Beta Hexachlorocyclohexane (Beta HCH)

Draft Risk Profile May 2007
http://www.pops.int/documents/meetings/poprc/drprofile/drp/DraftRiskProfile_b-HCH.pdf

Composition	One of 5 stable HCH isomers in technical HCH at levels of 5 – 14%.
Uses	Beta-HCH by itself is neither intentionally produced nor placed on the market. It is produced as constituent of technical HCH used as organochlorine insecticide or chemical intermediate to manufacture enriched HCH (lindane). Currently no production data on technical HCH have been reported, whereas manufacture of lindane still takes place.
Releases	Around 10 million tons of technical HCH were released to the environment between 1948 and 1997. According to Li and Macdonald (2005) global usage of technical HCH was dominated by 10 countries headed by China, which consumed almost half of the total global quantity. The other countries were (in order of decreasing usage): Former Soviet Union, India, France, Egypt, Japan, United States, East Germany, Spain and Mexico. Historically beta-HCH was released during the manufacture of technical HCH and its use as a pesticide. Li et al. (2003) estimated global emissions of beta-HCH from the usage of technical HCH between 1945 and 2000 at 850 000 tons, of which 230 000 tons were emitted into the atmosphere over the same period. As a result of the ban on technical HCH in northern countries, global emissions of beta-HCH have undergone a "southward tilt" (Li et al., 2003). Releases of beta-HCH into the environment are also possible from hazardous waste sites, stockpiles and residues of lindane production, which are not always controlled or maintained safely. Also, contaminated sites (e.g. from former production plants) may contribute to the environmental burden of beta-HCH.
Fate	Abiotic degradation processes do not play an important role in the fate of beta-HCH in the environment. Thus photolysis and hydrolysis are not significant. Under favourable conditions, beta-HCH is susceptible to biodegradation. However compared to the gamma- and alpha-HCH it is the most recalcitrant isomer. Laboratory and field data including a long-term soil study suggest that beta-HCH is persistent in soil, especially under low temperatures. It is mainly associated with particles and has a low leaching potential. The physico-chemical properties of beta-HCH allow the dispersal of the substance from its sources to the Arctic mainly by long-range environmental transport via ocean currents. Beta-HCH has been detected in the Arctic Ocean and is present in marine, terrestrial species, and humans.

Effects	Beta-HCH is acutely toxic to aquatic organisms and shows estrogenic effects in fish. Reduced fitness of offspring in birds as well as reduced retinol concentrations in polar bears is associated with beta-HCH and HCHs levels. Toxicological studies with beta-HCH have demonstrated neurotoxicity and hepatotoxicity. Also reproductive and immunosuppressive effects and effects on fertility were seen in laboratory animals. Beta-HCH has been classified in group 2B as possibly carcinogenic to humans by the International Agency on Research and Cancer (IARC). Several epidemiological studies indicate that beta-HCH might play a role in human breast cancer.
Exposure	Beta-HCH exposure levels in local areas have declined after worldwide prohibitions and restrictions. However regions with recent exposure and/or high pollution can still show elevated levels. A special concern also arises from exposure of hazardous waste sites and dumping grounds from disposed beta-HCH residues from lindane production. Due to its persistence beta-HCH can still be detected at low background levels in all environmental media except in regions with recent usage and/or high pollution. Data from the abiotic environment in the Arctic are scarce partly due to low levels compared with the other HCH isomers. In contrast to this fact fairly high concentrations in Arctic biota including marine mammals and birds were detected with increasing levels. Beta-HCH is present in terrestrial and aquatic food chain. Beta-HCH may bioaccumulate and biomagnify in biota and Arctic food webs, especially in upper trophic levels. In humans accumulation in fat tissue and high concentrations in blood and in breast milk may occur. Beta-HCH transfers from mothers to embryos and nursing infants. Human exposure to beta-HCH results mostly from ingestion of contaminated plants, animals and animal products. High exposure is expected in contaminated areas due to extensive use, former production, disposal sites and stockpiles. Based on the hazard profile and the exposure levels in the environment including the food chain, it can be concluded that beta-HCH may adversely affect wildlife and human health in contaminated regions. Arctic public health authorities believe the significant social, cultural and economic benefits of traditional foods outweigh the risks of contaminants such as HCH at present but give another reason for the quick control and elimination of all HCH isomers from traditional foods. However based on levels found in the Arctic region, it can be also concluded that beta-HCH can lead to significant adverse human and environmental effects as a result of its long-range environmental transport.
Status	Technical HCH is listed in Annex II of the 1998 Aarhus Protocol on Persistent Organic Pollutants (POPs) under the Convention on Long-Range Transboundary Air Pollution which restricted alpha-HCH use to an intermediate in chemical manufacturing only. HCH (mixed isomers)

	is subject to the PIC Procedure of the Rotterdam Convention and is listed in Annex III of the Convention. Canada, Mexico, and the United States signed the North American Regional Action Plan (NARAP) on Lindane and Other Hexachlorocyclohexane Isomers in 2006 with the goal of reducing the risks associated with the exposure of humans and the environment to lindane and other HCH isomers. In the European Union the production and use of technical HCH as an intermediate in chemical manufacturing will be phased out by the end of 2007 at the latest (Regulation (EC) No 850/2004). HCHs are also one of the priority substances (Decision No 2455/2001/EC) of the adopted EU Water Framework Directive 2000/60/EC. Hexachlorocyclohexane isomers, including the beta-isomer, are on the List of Chemicals for Priority Action under the OSPAR Commission for the Protection of the Marine Environment of the Northeast Atlantic.
Alternatives	Will be discussed together with Lindane in Annex F evaluation if Beta HCH advances.