

# Fact sheet #1

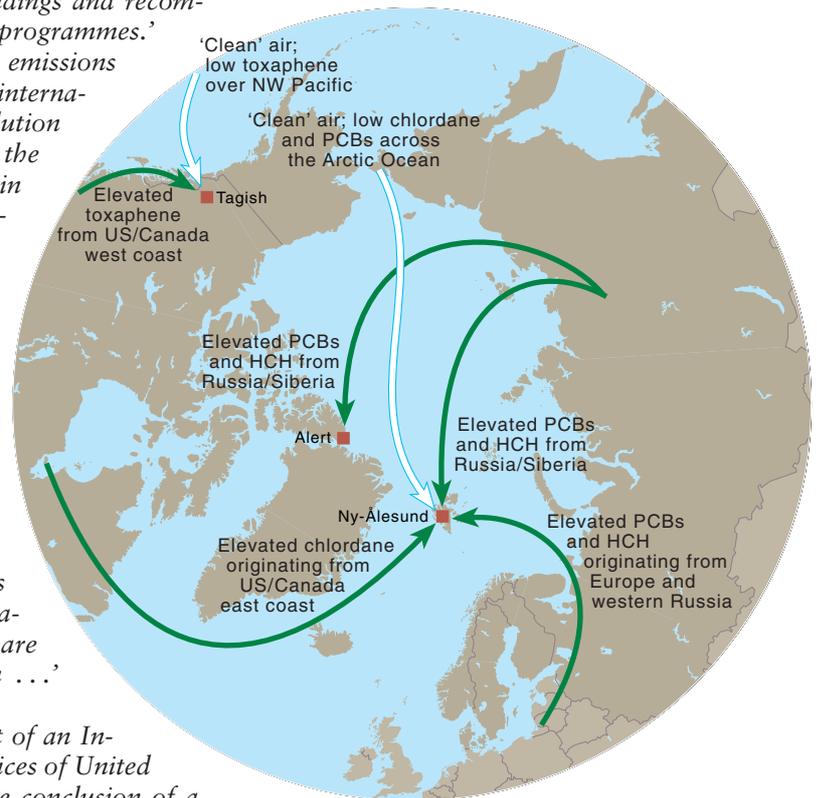
Produced for the Arctic Council by the Arctic Monitoring and Assessment Programme (AMAP)

# Persistent Organic Pollutants (POPs)

In 1997, Ministers committed 'to take [the AMAP] findings and recommendations into consideration in [their] policies and programmes.' They agreed 'to increase ... efforts to limit and reduce emissions of contaminants into the environment and to promote international co-operation in order to address the serious pollution risks reported by AMAP' and to 'draw the attention of the global community to the content of the AMAP reports in all relevant international fora ... and ... make a determined effort to secure support for international action which will reduce Arctic contamination.' (Alta Declaration, 1997).

In 1998, Ministers reaffirmed their agreement 'to work vigorously for the early ratification and implementation of the Protocols on the elimination or reduction of discharges, emissions and losses of Persistent Organic Pollutants (POPs) ... under the framework of the United Nations Economic Commission for Europe Convention on Long-Range Transboundary Air Pollution.', to 'encourage other states to do the same, with the aim to bring the Protocols into force as early as possible' and to 'fully support regional cooperation to facilitate the delivery of the measures that are needed to meet the obligations of the Protocols on ...' (Iqaluit Declaration, 1998).

Ministers also strongly welcomed 'the establishment of an Intergovernmental Negotiating Committee under the auspices of United Nations Environment Programme to work towards the conclusion of a global agreement on POPs by the year 2000,' and encouraged 'the Arctic States to act together to assist the early conclusion of such a global agreement.' (Iqaluit Declaration, 1998).



## Persistent Organic Pollutants (POPs)

Persistent organic pollutants (POPs) include a wide range of substances: *industrial chemicals* (such as polychlorinated biphenyls—PCB) and *by-products of industrial processes* (e.g., hexachlorobenzene—HCB, and dioxins) whose toxic characteristics are unintentional, and others, such as *pesticides* (e.g., DDT) and *herbicides* (e.g., lindane—HCH), that are designed to have toxic properties. POPs containing chlorine are referred to as *organochlorines*.

Interest in the presence of POPs in the Arctic environment arises in particular because of the concern that indigenous people and other northern residents depending on traditional food for all or part of their diet may be adversely affected by chronic exposure to these pollutants.

