

Chapter 8

Summary

New information on actual and potential sources of radioactive contamination in the Arctic environment has been provided for this assessment. More detailed knowledge for several sources has enabled new impact assessments; however the major sources of radioactive contamination of the Arctic environment are still fallout from atmospheric nuclear weapons tests conducted between 1945 and 1980, discharges from European spent nuclear fuel reprocessing plants, and fallout from the accident at the Chernobyl nuclear power plant in the Ukraine in 1986. Doses to humans are derived mainly from global fallout and fallout from the Chernobyl accident.

A topic new to this assessment is the loss of the submarine *Kursk* of the Russian Northern Fleet off Murmansk in August 2000 after an explosion on board. The *Kursk* has now been recovered and monitoring shows that the accident did not result in any measurable releases of radionuclides to the Arctic environment.

In general, levels of radionuclides in the Arctic are declining. The exceptions are seawater concentrations of the long-lived water-soluble fission products ^{99}Tc and ^{129}I . This is due to increased releases from nuclear fuel reprocessing in Western Europe and supports the recommendation by AMAP in 2000 that the Arctic Council encourage the United Kingdom to reduce the releases from Sellafield to the marine environment of technetium, by implementing best available technology.

There is evidence that sediments are now a source of Pu and ^{137}Cs to the Arctic. Previous releases, such as those from Sellafield that have deposited in Irish Sea sediments, are being remobilized such that these deposits now act as sources to the Arctic. Thus, even if operational releases from reprocessing plants are reduced, radionuclides remobilized from contaminated sediments in the Irish Sea and the Baltic Sea will continue to be observed in the Arctic. Nevertheless, present doses to Arctic peoples from radionuclides originating from spent nuclear fuel reprocessing plants are small, although the uncertainty surrounding the pathways to and effects of such radionuclides in the Arctic indicates the need for further assessment. Impacts on the Arctic should be considered when evaluating discharge reduction measures, and it is recommended that the Arctic Council support a more detailed study on the remobilization of radionuclides from sediment and its potential long-term effects on the Arctic.

Despite the decline in current levels, there is continuing uncertainty about the amount of radionuclides present at a number of sources and potential sources in the Arctic. Access to information about civilian and military sources continues to be a problem. It is recommended that the Arctic Council promotes more openness for restricted information.

New work has been done on doses to populations in the Faroe Islands, Canada, and northwest Russia. Doses to the non-indigenous populations in Russia and to the Faroe Islands' population were the same as estimated

during the first AMAP assessment, whereas the new estimates for doses to the indigenous populations in Canada and northwest Russia were lower and higher, respectively. In both cases, the difference was due to revised estimates of the intake of reindeer/caribou meat.

Previously, the focus of radiation protection has been the protection of human health. A new initiative, highlighted in this assessment, is an attempt to develop a basis for protecting the environment from the effects of radiation. An international consensus has emerged for the rapid development of a system and framework for the protection of the environment. The International Union of Radioecology, with support from AMAP, was one of the first international organizations to promote this. It is recommended that AMAP be asked to take an active part in continued efforts to address environmental protection, taking special responsibility for the Arctic. This should focus on the scientific needs associated with protection of the environment, and the development of associated monitoring strategies and assessment tools.

The major concern regarding potential environmental contamination relates to accidents involving nuclear material, especially accidents at nuclear power plants. Models show that a major accident at the Kola nuclear power plant in Russia resulting in substantial release of radioactive material to the atmosphere would require countermeasures to avoid high radiation doses to the population, which may then need to be applied for several years. Vulnerability, expressed as dose from a given fallout, can vary considerably, even over small areas. Owing to high transfer rates and long ecological half-lives, previous deposition must be quantified when estimating the consequences of potential accidents. It is recommended that AMAP be asked to clarify the vulnerability and impact of radioactivity on the Arctic environment and the consequences for emergency preparedness planning.

Major efforts are underway to reduce radiation risks associated with nuclear reactors and radioactive waste handling. Nevertheless, further improvements are warranted. The main criterion of success for a nuclear safety project is its net contribution to the improvement of nuclear safety. Projects must be undertaken within a context that includes safety assessments and environmental impact assessments that incorporate a variety of risk analyses, to demonstrate compliance with risk objectives relating to environmental and human health protection. Future effort will continue to be concentrated on the areas of greatest risk and the operations and facilities that pose the greatest potential threat. To reduce risk, to mitigate the consequences of possible future accidents, and to optimize the use of resources, work has been undertaken on risk management and risk analysis of nuclear activities and on assessments of the vulnerability of Arctic areas. This provides a basis for improved emergency prevention, preparedness, and response to nuclear incidents, with the optimal use of resources.

It is recommended that risk and impact assessment programs, including uncertainty estimates, be performed before action is taken to reduce risk. Risk and impact assessments, including accident scenarios, should be undertaken for the transport of nuclear waste and fuel within the Arctic and nearby areas, and with regard to storage and reprocessing within the Arctic and nearby areas. Since the first AMAP assessment, nuclear safety programs have been undertaken in Russia at nuclear power plants and other nuclear installations relevant to the Arctic. It is recommended that the Arctic Council continue its cooperation with Russia to improve the safety and safeguarding of nuclear installations and waste sites.

Co-operation is required between relevant authorities on the development of initiatives concerning health and safety, and preparedness. Of particular interest are

health and safety risks immediately before, during, and after a risk reducing initiative. Although such cooperation has not been prioritized to date, current cooperation between the authorities responsible for radiation protection, environmental protection, and nuclear safety is working well and contributing to effective international programs. Such efforts are not costly and contribute significantly to the development of large multilateral internationally funded projects. At the same time, they have wider significance – one consequence is that Russian management practices and demands relating to radiation protection are now becoming more transparent and more compatible with international guidelines. A further strengthening of the Russian authorities responsible for nuclear protection would increase their ability to effectively implement these improved management practices.