

OH Sub No. 43 (b)

4/22/2008

Recd From: Dr Vivian Howard

They are tested one at a time

Maternal Plasma Concentrations of Pesticides: Circumpolar Study 1994-1996 (Geometric means ug/kg lipid (ppt))

Country/ Pesticides	Canada ¹ (n = 67)	Green- land ² (n = 117)	Sweden ³ (n = 40)	Norway ⁴ (n = 60)	Iceland ⁵ (n = 40)	Russia ⁶ (n = 51)
β-HCH	9.3	18.5	9.2	8.1	32.1	222.5
α-chlordane	1.0	1.1	1.0	1.3	1.3	1.6
γ-chlordane	1.1	1.3	1.0	1.3	1.3	1.4
Cis-nonachlor	6.6	20.9	1.2	1.8	2.7	5.3
p,p'-DDE	133	407	84.0	79.4	113.2	411.9
p,p'-DDT	7.9	15.0	2.4	3.0	4.0	48.3
HCB	55.1	97.6	15.6	23.1	41.2	62.8
Mirex	4.5	9.1	1.1	1.4	1.9	1.4
Oxychlordane	27.8	60.8	1.9	3.7	6.6	3.3
Transnonachlor	30.5	110	3.8	6.8	12.2	11.5

¹ Inuit women from west/central NWT,

² women from Disko Bay region,

³ women from Kiruna,

⁴ women from Hammerfest and Kirkenes,

⁵ women from Nikel.

Source: Gilman *et al.* 1997).

Naturally Occurring Biochemical Organic Compounds

- Natural biochemical compounds are easily metabolised
- We have evolved enzymes to break down organic compounds
- We have evolved enzymes to build up new organic compounds
- Most of the tissues in the body have a high turnover

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Environmental Protection Agency

22 APR 2008

ORAL HEARING
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Persistent Organic Pollutants

- When organic chemicals accumulate in the body, it tells us that there are no mechanisms for their efficient metabolism and removal
- With persistent chemicals, any toxic effects that they possess are maximised, because of the extended period of exposure

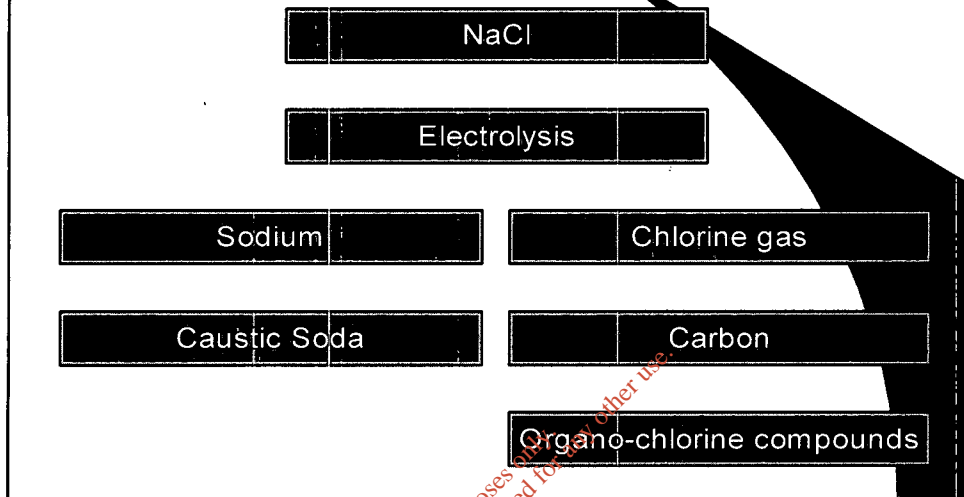
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The 12 persistent organic pollutants listed below are targeted for control under the draft UNEP Convention (UNEP 1995, 1997).

