

Persistent Organic Pollutants – Old and New

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."*

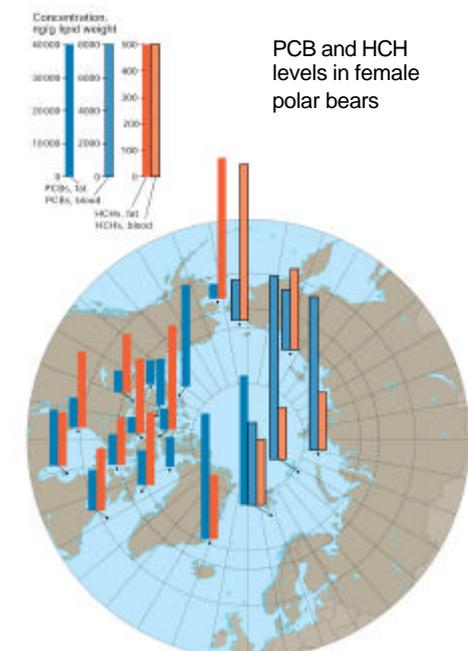
Persistent organic pollutants (POPs) include a wide range of substances, including organochlorine pesticides (e.g., HCH) and their metabolites from agricultural activities/practices; industrial chemicals (e.g., PCBs); and anthropogenic and natural combustion products, e.g. chlorinated dioxins/furans and polycyclic aromatic hydrocarbons. Sources of these substances are mainly the industrialised areas of the world – Europe, North America, and parts of Asia.

Due to a combination of their physico-chemical properties, these compounds accumulate in Arctic environments and ecosystems, in some cases reaching very high concentrations in biota and humans. POPs are known to have potential health effects on biota (such as polar bears – see figure below), including reproductive and developmental effects, neurotoxic effects, enzyme and immune function effects, effects on thyroid and vitamin A, and carcinogenic properties, etc.

OLD POPs: At a national level, the use and emissions of many POPs have been banned or restricted since the 1970s. At the regional level, the United Nations Economic Commission for Europe (UN ECE) agreed a POPs Protocol to the Convention on Long-range Transboundary Air Pollution in 1998, covering Europe, all states of the former Soviet Union, and North America. The global Stockholm Convention on Persistent Organic Pollutants was signed in May 2001. Both these agreements

identify POPs that should be banned or whose use or emissions are to be restricted. They include industrial chemicals and by-products (such as PCBs, dioxins, furans, and hexachlorobenzene) and a number of organochlorine pesticides (aldrin, chlordane, dieldrin, DDT, endrin, heptachlor, mirex, and toxaphene). Together, these are often called the 'dirty dozen'. Some POPs (e.g. hexachlorocyclohexane - HCH) are covered in the UN ECE Protocol but not the Stockholm Convention. For several listed substances, some limited use is allowed, for example DDT for fighting malaria. The regional and global agreements are some of the most important means by which POPs contamination of the Arctic can be effectively reduced – however, this will only occur if the agreements are ratified and brought into force.

POPs covered by these agreements are so-called 'legacy POPs' – new emissions are controlled and environmental pollution by these substances is largely a legacy of past practices. Contaminants such as PCBs will be slowly released for years to come from, for example building materials in which they were used. Oceans and soils constitute vast environmental reservoirs for some POPs – there is some evidence that the Arctic Ocean is becoming a source for α -HCH. Trends in levels of PCBs in biota are generally decreasing but only very slowly.



NEW POPs: The Conventions also define criteria for including new chemicals based on their persistence, bioaccumulation, potential for long-range transport, and adverse effects. The Arctic is well suited as an indicator region for long-range transport. Monitoring data that provide information about the fate of chemicals in the Arctic will therefore be critical in identifying new POPs to be considered under the agreements. 'New' POPs such as polybrominated diphenyl ethers (PBDEs), hexabromocyclododecane, and tetrabromobisphenol-A (TBBPA); perfluorooctane sulfonate (PFOS); chlorinated naphthalenes (PCNs); and short-chain chlorinated paraffins were, and in several cases continue to be produced and used. Several of these 'new POPs' are now being identified in the Arctic.

