

Contaminants exposure of Arctic humans and biota

Over the past 10 years, the Arctic Monitoring Programme (AMAP) has conducted two major assessments of the pollution status of the Arctic, documenting the sources, levels and trends, and effects of a wide range of contaminants, including persistent organic pollutants (POPs), heavy metals, radionuclides, acidifying substances, and petroleum hydrocarbons. The main conclusions of these assessments are that: *"In comparison with most other areas of the world, the Arctic remains a clean environment. However, for some pollutants, combinations of different factors give rise to concern in certain ecosystems and for some human populations. These circumstances sometimes occur on a local scale, but in some cases may be regional or circumpolar in extent."*

MECHANISM of EXPOSURE: Due to a combination of long-range transport, uptake by organisms, and biomagnification in food webs, contaminants in Arctic biota, including humans, can reach very high levels.

Although these same processes introduce contaminants to biota at lower latitudes, there are some special characteristics of Arctic ecosystems that can lead to enhanced exposures or contaminant burdens. Many Arctic biota rely on fat reserves for energy and insulation against the extreme cold – marine mammals are a prime example. However, many POPs also concentrate in fatty tissues. When fat reserves are used, for example when food is short or when rearing young, some animals experience a remarkable loss of body weight – the contaminant burden however remains resulting in increased concentrations in the tissues and organs.

The main periods of contaminant delivery, in particular for mercury, coincide with the end of the winter – contaminants deposited to snow and ice are washed into the freshwater and marine systems at exactly the time when biota are becoming productive – enhancing uptake. Biomagnification, in particular in the long Arctic marine food chains, results in very high contaminant exposures for top predators, including humans. When spawning or giving birth, females can pass a significant contaminant burden to their young – and in this connection mammals (seals, polar bears – and humans) can continue to transfer contaminants to their young via their milk.

The species that contain some of the highest levels of contaminants are also those exploited for food, in particular by Arctic indigenous people, many of whom live a traditional lifestyle based on hunting and gathering. Use of traditional food is an important part of the cultural and spiritual identity of indigenous groups and normally traditional foods are extremely healthy and provide a vital source of calories and nutrients. Indigenous populations groups that rely on marine mammals for their food, such as the Inuit of Canada and Greenland, have been identified as having among the highest exposures to contaminants such as PCBs, chlordanes and mercury of any people on the planet.

LEVELS: For some contaminants, in some areas of the Arctic, levels found in the environment or biota are comparable with those seen in industrialised parts of Europe. For some human populations in the Arctic, levels of contaminants in blood and breast milk are higher than those found anywhere else on the Earth.

HUMAN EXPOSURE: In contrast to the situation in most other parts of the world, Arctic people are exposed to contaminants that are used in agriculture or industrial processes from which they receive little or no benefit. Contamination of the Arctic is therefore a moral issue for countries that are the sources of these contaminants. Human exposure is largely through the diet, in particular through the traditional diet. However, in some parts of the Arctic, alternative foods are not available. Where they are available, imported foods are expensive, and a move away from traditional diets to greater reliance on imported foods has other negative health consequences – causing, for example, increasing levels of obesity, diabetes and heart disease.

Many Arctic residents want to follow a traditional lifestyle, their traditional foods are healthy and consumption of these foods is vital for their well-being. This is the message that is repeated by health authorities throughout the Arctic. At the same time, however, scientists are telling them that these foods contain contaminants that can have small but not insignificant associated health risks. This is the 'Arctic dilemma' – and one where appropriate communication is of vital importance.