The 12 UNEP POPs

PCBs	DDT
Dioxins	Chlordane
Furans	Hexachlo-
	Benzene
Aldrin	Mirex
Dieldrin	Toxaphene
Endrin	Heptachlor

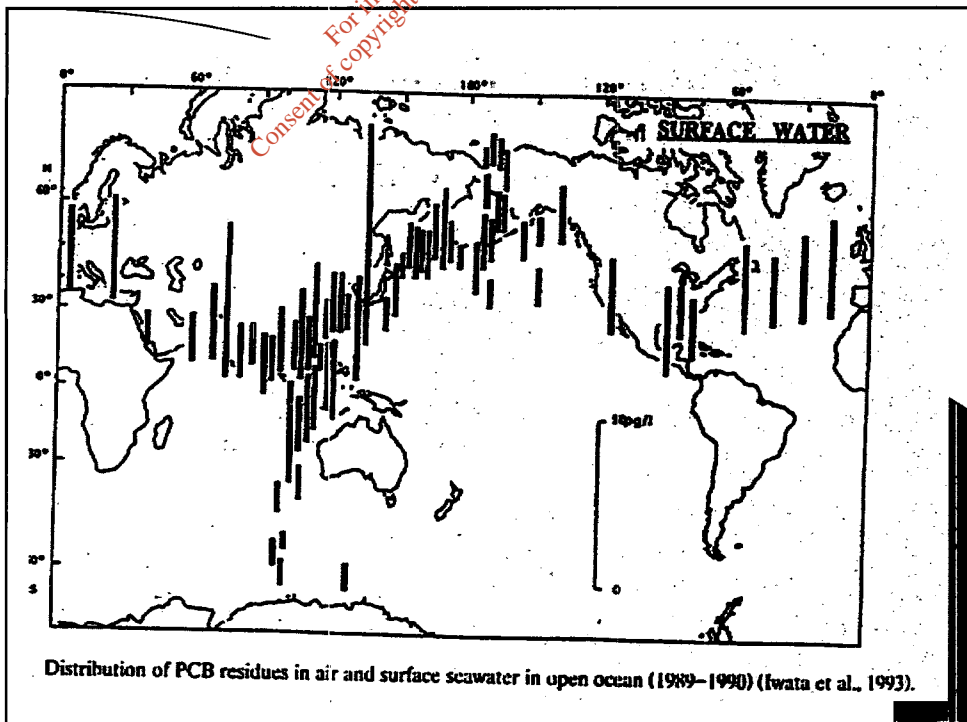
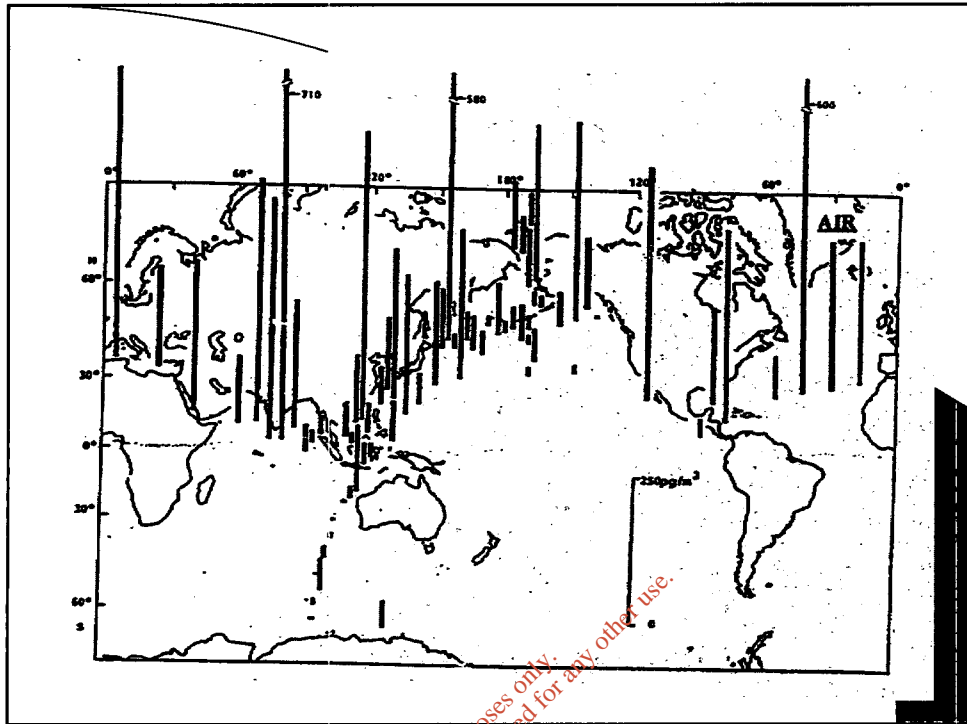
An example of POPS - Organochlorines



The Organo-chlorine Industry

- 40 million tonnes of chlorine are produced globally annually
- Used to make plastics, solvents, medicines, pesticides - over 11,000 commercial products
- 35% used to make PVC
- Combustion leads to dioxin formation