POPs are of special concern because:

- 1) they persist in the environment for long periods of time, which allows them to be transported large distances from their sources, are often toxic, and have a tendency to bioaccumulate; many POPs biomagnify in food chains;
- 2) many indigenous people in the Arctic depend on traditional diets that are both an important part of their cultural identity and a vital source of nourishment; alternative sources of food often do not exist; however, traditional diets are often high in fat and POPs tend to accumulate in fatty tissue of the animals that are eaten;
- 3) most northern residents have not used or directly benefited from the activities associated with the production and use of these chemicals; however, certain indigenous populations in the Arctic have some of the highest known exposures to these chemicals.

## Ministerial Decisions

In 1993, Ministers 'agreed to support the development of appropriate protocols under LRTAP auspices, and to consult with non-ECE nations whose emissions and discharges may affect the Arctic, to achieve their participation in the protocols' and 'to continue to take measures to reduce and/or control the use of a number of persistent organic pollutants ...' (Nuuk Ministerial Report, 1993).

Ministers also expressed their support for 'the work ... undertaken ... to prepare ... legally binding instrument[s] for controlling emissions and discharges of persistent organic pollutants (POPs).' and 'highly value the contribution being made by the AEPS countries in the evolution of new international agreements ...' (Inuvik Declaration, 1996).

As a part of their commitment to take AMAP findings into consideration in their policies and programmes, Ministers agreed 'to work vigorously for the early completion and implementation of a protocol on the elimination and reduction of persistent organic pollutants (POPs) under the framework of the United Nations Economic Commission for Europe (UN ECE) Convention on Long-range Transboundary Air Pollution.' (Alta Declaration, 1997).

At the 1998 meeting of the Arctic Council, Ministers reaffirmed their 'commitment from the Alta Declaration to increase ... efforts to limit and reduce emissions of contaminants into the environment and to promote international cooperation and make a determined effort to secure support for international actions in order to address the serious pollution risks reported by AMAP ...' (Iqaluit Declaration, 1998).

### UN ECE LRTAP Convention – POPs Protocol

The Executive Body [of the Convention on Long-range Trans-boundary Air Pollution] adopted the Protocol on Persistent Organic Pollutants on 24 June 1998 in Aarhus (Denmark). It focuses on a list of 16 substances that have been singled out according to agreed risk criteria. The substances comprise eleven pesticides, two industrial chemicals and three by-products/contaminants. The ultimate objective is to eliminate any discharges, emissions and losses of POPs. The Protocol bans the production and use of some products outright (aldrin, chlordane, chlordecone, dieldrin, endrin, hexabromobiphenyl, mirex and toxaphene). Others are scheduled for elimination at a later stage (DDT, heptachlor, hexachlorobenzene, PCBs). Finally, the Protocol severely restricts the use of DDT, HCH (including lindane) and PCBs. The Protocol includes provisions for dealing with the wastes of products that will be banned. It also obliges Parties to reduce their emissions of dioxins, furans, PAHs and HCB below their levels in 1990 (or an alternative year between 1985 and 1995). For the incineration of municipal, hazardous and medical waste, it lays down specific limit values.

(Text taken from [http://www.unece.org/env/lrtap/pops\\_h.htm](http://www.unece.org/env/lrtap/pops_h.htm))

### Ratification of the UN ECE POPs Protocol

The UN ECE LRTAP Convention Protocol on Persistent Organic Pollutants (POPs) was opened for signature in 1998. In order to enter into force, the protocol requires ratification by 16 parties to the Convention. As of July 2000, 36 parties, including all Arctic countries except the Russian Federation, had signed the Protocol. Canada was the first country to ratify the Protocol.

