in the region are less autonomous in nuclear safety issues than in fisheries management. In addition to the presence of Minatom and Gosatomnadzor, the State Committee/Department for Environmental Protection has regional branches in each federal subject, including Murmansk and Arkhangelsk Oblasts (see Chapter 6). The Murmansk branch of the committee consists of several departments, including the State Control and Radiation Security Department, which is charged with addressing nuclear safety issues. In the military sphere, the Directorate of Ecological Security of the Armed Forces of the Russian Federation has 'regional' units, including one in the Northern Fleet. However, the responsibility for nuclear safety in the Northern Fleet rests with another body, the Radiological, Chemical and Biological Protection Service.

A recent addition to the measures already in place to organise the scrapping of submarines, treatment of nuclear waste and rehabilitation of submarine bases in the northern areas is the planned establishment under Minatom of a state enterprise, Sevrao, to handle these tasks (Northern Enterprise for the Treatment of Nuclear Waste) (Government of the Russian Federation 2000). Altogether nine such regional enterprises are planned in the Russian Federation. The first will be Sevrao and Dalrao (Far Eastern Enterprise for the Treatment of Nuclear Waste) in the Far East. An overarching federal structure, Rosrao, might also be set up under Minatom. Sevrao will have its head office in Murmansk and branch offices in Andreyeva Bay and Gremikha. It was supposed to be on track by March 2000, but was hampered by changes in Russian property regulations (Hønneland and Moe 2000).

Implementation performance and target compliance

To what extent have Russia's international nuclear safety commitments been implemented in Northwestern Russia? Due to the complexity of the problem, implementation of global, regional and bilateral commitments are discussed separately. We look in particular at the London Convention, the CTR and AMEC agreements and the bilateral agreements with Norway, respectively.¹¹ This section also covers aspects of the discussion found in Chapters 4 and 6

under the headings 'the role of others' and 'joint implementation'. The former refers mainly to the participation of target groups in the implementation process.¹² The latter involves construction projects financed by the US and Norway under the CTR and AMEC agreements and the Norwegian Plan of Action for Nuclear Safety in Northwestern Russia.¹³

The global level

Soviet/Russian implementation of the London Convention, here related to the dumping of radioactive waste that had taken place in the Barents and Kara Seas since the 1960s, is studied by Stokke (2000b). He distinguishes four stages in terms of access and participation patterns in the Soviet/Russian 'implementation game': (1) a period of military self-regulation until the late 1970s; (2) a time of gradually expanding participation during the 1980s; (3) a stage of acute politicisation at the beginning of the 1990s; and, lastly, (4) the mildly ambiguous situation in recent years in which domestic involvement in nuclear affairs is contracting while foreign participation is on the rise.

Since the 1960s, the Northern Fleet and the Murmansk Shipping Company experienced a widening gap between their needs and actual capacity to store radioactive waste and spent nuclear fuel. As a result, they resorted to dumping waste matter into the adjacent Arctic waters. During the 1960s and 1970s, dumping was secret, closed to public scrutiny and under the sole regulation of the military authorities. An interim storage facility for spent nuclear fuel had been built for the Northern Fleet as early as in 1962, but it was plagued by constant operation problems. In 1973, the Northern Fleet and the Murmansk Shipping Company started to transport spent nuclear fuel to the reprocessing plant at Mayak in the Urals.

The Soviet Union ratified the London Convention in 1976, and in 1979 the Soviet Council of Ministers passed Resolution 222 on Measures to Ensure Performance of the Soviet Side's Obligations Following from the 1972 [London] Convention (Stokke 2000b, p. 490). The resolution prohibited the dumping of high-level waste and made the State Committee for Hydrometeorology and Environmental Monitoring (Goskomgidromet)¹⁴ responsible for issuing permits to dump low- and medium-level waste and for reporting permit allocation to the International Maritime Organisation (IMO). According to Stokke (pp. 491–492), the resolution – intentionally designed to spur

Soviet implementation of the London Convention – transformed the Soviet implementation game by shifting executive involvement to other levels of government, by prohibiting the dumping of high-level waste and by introducing a regulatory newcomer regarding low- and medium-level waste. All these measures were in line with the regulatory provisions of the London Convention and would be difficult to account for in the absence of the convention.

