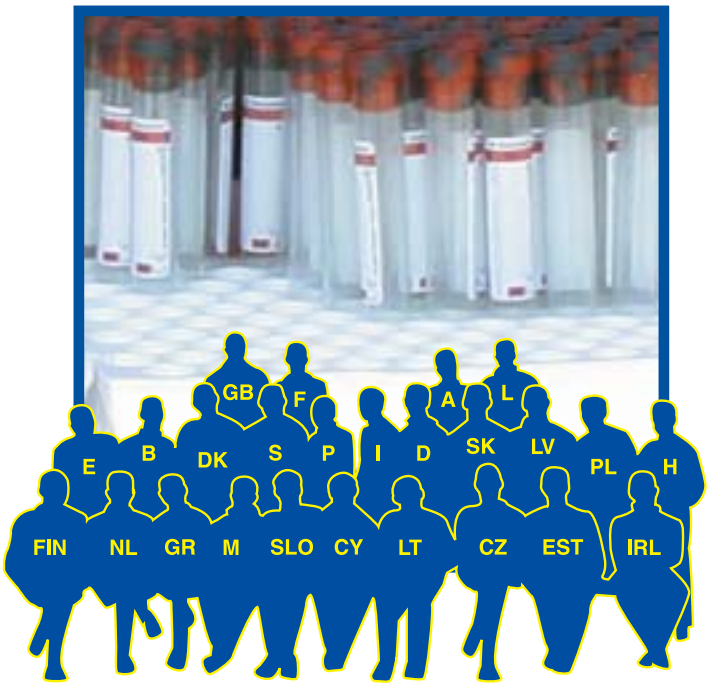
WWF

DETOX

CAMPAIGN

Bad Blood?

A Survey of Chemicals in the Blood of European Ministers



SAFER CHEMICALS

FOR A HEALTHIER FUTURE

WWF DETOX CAMPAIGN

Where chemicals are found in elevated concentrations in biological fluids such as breast milk, they should be removed from the market immediately.

– Royal Commission on Environmental Pollution, 2003

Often the weakest link in determining whether observed adverse effects in humans and/or wildlife are linked to EDCs is the absence of adequate exposure data.

Data on the magnitude and trends of global human or wildlife exposure is limited. Potential sources of exposure are through contaminated food, contaminated groundwater, combustion sources, and contaminants in consumer products. Information on exposure during critical development periods is generally lacking.

The exposure data sets that exist are primarily for various environmental media (air, food, water) rather than the most relevant internal exposure (blood, tissue). Limited exceptions are human breast milk and adipose tissue samples. Worldwide, in spite of large expenditures of money, time and effort, comparable data sets for assessing exposures to EDCs for humans or wildlife are not available. Such information is essential to adequately evaluate exposure/response relationships in field and epidemiology studies and to use these relationships to produce credible risk assessments.

– World Health Organisation, 2002

Acknowledgements:

WWF would like to record its thanks to:
- All the Ministers who kindly agreed to participate in this survey
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- Marie Morice

October 2004

In my blood there are at least 43 artificial, man-made chemicals. Chemicals used to make fire-resistant sofas, non-stick pans, grease proof-pizza boxes, baby bottles, the lining of tin cans and even pesticides banned decades ago. My reaction to this surprise discovery has been one of growing shock.

Shock initially because I had no idea these chemicals were in my body – or how they got there. And they are not just in me: many of the same chemicals have been found in polar bears, dolphins, birds of prey and other species.

Shock because nobody can tell me what effect these chemicals have. There is an almost complete absence of publicly available safety information on most chemicals in everyday use. And if scientists cannot tell me the effects of individual chemicals, what about the cocktail of chemicals streaming around my body?

Shock dawns again – the chemical industry has got away for decades without providing basic safety information. As scientists discovery more and more potential effects, such as the only recently acknowledged ability of chemicals to interfere with the hormone system, this gap in our knowledge becomes increasingly alarming. Why isn't it a public scandal?