(Updated information on the status of signing and ratification can be found on the Internet at [http://www.unece.org/env/lrtap/protocol/98pop\\_s.htm](http://www.unece.org/env/lrtap/protocol/98pop_s.htm))

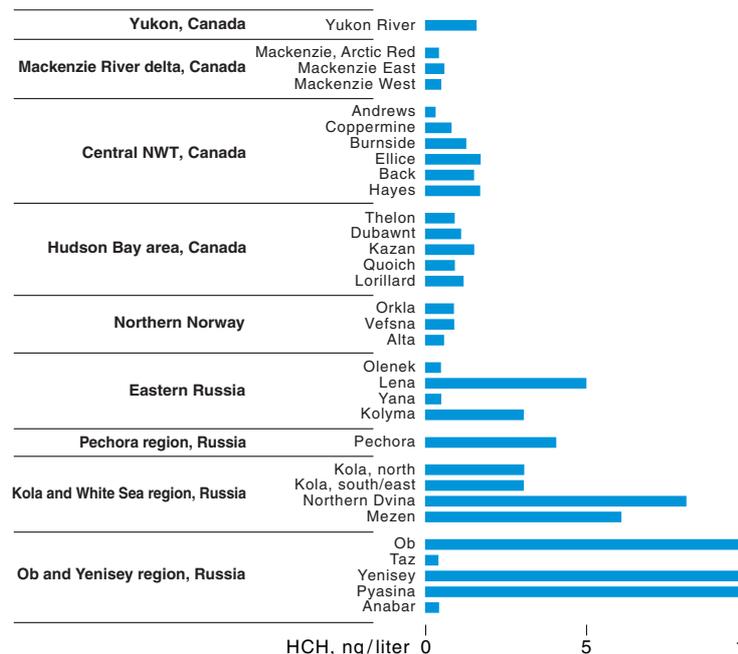
## AMAP's Findings

In comparison with most other areas of the world, the Arctic remains a clean environment. However, the following conclusions illustrate that, 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.

### Sources and pathways of POPs

POPs of concern in the Arctic mainly originate in temperate and warmer areas of the world. Pesticides that are banned or restricted in many countries continue to be used extensively in agricultural and pest control applications in developing countries; the environmental implications of new substances that are being introduced as replacements for banned substances are not well known. Industrial sources in Europe, North America and Asia also contaminate the Arctic.

There are also sources within the Arctic. These include sources at military installations with releases such as PCBs from early warning radar sites, industrial sources with emissions such as dioxins/furans from smelters, municipal and industrial waste disposal, and past use of pesticides for pest control. The extent of contamination from