During the 1980s, Goskomgidromet confirmed its role as an independent agency with its own ambitions in the dumping issue. It participated in the elaboration of new standards for the dumping of radioactive waste; it permitted the Northern Fleet to continue dumping low- and medium-level waste on the condition that it built a waste-processing plant; and, when this did not happen, it withdrew its dumping permit. Murmansk Shipping Company, which had less waste to handle than the Northern Fleet, had already built a processing plant and stopped dumping liquid waste in 1984 and solid waste in 1986. The Northern Fleet, for its part, disregarded the instructions of Goskomgidromet and even increased the amounts of dumped waste towards the end of the 1980s. The newly established State Committee for Environmental Protection replaced Goskomgidromet at the head of the Soviet delegations to the London Convention in 1989.

Largely as a result of the Chernobyl accident, nuclear safety became a major issue in Soviet/Russian politics at the end of the 1980s and early 1990s. The barriers to involvement in nuclear safety issues were dramatically lowered as institutional rivalry during the transition from the Soviet Union to the Russian Federation enhanced participation in the decision-making process. Implementation of international nuclear safety obligations went from being a process involving a handful of regulatory bodies to a key issue at the highest political level with broad societal scrutiny and activity. However, during the 1990s interest in environmental affairs levelled off as the economic crisis claimed most ordinary citizens' attention. At the same time, foreign assistance directed towards nuclear safety in Russia increased. This foreign involvement, mainly at the regional and bilateral level, generally took the form of financial assistance to Russia to help the country comply with its obligations at the global level. Hence, implementation of obligations at the global level became linked to implementation at the regional and bilateral level (discussed below). The Kola Nuclear Power Plant's ability to comply with the IAEA standards and the Northern Fleet and Murmansk Shipping Company's ability to process

radioactive waste and spent nuclear fuel in accordance with Russia's international obligations are in a major sense dependent upon the success of various bilateral projects under the Joint Russian–Norwegian Commission on Nuclear Safety.

The regional level

A thorough study of the implementation of the CTR and AMEC programmes is found in Sawhill and Jørgensen (2001).¹⁵ The main objective of the CTR programme is to eliminate strategic weapons and their launching systems in Russia in order to enable the country to comply with its arms reduction obligations under START I. By 2007, 41 ballistic missile-firing submarines (SSBNs) and their associated missiles and missile launchers are to be eliminated through the CTR programme. While Russia would comply with the START II treaty by removing the missile compartment from submarine hulls and cutting the missile tubes in half, this is only one step in a comprehensive process of dismantling the entire submarine quota. In particular, the rate of the scrapping depends on how quickly the reactor fuel can be removed. In 1995, the rate was four submarine reactor cores (or two submarines) annually. The main obstacle was lack of capacity to handle spent nuclear fuel and radioactive waste.

In its initial years, the CTR programme provided mainly heavy industrial equipment to Russia, such as cutting tools, cranes and other things necessary for removing the missile tubes and scrapping submarine hulls. As the Russian shipyards from the mid-1990s became increasingly unable to pay their workers and maintain basic operational procedures, the CTR programme shifted from providing equipment and technology to signing direct contracts with Russian shipyards to dismantle submarines. The first contract was signed with the Zvyozdochka shipyard in Arkhangelsk Oblast in 1997. In addition to this shipyard, the Nerpa shipyard in Murmansk Oblast was later included in the scheme. After infrastructure improvements provided by the CTR programme, Nerpa can now dismantle two to three submarines and Zvyozdochka six per year. Spent fuel from six SSBNs will be reprocessed at the Mayak Chemical Combine. For spent fuel from the remaining SSBNs, the CTR programme is purchasing some 100 40-tonne storage casks, developed under the AMEC programme (see below), that can safely store the fuel for up to fifty years. Due to continued difficulties in getting the casks licensed, the problem of spent nuclear fuel remains a serious obstacle

to submarine dismantlement. Nevertheless, 18 of the projected 41 SSBNs were dismantled by February 2001, see Table 5.2.