Shock once more because a proposed European Union law to finally begin identifying and phasing out the worst chemicals is actually causing controversy! Far from accepting that the well-being of people and our planet is crying out for better chemical controls, it appears that one of the globe's most successful industries is arguing that it can't afford to find out if its products are dangerous!! I say life on our planet cannot afford not to find out.

A recent article in the respected medical journal "The Lancet" said that chemicals could become "the next tobacco." WWF's DetoX Campaign is working to persuade Governments to act a faster and more decisively to the dangers of chemicals than they did to the dangers of tobacco – or asbestos.

Government inaction on tobacco and asbestos, caused in large part by industry lobbying, has caused incalculable misery and suffering. Rising cancer rates and illnesses such as multiple chemical sensitivity are a warning that similar inaction on chemicals could have similarly dangerous (and expensive) consequences.

This report – revealing the presence of 55 chemicals in the blood of 14 Government Ministers – is WWF's attempt to ensure that Governments get the message in the most personal way possible. We are grateful for to all the Ministers who gave us the opportunity to do so…

Karl Wagner
Director, WWF DetoX Campaign

CONTENTS

1. EXECUTIVE SUMMARY

In June of 2004 WWF took blood samples from 14 Ministers from 13 European Union countries. The table below shows who was tested from each country and their position.

Table 1: Ministers tested

Constantina Akkelidou	Cyprus	Minister of Health
Libor Ambrozek	Czech Republic	Minister of Environment
Hans Christian Schmidt	Denmark	Minister of Environment
Olavi Tammemäe	Estonia	Vice minister Environment
Jan-Erik Enestam	Finland	Minister of Environment
Serge Lepeltier	France	Minister of Environment
Miklós Persányi	Hungary	Minister of Environment
Mihaly Kokeny	Hungary	Minister of Health
Roberto Tortoli	Italy	Vice Minister Environment
Juozas Olekas	Lithuania	Minister of Health
Laszlo Miklos	Slovakia	Minister of Environment
Cristina Narbona	Spain	Minister of Environment
Lena Sommestad	Sweden	Minister of Environment
Alun Michael	UK	Minister of Environment

The Ministers blood samples were analysed for a total of 103 different man-made chemicals from 7 different chemical families: organo-chlorine pesticides, Poly Chlorinated Biphenyls (PCBs), synthetic musks, perfluorinated chemicals, brominated flame retardants, phthalates and anti-bacterials. This report summarises the analytical findings of the level and type of chemical contamination detected in these 14 Ministers.

A chemical from each of the groups analysed for was found in the survey with the exception of the anti-bacterials.

Table 2. Proportion of Volunteers Contaminated by each of the Chemicals Groups Tested

Chemical Group	Percentage of Ministers Contaminated
PCBs	100
OC Pesticides	100
Brominated flame retardants	100
Perfluorinated chemicals	100 (of those tested)
Phthalates	79
Synthetic musks	21
Anti-bacterials	0

Twenty five of the same chemicals were found in all the Ministers. These chemicals are shown in the table below.

Table 3: Most Frequently Detected Chemicals

Chemical	Percentage of Ministers Contaminated
22 separate PCB congeners	100
p,p'-DDE (OC Pesticide)	100
Hexachlorobenzene (HCB) (OC Pesticide)	100
BDE-153 (Brominated Flame Retardant)	100
ß-HCH (OC Pesticide)	93
PFOA, PFNA (Perfluorinated Chemical)	75 (of the 12 tested)
DEHP (Di Ethyl Hexy Phthalate)	79

Whilst many of these chemicals have been banned, many others are still used in everyday products.

The total number of chemicals found in the blood of the Ministers was 55. That represents 53 per cent of the 103 chemicals looked for. The maximum number of chemicals found in any minister was 43. The average (and median) number of chemicals found was 37 and the lowest number of chemicals found was 33.