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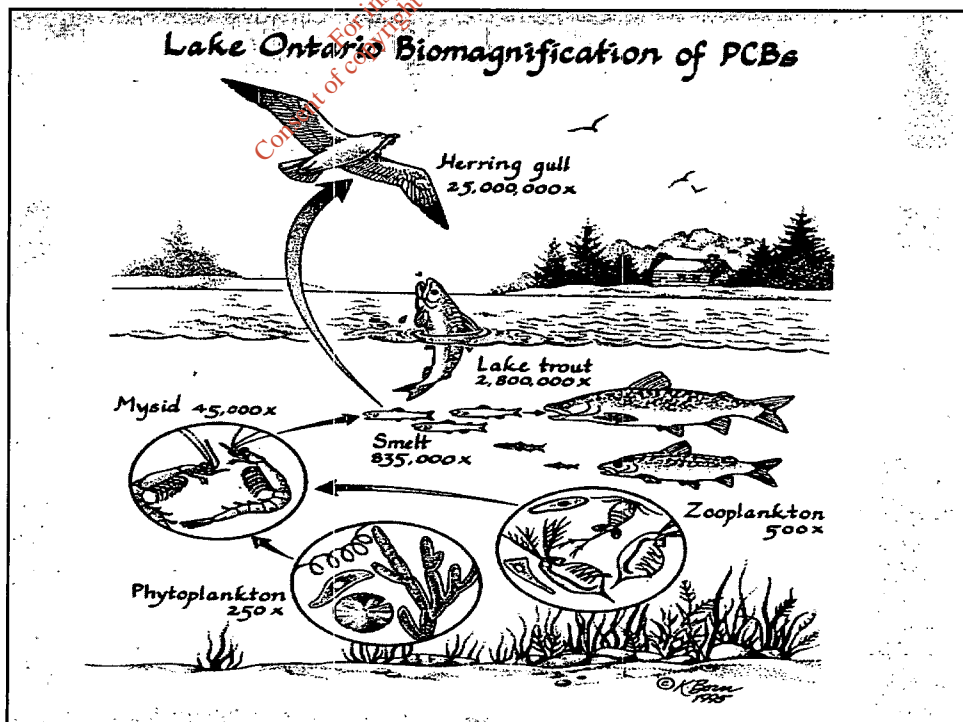


Distribution of PCB residues in air and surface seawater in open ocean (1989-1990) (Iwata et al., 1993).

POPs which Bioaccumulate

- Fat-soluble persistent chemicals tend to accumulate in the body
- The longer the half-life, the more they accumulate
- Levels of such chemicals increase with age
- They are found in breast milk and cross the placenta

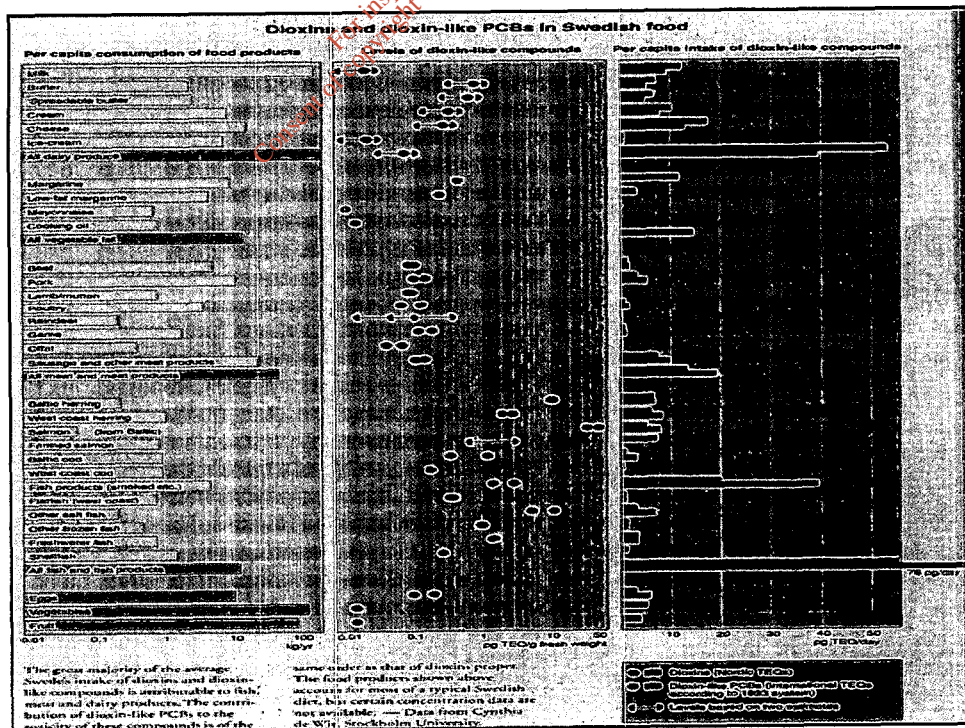
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Dioxins and other OC POPs