Table 5.2 *CTR accomplishments and projections (as of February 2001)*

	<i>Original inventory baseline</i>	<i>Eliminated February 2001</i>	<i>Eliminated 2004 (projection)</i>	<i>Eliminated 2007 (projection)</i>
Submarine- launched ballistic missiles (SLBM)	936	184	503	661
SLBM launchers	728	308	480	612
Ballistic missile- firing submarines (SSBNs)	48	18	32	41

Source: Sawhill and Jørgensen (2001).

The AMEC programme comprises seven project groups, five of which deal with spent nuclear fuel and radioactive waste management, see Table 5.3. Most importantly, a 40-tonne prototype container suitable for interim storage and transportation of spent nuclear fuel has been developed under the programme (project 1.1). The prototype was completed in late 1999, but the cask's certification has been complicated by disagreement between Minatom and Gosatomnadzor concerning which of these organisations should be the certifying agency. Concrete storage pads, of which up to fifty casks may be temporarily stored, should have been ready by mid-2001 (project 1.1-1). However, the construction of the pads has been delayed due to difficulties in obtaining land-use permits from regional authorities.

Project 1.2 aims at reducing the growing volume of low-level liquid radioactive waste through the development of a mobile waste-processing facility. The facility is intended to serve submarines at remote sites on the Kola Peninsula. The first mobile unit is under construction at the time of writing. Projects 1.3 and 1.4 are related to solid radioactive waste stemming from the dismantlement of submarines. Several facilities are scheduled to be completed during the years 2001–2.

In summary, the CTR and AMEC projects – mainly aimed at the scrapping of submarines and the development of infrastructure

Table 5.3 *Nuclear safety projects in the AMEC programme*

<i>Project number</i>	<i>Project description</i>
<i>Naval spent nuclear fuel management</i>	
1.1	Design and construct interim storage and transportation container
1.1-1	Design and construct temporary storage pad for spent nuclear fuel cask
<i>Naval liquid radioactive waste treatment</i>	
1.2	Design and construct mobile liquid radioactive waste processing facility
<i>Solid radioactive waste volume reduction</i>	
1.3-1	Assess technology for waste volume reduction
1.3-2	Manufacture a mobile pre-treatment facility
1.3-3	Manufacture a decontamination unit for metal wastes
<i>Solid radioactive waste storage</i>	
1.4-1	Assess surface coating technologies
1.4-2	Manufacture steel radioactive waste containers
1.4-3	Manufacture concrete radioactive waste containers
<i>Radiation monitoring and personnel and environmental safety</i>	
1.5	Equipment transfer, training and exchange of monitoring strategies
1.5-1	Radiation control at facilities

Source: Sawhill and Jørgensen (2001).

necessary for the unloading, transportation and storage of spent nuclear fuel and radioactive waste – are in the process of being implemented, but largely behind schedule. Delays are caused by a mixture of internal Russian factors and factors found in the interface between donor states and Russia. The major problem among the latter is slowness in the elaboration of an international legal framework, in particular related to indemnity against liability, access to nuclear sites, personnel immunity and tax exemptions. The internal Russian factors are mainly related to institutional controversies: cf. the disagreement between Minatom and Gosatomnadzor as to which agency has the right to license the 40-tonne cask developed under the AMEC