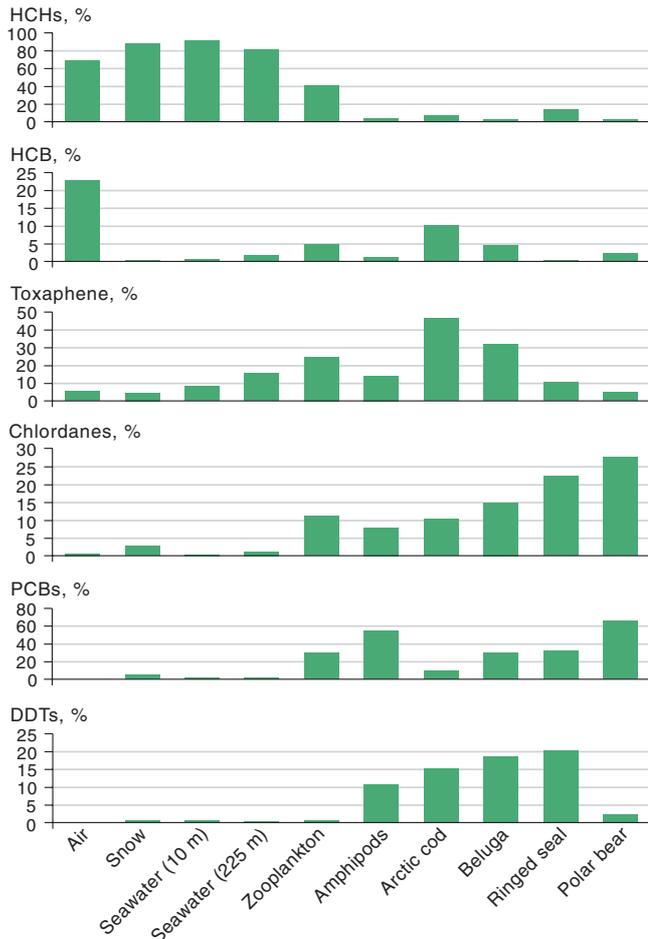


HCH, ng/liter 0 5

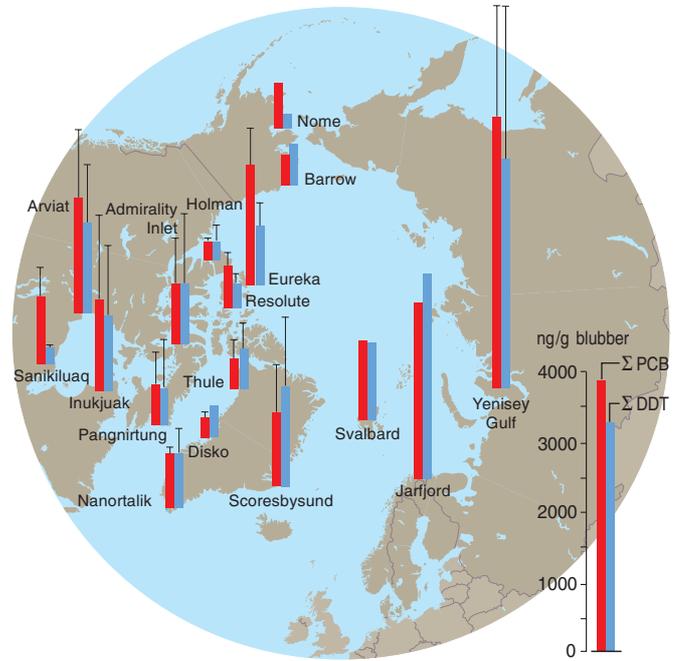
many of these sources, and of possible continuing use of restricted substances in some areas, is not well documented.

POPs reach the Arctic mainly via atmospheric and riverine pathways. In the atmosphere, POPs travel by a series of 'hops', depositing from the atmosphere under cold conditions and then revolatilizing when temperatures increase. The Polar regions form potential cold traps for these compounds.

It is possible that transport of POPs by sea ice results in their release in marginal ice areas. For example, release of particulates following melting in the marginal ice areas in the Greenland and Barents Seas may be an important mechanism for focusing contaminants from a wide area



POPs are found in all compartments of the Arctic environment. The figure shows the distribution between selected environmental compartments or species of six major classes of organochlorine contaminants, illustrating the process of transfer between compartments and bioaccumulation in the marine mammal food chain.



PCB and DDT in ringed seal in different Arctic regions.

of the Arctic into these regions. The potential for damage to ecosystems is enhanced by the fact that transport pathways tend to focus POPs in areas of high biological productivity.

### *Biomagnification in Arctic food chains increases the potential threat from POPs*

Due to the processes of bioaccumulation and biomagnification, POPs can reach very high concentrations in top predators even when levels in air, soil and water are low. Biomagnification is a process that occurs in food chains where animals consume other animals for food and at the same time consume all the contaminants that their prey have accumulated. Since many POPs are not broken down or excreted, concentrations increase with each step from prey to predator. Biomagnification of POPs is particularly strong in Arctic marine food chains leading to high levels of POPs in top predators such as seals and polar bears, and ultimately humans. The role of fat reserves in allowing many Arctic animals to survive the cold climate, and its importance in the diet of top predators including humans, further promotes the biomagnification of lipid-soluble POPs.

Studies have shown that POPs can affect the immune system and lead to developmental, behavioral and reproductive effects in a number of species including birds, fish

Data for river water and sediments indicate a substantial input to the Arctic of certain POPs by the large Russian rivers that flow northward to the Arctic Ocean (Ob, Yenisey, Lena). This may indicate recent or continuing use of banned or restricted substances, such as DDT; however, these data need further confirmation.

and mammals. Current levels of POPs found in some species in some areas are approaching or even exceeding thresholds associated with these types of effects. The concern for Arctic ecosystems is that effects at the individual level may ultimately lead to effects at the population or community level. Temporal data show that levels of some POPs in the Arctic environment are not yet decreasing even though their uses have been restricted for some time; in some cases levels are still rising.

### *Intake of POPs from traditional food consumed by indigenous people in the Arctic*

Species higher up the Arctic food chain are consumed by indigenous people as part of their traditional diet. POPs accumulate in the fatty tissues of many such species. The diet of indigenous coastal communities tends to involve the consumption of relatively high quantities of marine mammals. Inland communities tend to consume more reindeer and wild meat. More objective dietary assessments are required, particularly in northern Russia, to better estimate exposure risk to indigenous communities from the consumption of traditional country foods.

Because the periods of fetal development and development in children during the early years of life are those associated with the greatest vulnerability to toxic substances, contaminant intakes by pregnant women and children are of great concern.