- During the manufacture of PVC and other OC products, dioxins are produced
- When OC compounds are combusted, they form new compounds, including dioxins
- Up to 80% of dioxin contamination of the land has been caused by the incineration of waste

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Current Dioxin Body Burdens

- 1% of the US population have 30-40 ng I-TEQ/ kg body weight
- average US 10 ng I-TEQ/kg body weight
- oxidative stress is found at 0.45 ng I-TEQ/kg body weight
- experimentally rats at 100 ng I-TEQ/ kg body weight have shown permanently reduced allergic responses

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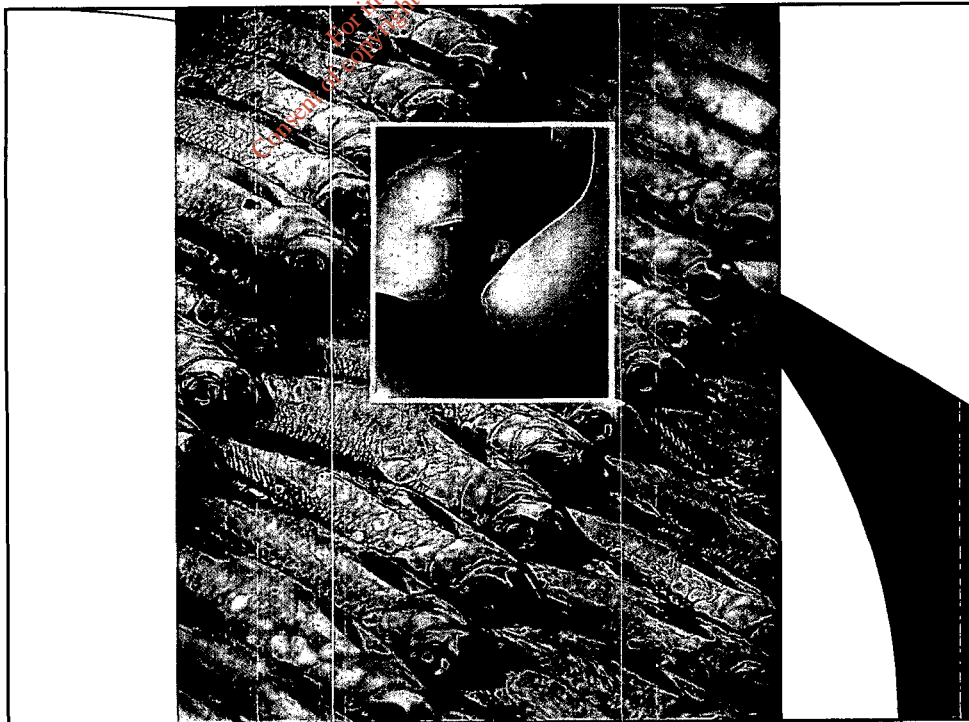
Additional substances with dioxin-like activity: HCB