programme. Apart from open conflict, the lack of co-ordination between various Russian agencies has reportedly created serious problems for the implementation of both CTR and AMEC. Moreover, there seems to be a positive correlation between the potential for financial gain for the institutions involved and implementation success. For instance, the enthusiasm of Minatom and the Ministry of Defence is related to the financial support channelled through these agencies by the programmes. Likewise, the defence industry gained substantially from the agreements, which enhanced their supportive attitude. Furthermore, Minatom's interest cooled off markedly when the ministry in the mid-1990s acquired control of the lucrative nuclear export market (and was thus no longer so 'dependent' on financial support from abroad). The Ministry of Foreign affairs, for its part, has often put on a tougher stance towards the US in CTR negotiations than other Russian agencies, which can probably be explained, at least partly, by the fact that this ministry has only had a co-ordinating role in the CTR process. Finally, the overarching political controversies of the Russian Federation – between the executive and the legislative and between the federal centre and the regions – have also hampered co-operation under the CTR and AMEC agreements. The key to the solution of the most pressing unresolved issues affecting AMEC co-operation – tax exemptions, liability and immunity – rests largely with the Federal Parliament. As far as centre–region relations are concerned, there are examples of projects having been exempted from taxes by federal authorities, yet having to face demands for taxes at the regional level.

The bilateral level

The Norwegian Plan of Action for Nuclear Safety in Northwestern Russia provides further infrastructure to facilitate implementation of the agreements at global and regional level. The Plan of Action was evaluated in 2000 by one of the authors of this book (Hønneland and Moe 2000).¹⁶ Project participants were interviewed at various levels of government in both countries.

The evaluation comprised five of the projects covered by the Framework Agreement on Nuclear Safety between Russia and Norway, see Table 5.4. Project 202 involved the upgrading and expansion from 1200 m² to 5000 m² of the effluent treatment facility for liquid radioactive waste at the facility serving nuclear-powered icebreakers in Murmansk. The project was conceived in 1994

Table 5.4 *Projects financed by the Norwegian Plan of Action for Nuclear Safety in Northwestern Russia and included in the Framework Agreement on Nuclear Safety between Norway and Russia*

<i>Project number and description</i>	<i>Funding in USD</i>
<i>Defence-related spent nuclear fuel projects</i>	
211: Build ship for transport of spent naval nuclear fuel	376,000
212: Build four railway cars for transport of spent naval nuclear fuel	2,963,000
216: Empty/decommission spent naval nuclear fuel at Andreyava Bay	733,000
217: Establish interim storage facility for spent naval nuclear fuel at Mayak	186,000
230: Develop transportable storage cask for spent naval nuclear fuel	610,000
232: Build pad for temporary storage of spent naval nuclear fuel casks	595,000
<i>Defence-related radioactive waste projects</i>	
213: Modernise liquid radioactive waste storage facility in Severodvinsk	4,185,000
214: Deliver mobile equipment for processing liquid radioactive waste	0
215: Build temporary storage facility for solid radioactive waste at Andreyava Bay	8,578,000
226: Build system for processing solid radioactive waste from submarines	75,000
<i>Civilian nuclear safety projects</i>	
101: Enhance operational safety at the Kola Nuclear Power Plant	9,668,000
202: Modernise liquid radioactive waste treatment facility in Murmansk	1,996,000
203: Dismantle the floating technical base Lepse	2,852,000
229: Develop transportable storage cask for spent nuclear fuel	472,000

Source: Sawhill and Jørgensen (2001).

as a bilateral Norwegian–Russian initiative; the USA joined the project in 1995. The facility will serve both the nuclear-powered icebreaker fleet and the Russian Northern Fleet. The opening of the facility was postponed several times, but finally took place in June 2001. Main project participants in Russia were Nuklid and RTP

