

Format for submitting pursuant to Article 8 of the Stockholm Convention the information specified in Annex E of the Convention

Introductory information	
Name of the submitting Party/observer	World Wild Fund for Nature (WWF)
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Chemical name (as used by the POPS Review Committee (POPRC))	Lindane, and isomers
Date of submission	January 26, 2006

(a) Sources, including as appropriate (provide summary information and relevant references)	
(i) Production data:	<ul style="list-style-type: none"> WWF Canada has compiled an overview of Lindane, including its CAS number and structure, uses, release to the environment, fate and exposure, human exposure, acute toxicity, chronic toxicity, reproductive toxicity/endocrine effects, neurotoxicity, immunotoxicity, carcinogenicity, and regulatory status (Sang et al 1999) (Full article in PDF format is attached for reference) In China, the total production was about 4 million tons for technical HCH from 1952 to 1984, and 11,400 tons for lindane between 1991 and 2000. Only 3,200 tons of lindane were used between 1990 and 2000 in China, the rest were for export or as unused stock (Li et al 2001). Major use of lindane in Canada was on canola and corn. The use of lindane on canola and corn in Canada between 1970 and 2000 has been estimated to be 9000 tons, with the highest (558 tons) in 1994. As high as 8,500 tons (94%) of total usages were in the Prairie Region (Li et al 2004)
Quantity	
Location	
Other	
(ii) Uses	
(iii) Releases:	
Discharges	
Losses	
Emissions	
Other	

(b) Hazard assessment for endpoints of concern, including consideration of toxicological interactions involving multiple chemicals (provide summary information and relevant references)	
	<ul style="list-style-type: none"> Exposure to lindane during lactation induces reproductive hazards to male offspring rats, including significant reduction in testicular weight, the number of sperm and spermatids, and testosterone level (Dalsenter et al 1997, Dalsenter et al 1996). Treatment with 1-40 mg of lindane/kg b.w. disrupts testicular morphology, decreases spermatogenesis, inhibits testicular steroidogenesis, reduces plasma androgen concentrations and may adversely affect reproductive performances in males. In females, lindane disrupts the estrous cycle, reduces serum estrogen and progesterone levels, and decreases sexual receptivity whereas in pregnant dams it decreases whelping rate and litter size. These effects were also observed in some rats exposed to residual environmental doses. In addition, there is concern that irreversible effects may be induced when animals are exposed to endocrine disrupting chemicals during critically susceptible phases of sexual differentiation or development (Pages et al 2002). Lindane suppressed both primary and secondary humoral immune responses in albino mice, in a time and dose dependent manner (Banerjee et al 1996) Reported use of lindane significantly increased the risk of non-Hodgkin's lymphoma among white men from Kansas, Nebraska, Iowa, and Minnesota by 50%. Odds ratios were greater among persons exposed from use lindane on crops (OR=1.9) than from use lindane on animals (OR=1.3) (Blair et al 1998).

(c) Environmental fate (provide summary information and relevant references)	
Chemical/physical properties	<ul style="list-style-type: none"> See WWF Canada's review (Sang et al 1999)
Persistence	

<p>How are chemical/physical properties and persistence linked to environmental transport, transfer within and between environmental compartments, degradation and transformation to other chemicals?</p>	
<p>Bio-concentration or bio-accumulation factor, based on measured values (unless monitoring data are judged to meet this need)</p>	

(d) Monitoring data (provide summary information and relevant references)

- WWF-UK has found α -, β -, γ -HCH in 23, 151, and 17 of total 155 tested people in its national survey of 2003, ranging from 0.98-23, 1.9-80, and 6.8-110 ng/g lipid, respectively (Table 2 on page 40) (WWF 2003).
- A WWF-UK Chemicals and Health campaign report indicated that β -HCH was detected in 17 out of 33 tested subjects, with the highest level at 130 ng/g serum lipid, whereas α - and γ -HCH were found in 1 and 3 of 33 tested, with a maximum of 8.9 and 15.2 ng/g serum lipid, respectively (WWF-UK 2004).

- A baseline study (Leung et al 2005) regarding organochlorine and other chemicals in tissues of Indo-Pacific humpback dolphins from south China waters showed the concentrations of HCH isomers in samples, see Table 2 below.