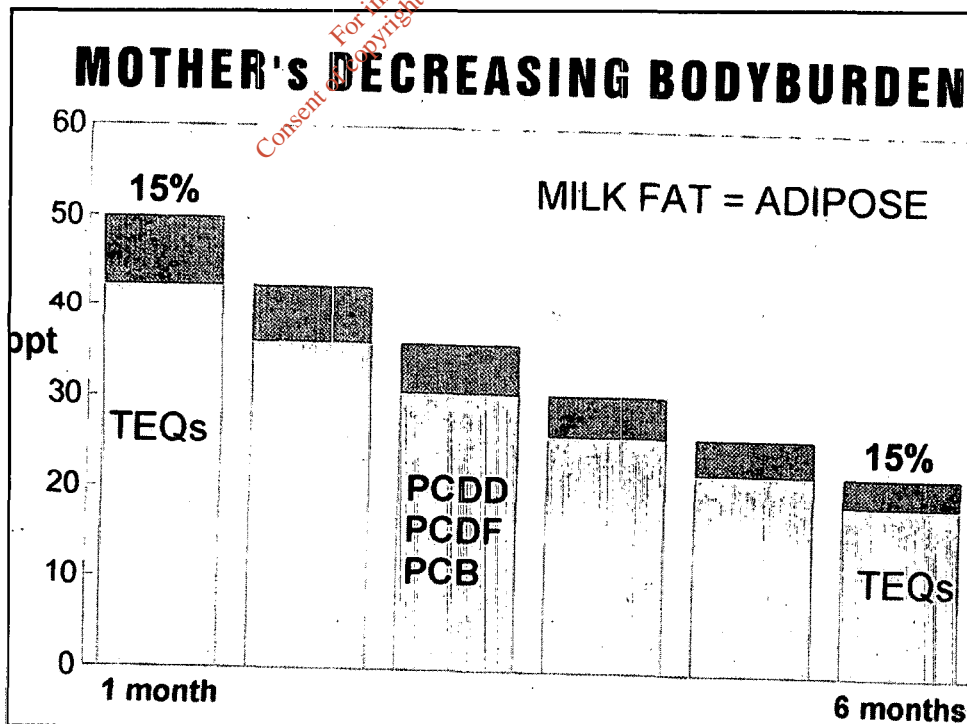
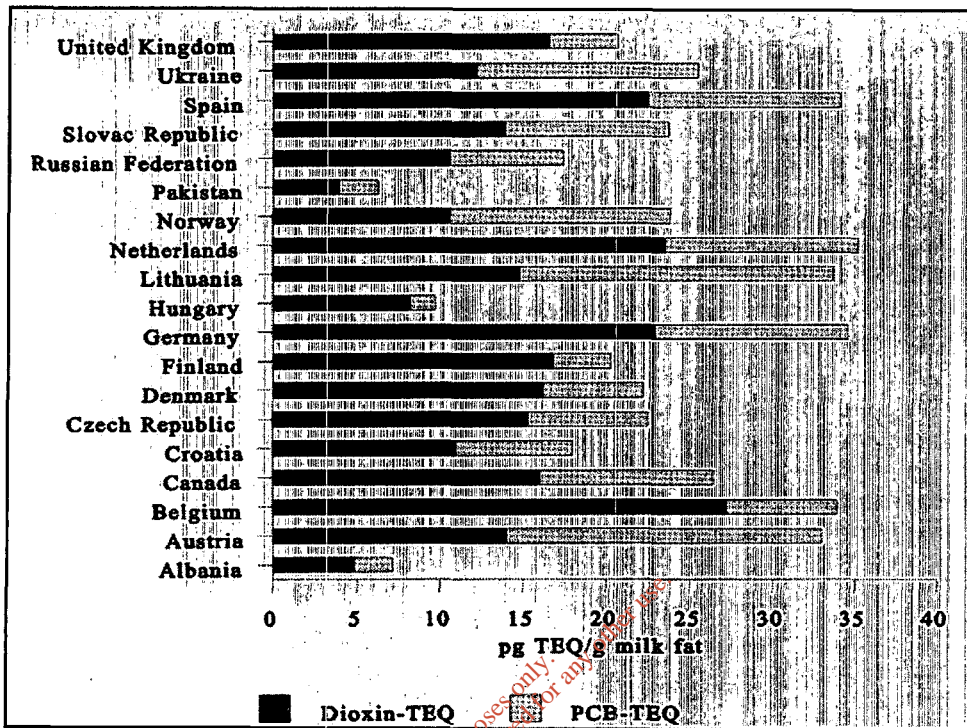
- Hexachlorobenzene (HCB) has Ah receptor activity TEF 0.0001.
- Global production of 1,000 kg TEQ in 100 years (A. van Birgelen, 1999)
- HCB breast milk levels in Germany 50 pg TEQ/g fat = >50% total TEQ
- Canada 2.6 pg HCB TEQ/g milk fat = 10% of total TEQ