Atomflot, on whose premises the facility was built. A major goal for the Norwegian side was to sway Russia to accede to the London Convention's prohibition on the dumping of nuclear waste (including low-level waste) at sea. In the interviews, this was mentioned by all Norwegians who had something to say about this project, but by none of the Russians. They, instead, stressed the need to solve the increasing problem of liquid radioactive waste, and to expand activities and secure revenues at RTP Atomflot (by selling services to the Northern Fleet). The Russians and Norwegians agreed that the goals of the project had been 'nearly achieved'. The Norwegians here probably referred to the finalisation of the facility, not to Russian accession to the dumping ban in the London Convention. To explain the delays in finalising the facility, the Russian project participants referred to changes in the Russian security norms twice during the project period (in 1996 and 1998). On the Norwegian side, 'Russian bad [management] culture' and 'the culture clash between Americans and Russians' were given as reasons for the delays. Both parties mentioned the Russian need for pre-payment as a major obstacle. Nevertheless, bilateral co-operation between Norwegian and Russian project participants was generally perceived as unproblematic. The project has had a relatively high profile and was also mentioned frequently in evaluation interviews we had with people other than those directly involved in it. Most seemed to perceive it as 'partly successful'. For some time, it was clearly viewed as something close to an exemplary project since the parties did manage to get something done here. With the repeated delays in finalising it, however, enthusiasm dwindled. Several of the Russian interviewees peripheral to the project referred to it as 'too golden', indicating that the abundant financing dampened Russian enthusiasm to finalise it. Some said outright that the Norwegian side should have stood more firmly on its position and demanded the finalisation of the project with the funds initially allotted.

A Norwegian initiative resulted in the establishment of an international advisory committee to work for the solution of the environmental threat posed by *Lepse*, the nuclear-powered icebreaker fleet's old storage vessel for radioactive waste (project 203). The committee is led by Norway; the other participants are Russia, France, the USA, the European Commission and the Nordic Environmental Finance Corporation (NEFCO). Major participants on the Russian side include Minatom, Nuklid, Murmansk Shipping

Company (the owner of *Lepse*), the State Committee/Department for Environmental Protection, Gosatomnadzor and various research institutes and enterprises. The vessel was docked in the summer of 1999 and is assumed by Russian experts to be safe for another ten years. Documentation is being elaborated on the whole process of removing the damaged fuel and liquidating the vessel; the present project only embraces the former aspect. There has been very little progress in the project so far, except for a fruitful sub-project on licensing. From the point of view of the Norwegian leadership of the project, practical work cannot start until all Western parties involved have been secured tax freedom and indemnity against liability through framework agreements with Russia. Such agreements are still lacking for NEFCO and the USA. An agreement between Russia and France was signed in June 2000. During the interviews, Russian actors at both the project level in Murmansk and the co-ordinating level in Moscow showed little understanding for the Norwegian stance and complained about the lack of progress in the project.

It has long been acknowledged that Russia will need a specialised vessel for safe transport of spent nuclear fuel and possibly also other radioactive waste from decommissioned nuclear submarines from remote locations in Northwestern Russia to transfer terminals in Murmansk and the Sevmash shipyard in Severodvinsk. Spent fuel is transported in containers too heavy to be transported by road. The ship will be required to have independent propulsion machinery, a double hull and other safety features. The firm Moss Maritime was responsible for an elucidation (project 211); the main actors on the Russian side were Minatom and a co-ordinating body for Russian shipyards Morskoye Korablestroyeniye (Maritime Ship-Building). The original plan was to build a new ship. However, in 1998 the Russian party announced that it would instead reconstruct an old vessel, the *Amur*, arguing that it would be a less expensive solution. The Norwegian position was that the cost of reconstructing *Amur* would hardly be lower than that of building a new vessel. It also argued that *Amur* would not be fit to fulfil the tasks of the required specialised vessel. Separate expert groups were established in Norway and Russia in 1999, and in the autumn of that year they came to a joint conclusion: building a new vessel would be the better alternative. At the beginning of 2000, Minatom formally informed the Norwegian party that it would go in for a new vessel. Since then, planning has progressed rapidly. The Norwegian project participants

assumed that external concerns were delaying the project. Minatom was out of ideas about how to rid itself of the old and polluted vessel, the *Amur*, and the planned specialised vessel for transport of spent nuclear fuel was perceived as a possible way of solving this problem. The Russian project participant viewed the Norwegian approach to the project as constructive and acknowledged that the delay was indeed due to problems on the Russian side.