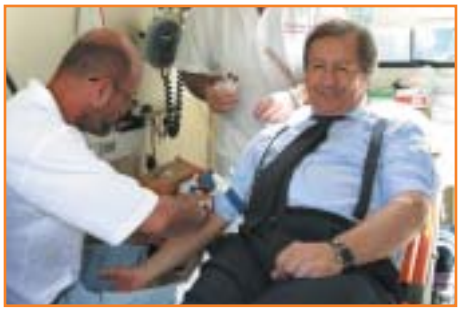
It is not possible to give a single value for the total concentration of chemicals in each individual since some chemicals were analysed in whole blood whilst others were analysed in blood serum. This was necessary because of the analytical methods used, and there is no reliable way of converting between the two figures. Half of the chemicals were analysed in whole blood, these were: phthalates, musks, and perfluorinated chemicals. The other chemicals, OC Pesticides, PCBs and brominated flame retardants, were analysed in blood serum. The maximum concentration of chemicals found in each blood media is shown in the table below.

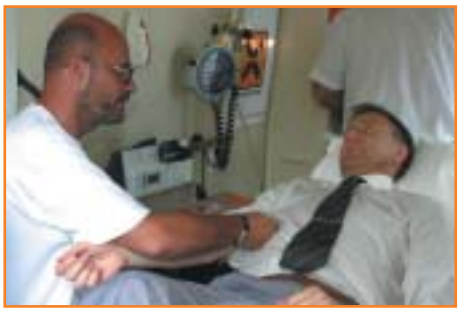
Table 4: Maximum Total Chemical Concentrations found in the different blood fractions

Blood Fraction	Chemicals Analysed	Total Maximum Concentration
Whole Blood	Phthalates, musks, and perfluorinated chemicals	192 ng/g
Blood Serum	Pesticides, PCBs and brominated flame retardants	9727 pg/g (or 9.7 ng/g)

The highest concentration of any chemical found in whole blood was 160 ng/g of the phthalate, diethylhexyl phthalate (DEHP). The highest concentration found in blood serum was 3300 pg/g of the DDT metabolite, p,p'-DDE.

Exact comparisons of the levels of chemicals found in this survey compared to previous WWF surveys are difficult, due to, amongst other things, different laboratories used. However this survey, like the ones before, confirms the ubiquitous contamination by a cocktail of hazardous chemicals of every person tested. It is possible to infer that every person in Europe, and probably the world is similarly contaminated. People and wildlife are being contaminated with chemicals in everyday use that have similar properties to chemicals that have been banned due to their harmful properties.





2. INTRODUCTION

In June 2004. fourteen Health and Environment Ministers from thirteen European Union countries volunteered to have their blood tested for a range of 103 hazardous man-made chemicals made up of the following:

- 12 Organochlorine pesticides (including DDT, Chlordane, lindane and HCB)
- 40 PCBs
- 32 Brominated flame retardants (30 PBDEs plus HBCD and TBBP-A)
- 8 Phthalates
- 7 Perfluorinated chemicals
- 2 Synthetic musks
- 2 Anti-bacterials (triclosan and its breakdown product, methyl triclosan)

METHODOLOGY

Volunteers

The volunteers in this report comprised fourteen individuals, eleven males and three females. No information regarding their ages or any other personal information was collected.

The fourteen volunteers represented thirteen European countries. These are: Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Hungary, Italy, Lithuania, Slovakia, Spain, Sweden and the UK.

Due to the very small sample size (i.e. generally one volunteer per country) no attempt has been made to associate the levels of contaminants in the individuals with their country of origin.

Blood sampling

Approximately 60 ml of blood, where possible, was taken from each volunteer by vein-puncture, using the Vacutainer® system. Blood samples were immediately centrifuged (3000 rpm, 10 minutes) after collection, to separate the blood cells and platelets from the serum. Samples were then frozen and kept frozen for transport to the laboratory for analysis. Blanks (ultrapure water) were also taken at the time of sampling to ascertain the contribution of background levels of analytes at each sampling location.