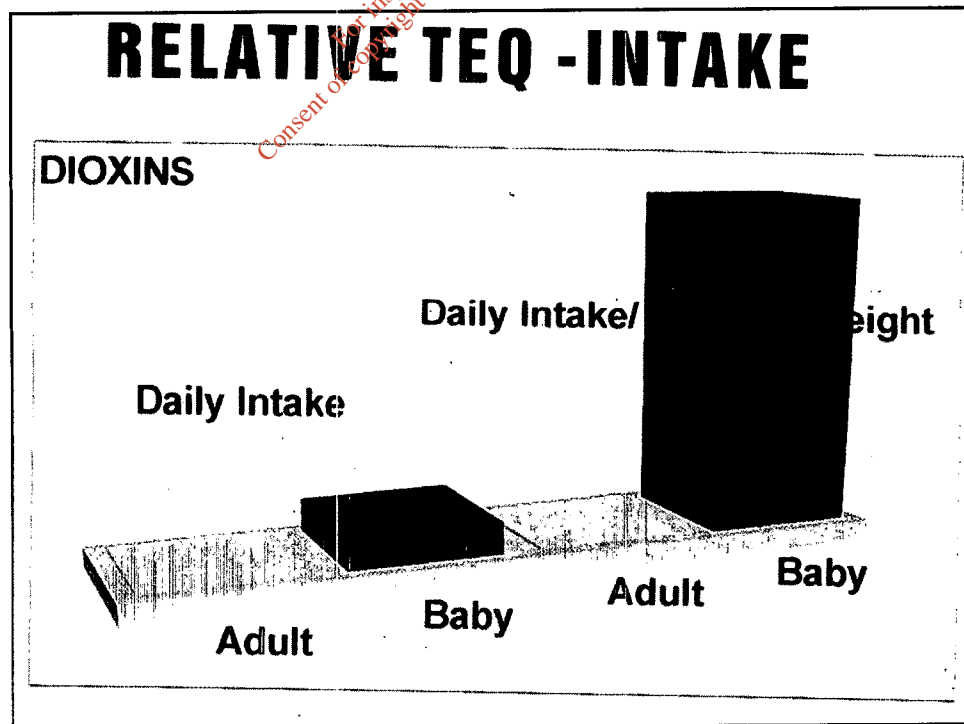
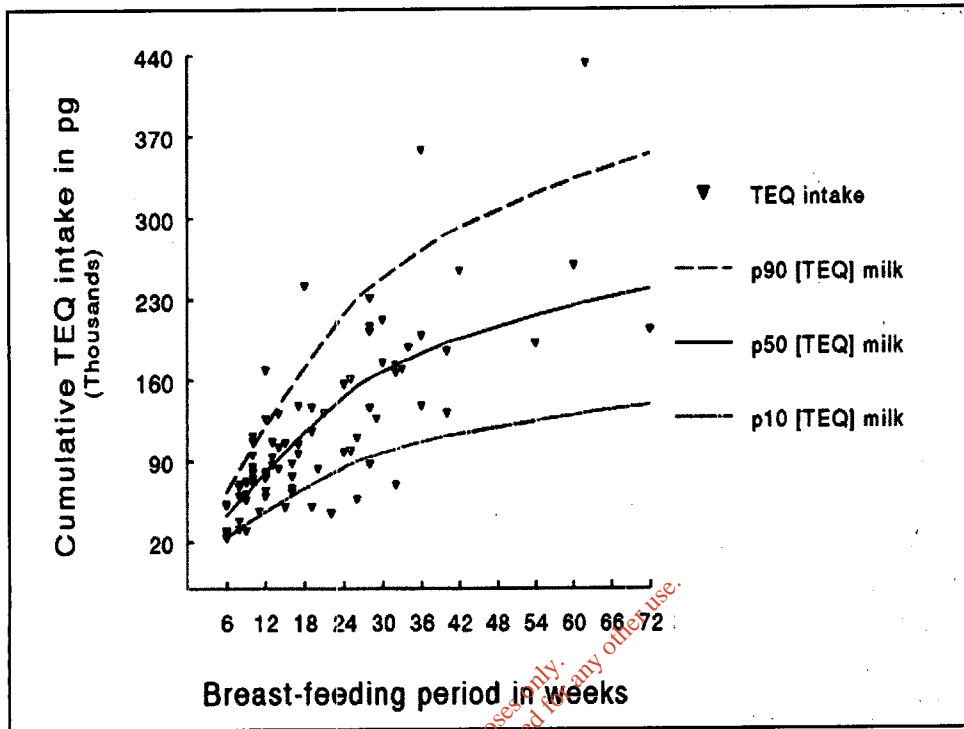
**Umbilical cord blood concentrations of PCBs and DDE
(geometric means, ug/kg lipid (ppt)):
Circumpolar study 1994-1996**