In order to transport spent nuclear fuel from terminals in Murmansk and Severodvinsk to interim storage or reprocessing in Mayak, Russia will need specialised railway rolling stock able to provide safety-approved transport for the 40-tonne casks developed under the AMEC programme. Project 212 in the Norwegian Plan of Action involved procurement of four such specialised wagons, of which Russia already had four. The Norwegian firm Moss Maritime was responsible on the Norwegian side while Nuklid was main Russian contractor of the project. The wagons – finalised in March 2000 – were built at Tver Railway Factory in Central Russia. All subcontractors were also Russian. Negotiations on the realisation of the project started in September 1998. The Norwegian project manager claimed that they were ‘forced’ by the Norwegian Ministry of Foreign Affairs to accept Nuklid as main contractor on the Russian side. They would have preferred to control all activities in Russia itself, selecting subcontractors by means of tenders. Nuklid does not use tenders; it selects subcontractors on the basis of fixed prices. According to the agreement between the Norwegian project leader and Nuklid, the former has no right even to be informed of financial dispositions by the Russians. The only reason Moss Maritime accepted the idea was because it was a concrete project, with easily monitorable progress. The wagons were built without any particular problems. However, a major problem arose when they were being completed in spring 2000. The Norwegian project manager was informed that the Russian main contractor had changed ownership of the wagons. Moss Maritime’s agreement with Nuklid states that the wagons shall be owned by the Mayak facility. However, it turned out that they had been transferred to a newly established firm, Atomspetstrans. Moss Maritime requested further information on this matter and immediately stopped remaining payments to Nuklid. Moss Maritime was concerned for the lack of respect shown to concluded agreements by the Russian party. They claimed not to have been informed about the change of ownership, nor about the status

of Atomspetstrans. During the interviews, representatives of other agencies in Russia claimed that Atomspetstrans did not exist and that if it had in fact been established, it would be a 'paper firm' only performing an unnecessary middle-man role, leasing the wagons to the Mayak facility. The following interview extracts illustrate the antagonism between the Norwegian project management and Russian main contractor of this project:

As far as our relationship with Moss Maritime is concerned, our functions are quite similar, but we're interested in the end result, and we know Russian management culture; Moss Maritime exaggerates its function; they're only interested in making money, which is quite understandable, but they shouldn't have been given so much money for doing it; they have only been a financial agent for the [Norwegian] Ministry of Foreign Affairs; I don't know how much Moss Maritime took from the Ministry of Foreign Affairs, and it really doesn't interest me, but I proposed to manage the project on my own and inform Moss Maritime of its progress; [. . .] it would have been financially beneficial also for Nuklid only to be a financial agent and receive money from Moss Maritime for our intellectual services, but it wouldn't have been beneficial for Russia. (Russian project participant and co-ordinator)

[The Russians] view themselves as responsible for the project and us as donors; Nuklid thinks of itself as contractor, but they're not able to manage projects; the [Norwegian] Ministry of Foreign Affairs should support us here . . . , they should at least insist on professional project management; the Ministry of Foreign Affairs could avoid using Nuklid by arguing that experience from other projects is not too good, for instance in [Project 202]; [. . .] Norway displays naivety in relation to Nuklid, if the authorities suspect that not all money goes to the agreed measures, it's wrong to continue. (Norwegian project participant)

In contrast to project 212, Moss Maritime was given the opportunity to carry out the upgrading of storage tanks for liquefied radioactive waste at the Zvyozdochka shipyard in Severodvinsk (project 213) without the involvement of Nuklid. The project involved the upgrading of two existing tanks and the modernisation of piping systems and control equipment at the premises. The tank facility is located next to a planned effluent treatment facility for liquid radioactive waste and will primarily function in connection with the dismantling of nuclear submarines at the shipyard. The project was started in May