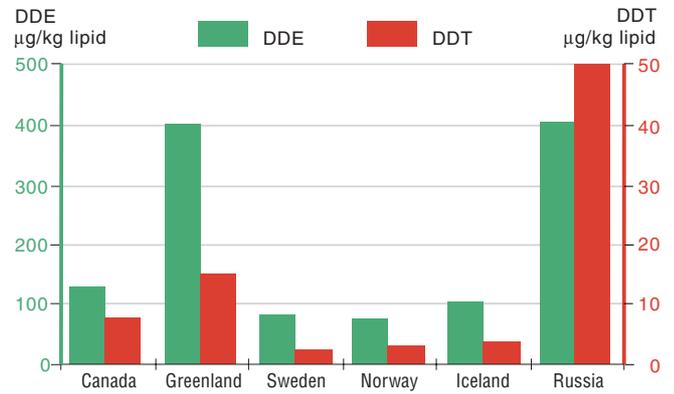
Studies in Canada have shown that average intakes are generally higher in the Baffin Inuit population as a result of a diet involving large amounts of marine mammals and fish, while the Sahtu Dene/Metis peoples who consume mainly caribou and fish have lower intakes. Baffin Inuit exhibit one-day intakes that exceed tolerable daily intakes (TDIs) for chlordane and toxaphene by nearly ten-fold. It is possible to gauge the relative, but not absolute, risk by comparing estimated one-day intakes with currently held tolerable daily intakes. Exceedance of TDIs is of particular concern if an individual continues to exceed the limit for a significant period of their life. Existing TDI guidelines need to be improved for Arctic residents based upon studies of interactions among individual contaminants present in Arctic foods, and between contaminants and nutrients.

### *Corresponding levels of POPs are seen in human blood and breast milk samples*

Due mainly to dietary factors, certain populations of Inuit in Canada and Greenland seem to be particularly exposed to some POPs. Because many POPs can pass the placental barrier, POP levels as measured in the blood of pregnant women are reflected in their offspring. Mothers can pass POPs to their newborn through breast milk. In some Canadian Inuit women, breast milk concentrations of PCB and DDT are several times greater than levels found in southern Canadian women. The effects of this exposure to infants are not fully understood.

Levels of POPs in Arctic indigenous populations have been investigated in an international pan-Arctic study conducted by AMAP.

From results obtained so far, highest levels of a number of POPs occur in people living in Greenland and the Canadian Arctic, and for DDT in populations in northern Russia; however, there are gaps in the available data for Alaska and much of Siberia. It is important to remember



DDTs in maternal blood plasma in different Arctic countries.

that the social, and cultural well-being, and the physical health of many Arctic indigenous populations depends on the collection and consumption of traditional (country) foods. In the majority of cases the benefits of these traditional diets outweigh the disadvantages from associated contaminants – however, greater knowledge is required to allow appropriate advice to be given to indigenous populations on the security of their food.

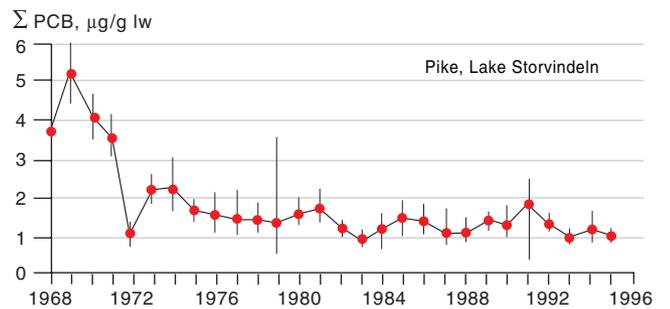
### *Advice concerning human exposure*

Several groups of people in the Arctic are highly exposed to POPs derived from long-range transport or local sources, which accumulate in animals that are used as traditional foods. However, weighing the well-known benefits of breast milk and traditional food against the suspected but not yet fully understood effects of POPs, it is recommended that:

- Consumption of traditional food continues, with recognition that there is a need for dietary advice to Arctic peoples so they can make informed choices concerning the foods they eat.
- Breast feeding should continue to be promoted.

### *POPs levels respond to controls*

Environmental levels of a number of POPs decreased in the 1970s and the early 1980s following the introduction of bans and restrictions; however, concentrations do not appear to have changed significantly over the last 15-20 years in the Arctic.



Decreasing trend in PCBs in pike in a Swedish lake.

#### Arctic Council

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