Table 2
Mean concentrations of OC pesticides and PCBs in Dolphin blubber from Hong Kong, Xiamen and Zhuhai waters (ng g⁻¹ wet weight)

Location	Hong Kong (n = 5)	Xiamen (n = 4)	Zhuhai (n = 1)
α-HCH	24.7	26.5	2
β-HCH	910.4	129.3	nd ^a
γ-HCH	197	38.1	17.1
δ-HCH	32.6	33.6	13.7
Total HCHs	1164.7	227.6	32.8

- A baseline study (Schlenk et al 2005) regarding of organochlorine pesticides in muscle and liver tissues of South African great white sharks *Carcharodon carcharias*. see Table 2 below

Table 2
Organochlorine pesticides in white shark tissues (ng/g wet wt. and (ng/g lipid))

Pesticide	Liver			Muscles		
	Durban female	Umhlanga female	Zinkwazi male	Durban female	Umhlanga female	Zinkwazi male
HCB	6.2 (8.4)	3.3 (4.9)	1.8 (3.0)	0.4 (3.6)	0.4 (4.0)	0.1 (1.3)
Lindane	3.0 (4.1)	2.5 (3.6)	2.2 (3.6)	1.6 (16.0)	0.8 (7.9)	0.4 (3.7)

- In a study that WWF conducted to test chemicals in the blood of families of three generations from Europe, β-HCH was detected in 38 out of 39 tested, ranging from 64 to 1821 pg/g serum (WWF 2005)
- Ricking et al (2005) has conducted a study comparing the organic pollutants in sediment cores of NE-Germany. Among 5 tested sites, HCHs were only detected in sediments from the Teltow Canal and Lake Quenz, due to the point source, lower logKow value and higher water solubility. HCH detected in samples taken from QS and TK from 1995 to 1997 were from 11.5-148 and 2.9-394 ng/g dry weight, respectively. The accumulation rate in this two places were 0.3-140 and 75-420 ng/cm²/yr, respectively.
- A study tested chlorinated pesticides in Singapore (Wurl and Obbard 2005). Among the 19 OCPs analysed, HCHs isomers (α-HCH, β-HCH, γ-HCH and δ-HCH) were among the most abundant in subsurface and sea-surface microlayer samples. The concentration range for PHCH in subsurface water varied from 0.4 to 27.2 ng/l and in SML samples from 0.6 to 64.6 ng/l.
- HCH isomers as organohalogenated persistent pollutants were measured in 37 individual human milk samples from Kahramanmaras region, Turkey (Erdog˘rul et al 2004). β-HCH had a detection frequency of 97%. β-HCH was the most prevalent HCH isomer with a mean value of 2.08 ng/g ww. The mean concentration of γ-HCH was 0.38 ng/g ww, while α-HCH was not detected in any sample. Although the number of samples is relatively low and they may not be representative for the whole Turkish population, the results of the study are important to provide additional data on the concentrations of persistent organochlorinated pollutants in Turkey.
- In China, air samples were collected in the Taihu Lake Region from July 23 to August 11, 2002, to measure concentrations of OC pesticides in air, including HCH (Qiu et al 2004). The average concentrations of α and γ-HCH in the air were 74 and 46 pg m⁻³, respectively.
- Age dependent accumulation of HCH concentration was found in a study of organochlorine contaminants in human adipose tissues from China (Nakata 2005), possibly due to the considerable reduction in average dairy intake of HCHs by Chinese during past two decades.
- In a study that WWF conducted to test chemicals in the blood of Members of the European Parliament, HCHs were also detected, with β-HCH as the dominant isomer, ranging from 0.0072-0.57 pg/g serum (Annex 3 page 58) (WWF 2004).
- A Danish study on POPs and their long-term temporal changes and effects on eggs of a bird of prey has shown the levels of HCH and its isomers in biota. The Appendix 3 of this study, titled “DDT and degradation products. Toxaphene. Chlordane-related compounds and Hexachlorobenzene”, presented data relevant to HCHs (Sørensen et al 2004).
- Concentrations of HCHs were measured in sperm whales involved in two mass stranding events on the west coast of Tasmania, Australia in February 1998, with a concentration of 0.01±0.1 µg/g lipid weight (Evans et al 2004).

(e) Exposure in local areas (provide summary information and relevant references)	
- general - as a result of long-range environmental transport - information regarding bio-availability	<ul style="list-style-type: none"> • See WWF Canada's review (Sang et al 1999)

(f) National and international risk evaluations, assessments or profiles and labelling information and hazard classifications, as available (provide summary information and relevant references)
<ul style="list-style-type: none"> • See WWF Canada's review (Sang et al 1999)

(g) Status of the chemical under international conventions

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