	Canada (Inuit) ¹ (n = 319)	Canada, general population (n = 502)	Greenland (n = 102)
PCBs (as Aroclor 1260)	780	211	1388
PCBs (Σ 14 congeners)	309	115	504
p,p'-DDE	384	173	424

¹ Nunavik (northern Quebec, Canada)
Source: see AMAP (1998 p820)







Findings in Infants Related to Mother's Dioxin Body Burden

- Reduced intelligence
- Altered immune system
- Disruption of hormones
- All of the above have been found to occur in a dose-dependent manner

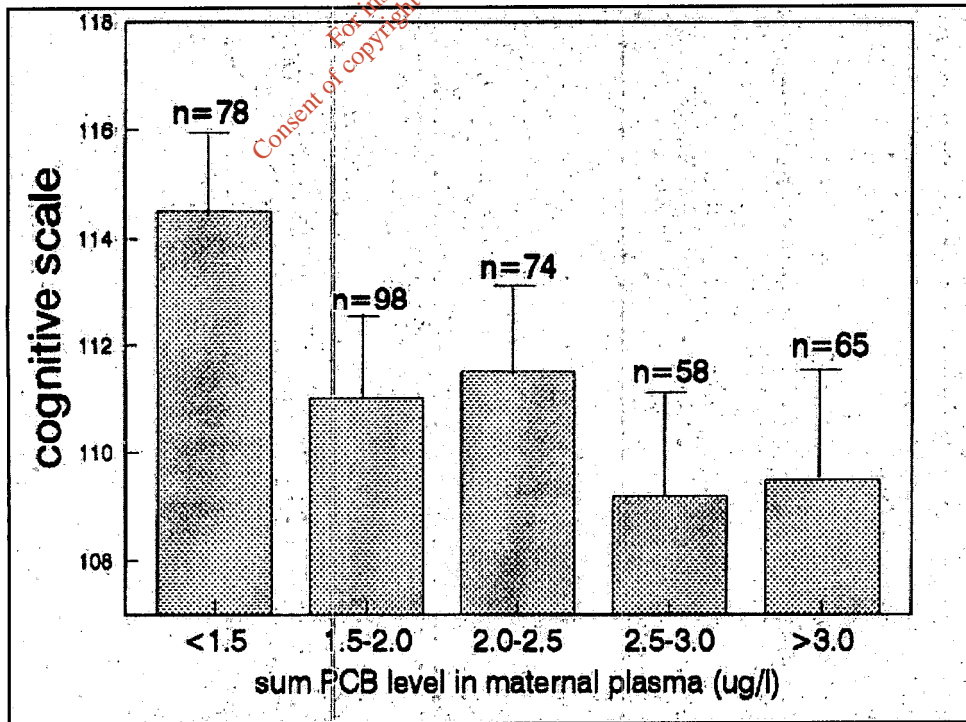
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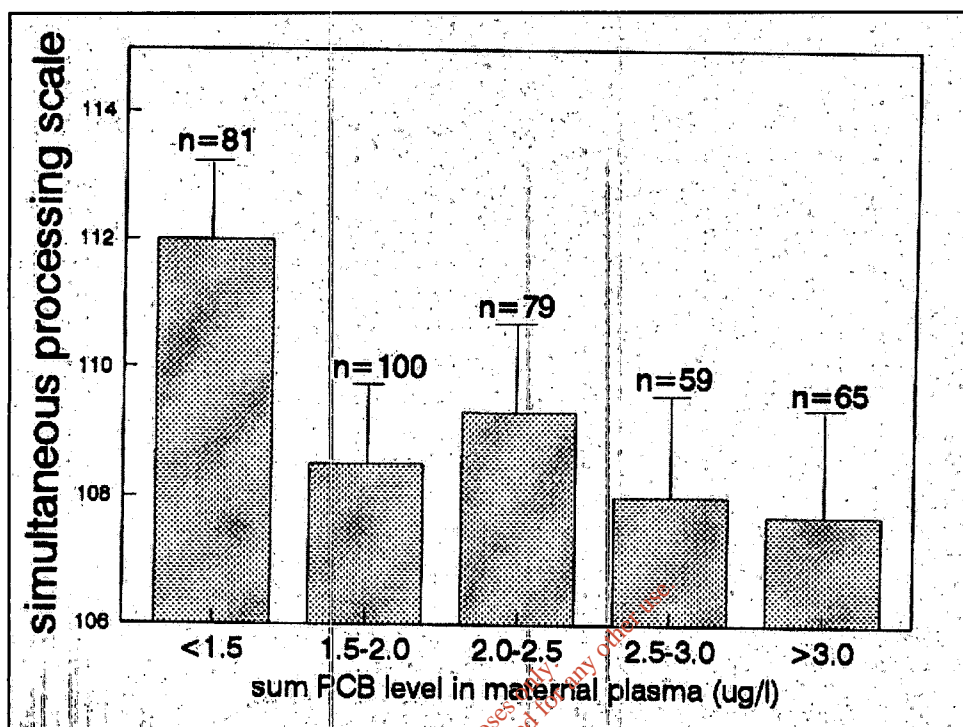
Koppe et al (2000) in 'Health impacts of Waste Management'