1998 and completed in August 1999. It is generally perceived of as one of the most successful under the Plan of Action. It involved intensive work for fourteen months and ended in the completion of the modernised tank facility. Moss Maritime used a Russian employee as project manager. He remained for most of the project period in Severodvinsk. In contrast to several other projects under the Plan of Action, this one was completed without delay. The total costs amounted to NOK 5.7 million less than budgeted. In explaining the success of the project, Moss Maritime stressed its freedom to select Russian subcontractors itself, i.e. non-interference by Nuklid. At an early stage in the project, it discovered that payments from the Norwegian side had been used by the shipyard for other purposes than agreed upon. The project leader warned the Zvyozdockha leadership that he would have to report this to the Norwegian Ministry of Foreign Affairs. The shipyard then decided to take up loans to pay for the agreed equipment. Another problem was to make workers at the shipyard actually work. A rather unconventional measure by the project management was to physically show up at the yard and promise to pay the workers a reward if they performed the work they were supposed to do anyway. The project manager circumvented the requirement (in line with the provisions of the Framework Agreement) that inputs to the project be tax and customs exempted, by simply buying materials in the Russian market at whatever price was offered. The director of Nuklid – who was initially appointed by the Russian side as ‘leader of the project’s working group’ – took exception to the project’s objective. She recognises that the project was successfully implemented, but disputes its rationale, arguing that it was ‘basically unimportant, [. . .] far too expensive, and directed towards a completely irrelevant goal’. However, her position seems to be in direct contradiction to her own government’s nuclear safety priorities as presented to the international community: that Russia requires additional capacity to collect and process liquid radioactive waste from the Northern Fleet, the Murmansk Shipping Company and the shipyards that are dismantling decommissioned submarines (Gubanov and Akhunov 1995; Semenov and Bonne 1999).

The bilateral co-operation at state level between Norway and Russia in areas covered by the Plan of Action has found its form, although some problems and difficulties remain. Co-operation between environmental and nuclear safety authorities functions to the satisfaction of both parties. The signing of the Framework

Agreement and establishment of the Joint Commission for its implementation in 1998 represent major achievements at the highest political level in the two countries. Current problems, such as the inclusion of new projects under the provisions of the Framework Agreement, are mainly to be found on the Russian side. However, where the Norwegians feel that their Russian counterparts are moving too slowly, some Russians miss a more profound understanding by the Norwegians of the difficulties on the Russian side. Regional actors in Northwestern Russia also complain that the Norwegian party relies too heavily on contacts with federal agencies in Moscow. Collaboration at project level between the two nations can generally be characterised as very good. In our interviews, no major differences in the perception of goals, processes and results were revealed – except in some of the projects where Nuklid was involved. The role of this co-ordinating body in nuclear safety projects is highly disputed in both Norway and Russia, which is even more explicitly reflected in the analysis of concrete projects. First, Norwegian project managers object to the lack of financial transparency seen when Nuklid stands for project management on the Russian side. Second, working relations between Norwegian and Russian project participants are reported to be far more problematic when Nuklid is involved than when it is not.

Conclusions

If we compare the above with fisheries management, the nuclear safety sector is far more complex both with regard to issues and actors involved. We noted in Chapter 4 that Northwest Russian fisheries during the 1990s were characterised by a fragmentation of management responsibility, degeneration in implementation performance and a reduction in target compliance. For both the fisheries and nuclear safety sectors, we assumed implementation capacity to be quite good during the Soviet period. Implementation performance and target compliance in the fisheries decreased during the 1990s mainly as a result of bureaucratic controversies as well as changes in the targets' incentive structure brought about by the end of the command economy. In the area of nuclear safety, most of the Russian obligations we have reviewed in this chapter came into being in the post-Soviet period, and several of the problems met in the fisheries sector were encountered here too. In particular, bureaucratic

controversies – notably between the ‘hard’ and ‘soft’ regulatory agencies at the federal level – have clearly hampered implementation. Moreover, foreign assistance has come to dominate the implementation of Russia’s international nuclear safety commitments during the post-Soviet period. Some of the most serious problems encountered in implementation efforts can be ascribed to unresolved issues between Russia and the Western donor states, relating, i.e., to indemnity against liability, access to nuclear sites, personnel immunity and tax exemptions. So while there is some progress in the implementation of Russia’s international nuclear safety commitments at the present moment, it is slow and it is fumbling.