- Eds: Stamati, Hens & Howard. Pp 135-154
Kluwer Sci Press. ISBN 0-7923-6362-0
- IUGR
- Faulty imprinting
- Psychomotor development: cognitive
- Behavioural development: apathy, hyperactivity, reduced reaction times

Health Effects of Background Exposure to PCBs & Dioxins

- Haemorrhagic disease of the newborn
- Midline fusion defects - gastroschisis, hypospadias, cleft palate
- Altered sex ratio
- Reduced thyroid hormone levels
- Perinatal reduction of white blood cells
- Increased infection, otitis media, Strep- β





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Déjà-vu - Polybrominated Fire Retardants

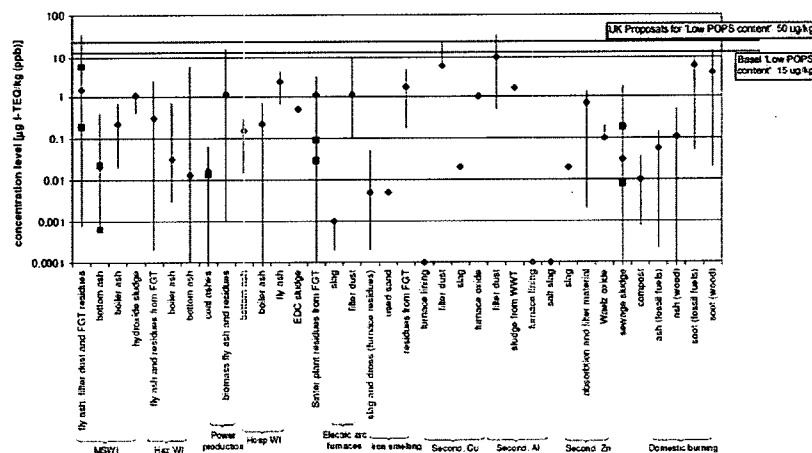
- Persistent, bioaccumulative with dioxin-like properties
- The average concentration of PBDE congeners has risen from 72 to 4010 pg/g of lipid during the last 25 years
- One congener, 2,2',4,4'-tetraBDE (BDE47), was predominant in all pooled samples, and constituted 70% of the total amount of PBDEs. The concentration of PBDEs was observed to have doubled in 5 years.
- Semivolatile - chloracne reported from off-gassing
- Binds to human thyroid receptor protein

Brominated flame retardants neurotoxicants in experiments

- Erikson, Jakobsson & Fredriksson (2001)
- “Brominated flame retardants: A new class of developmental neurotoxicants in our environment?”
- Environmental Health Perspectives 109: 903-908 (Sept 2001)
- Dose related effects to spontaneous behaviour in neonatally exposed animals

Total dioxin emissions!

Figure 1. Distribution of dioxin and furan concentrations in wastes. (• mean and concentration range) as per European Commission (2005) & UNEP (2005). □ indicate published ranges of concentrations in UK wastes (AEAT 2005).



Total mass balance of dioxin per tonne of waste burned

- If working to Waste Incineration Directive:
- ~550 ng TEQ dioxin to air
- ~ 300 kg bottom ash would contain ~ 100 times as much dioxin as goes to air
- ~ 30 kg of fly ash would contain ~ 100 times as much as goes to air
- When this goes to landfill, road building etc, it represents a future hazard

When not working to spec

- Tejima et al (2007) found that a single incinerator start up released > 2 month's worth of dioxin at steady state conditions. Ashes also had increased dioxin levels.
- Wang et al (2007) calculated that one start up could generate 60% of the total annual dioxin emission under steady state. Furthermore start-up of some of the incinerators they studied were at least 2x larger than a whole year's operations