Notes

- 1 On the other hand, strategic submarines sometimes go to dismantlement well before the expiration of their service life.
- 2 The icebreaker fleet also includes conventionally powered ships.
- 3 However, even underground tests, both US and Soviet, have been known to cause radioactive fallout on the territory of other states (Stortinget 1994).
- 4 The Kola Nuclear Power Plant and submarines at refuelling are both classified as sources of known or probable risks – i.e. ‘release is known to have occurred or [. . .] significant probability for release has been confidently estimated’ (Bergman and Baklanov 1998, p. 55). Sources of *potential* risk are ‘those expected to constitute a risk for considerable release provided the outcome of further analysis for certain steps in the event chain’ (*ibid.*).
- 5 Nevertheless, the regional branch of the State Committee/Department for Environmental Protection (see section on implementation by federal authorities below) allegedly has the right to inspect some military objects; see the section below on the role of federal agencies in the region.
- 6 In 1966, there was a major discharge of radioactivity from the reactor section, and as the fuel assemblies in the reactors were to be replaced the same year, it was discovered that several of them had expanded due to overheating. Forty per cent of them were removed and transferred to the *Lepse*. In 1967, there was a major leakage in the cooling system of one of the vessel’s reactors (Bergman and Baklanov 1998, p. 32).
- 7 The possibility of substituting electricity from Norway for the nuclear energy has been discussed, but it soon became clear that Norway could not provide the necessary amounts. Substituting various forms of alternative energy for nuclear power, or solving the problem by way of

energy-saving measures will take a long time, if at all feasible. In a long-term perspective, gas from the Shtokmanovskoye field in the Barents Sea may prove the most realistic option.

- 8 Other federal agencies engaged in the implementation of international nuclear safety agreements are the State Committee/Federal Service for Hydrometeorology and Environmental Control (see Chapter 6 for further information about this agency), the Russian Ship-Building Agency, the Ministry of Economy and the continuously changing agencies for defence industry. However, their role is of a more peripheral character compared to those federal agencies discussed in this section.
- 9 For example, it turned out at the second session of the joint Russian–Norwegian Commission for Nuclear Safety that the Russian delegation leader did not know that a joint Russian–Norwegian secretariat for the joint commission had been set up at the premises of Minatom. An employee of Nuklid was paid through a bilateral Russian–Norwegian project to run the secretariat. The director of Nuklid claimed that not having been informed of the secretariat was a case of ‘simple fraud’ (Hønneland and Moe 2000). She fired the employee, and the Russian part halted the project. The secretariat could not have been established without Minatom’s knowledge and acceptance. By other Russian interviewees in the Norwegian evaluation of the bilateral nuclear safety co-operation, these events were referred to as ‘another attempt at centralisation by [the director of Nuklid]’ (2000, p. 26).
- 10 Later, the regional electoral commission declared the referendum plans illegal, and it was not carried out.
- 11 The BEAR co-operation has mainly served to relate environmental concern to broader foreign policy issues (Stokke 2000a). This regime has not contributed funds and engaged in practical nuclear safety projects to the same extent as CTR, AMEC and the Norwegian Plan of Action.
- 12 Environmental NGOs are generally few and weak in Murmansk Oblast. The most important NGO in nuclear safety issues in North-western Russia is the Norwegian organisation Bellona, which has an office in Murmansk. However, Bellona’s role has been more important in agenda-setting than in implementation of Russia’s international agreements.
- 13 The title of the Plan of Action does not specifically refer to North-western Russia, but to ‘areas adjacent to our northern borders’ (Ministry of Foreign Affairs 1995).
- 14 See Chapter 6 for details on this agency.
- 15 This section is based mainly on Sawhill and Jørgensen (2001). Underlying documentation is found in Shields and Potter (1997) and Safranchuk (2000a). See, in particular, Orlov (1997), Pikayev (1997) and Safranchuk (2000b).

- 16 This section provides a summary of the report's evaluation of project implementation; see the report for a detailed account (Hønneland and Moe 2000).