Chemical analysis

Blood samples were analysed by SAL (Scientific Analysis Laboratories Ltd), Manchester, UK for seven groups of chemicals: PCBs, organo-chlorine pesticides, brominated flame retardants, synthetic musks, phthalates and perfluorinated chemicals and anti-bacterials.

The laboratory used to conduct the analysis in this survey is different to the laboratories used previously. Whilst every effort has been made to ensure that similar sampling and analytical methodologies were followed, differences no doubt do exist. The results of this study are therefore not directly comparable to WWF's previous biomonitoring studies.

These chemicals were chosen on the basis of their potential to persist and bioaccumulate in the environment and that they had either previously been found in humans or there was a chance that they would be found.

Due to the analytical methodologies used, different chemicals were looked for in different blood fractions. Three of the chemical groups were looked for in whole blood and three in blood serum. The results of analysis are therefore given in different units which means that the results from the different blood fractions are not directly comparable.

CHEMICAL GROUPS ANALYSED

Organochlorine Pesticides (OCPs)

Many pesticides developed and in widespread use in the 1950s, ’60s and ’70s were OCPs. Many have now been banned in the EU after they were belatedly found to be highly persistent in the environment and cause long-term toxic effects in wildlife.

PCBs (Polychlorinated biphenyls)

This is a group of industrial chemicals which were used in electrical equipment in the 1970s but banned in the EU after they were found to be toxic and to be building up in animals and people across the globe. Research has shown that exposure to PCBs in the womb is associated with adverse behavioural and neurological effects.

BFRs - Brominated Flame Retardants (PBDEs, TBBP-A and HBCD)

Many brominated chemicals are used as flame retardants in numerous consumer products. There are several different classes within this group of chemicals including the PBDEs (Poly Brominated Diphenyl Ethers). We also looked for two other compounds, tetrabromo bisphenol A (TBBP-A) and Hexabromo cyclododecane (HBCD). PBDEs are used to flame retard many everyday items (e.g. plastics, textiles, furniture, electrical appliances). Several of them are contaminating humans and wildlife throughout Europe, the Arctic, and North America and the levels of contamination are increasing in some areas. TBBP-A and HBCD, used as flame retardants in plastics, insulation foams and electrical goods are also accumulating in the environment, wildlife and humans.

Phthalates

Are a group of man-made chemicals which are widely used as additives in many plastics and consumer products. Diethylhexyl phthalate (DEHP) is the most commonly used phthalate and is a ubiquitous environmental contaminant. Phthalates such as DEHP are relatively persistent in the environment and have been detected in drinking water, soils, household dust, fish and other wildlife. Phthalates have also been detected in fatty foods (meat and dairy products), in human blood and breast milk and phthalate metabolites have been detected in adult and children’s urine.

Perfluorinated Chemicals (PFCs)

PFCs are heat stable, extremely resistant to degradation and environmental breakdown, and repel both water and oil. It is these properties that are exploited in their various applications, ranging from non-stick pans, stain/water repellents for clothing/furniture to floor waxes and paper coatings. Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) are members of this group of chemicals. These chemicals in particular have been found to be accumulating in the environment and have been found in a wide range of wildlife, as well as in humans and are also associated with cancers and reproductive toxicity.

Synthetic musks

Synthetic musks are group of man-made chemicals used to fragrance a wide variety of toiletries, cosmetics and cleaning products. Being persistent and bioaccumulative, they are found to be widespread environmental contaminants and they are also suspected as being potential endocrine disrupting chemicals. HHCB and AHTN, the two synthetic musks analysed for in this study, have previously been measured in rainwater, river water, lakes, sediment, sewage sludge and wastewater treatment plant effluent in Canada, United States, and Europe.

Anti-Bacterials

Triclosan and methyl-triclosan are man-made chemicals used as antibacterial/antimicrobial agents incorporated into numerous everyday products e.g. in kitchenware, soaps, personal care products. They have been shown to be accumulating in the environment and wildlife and have been detected in human breast milk.

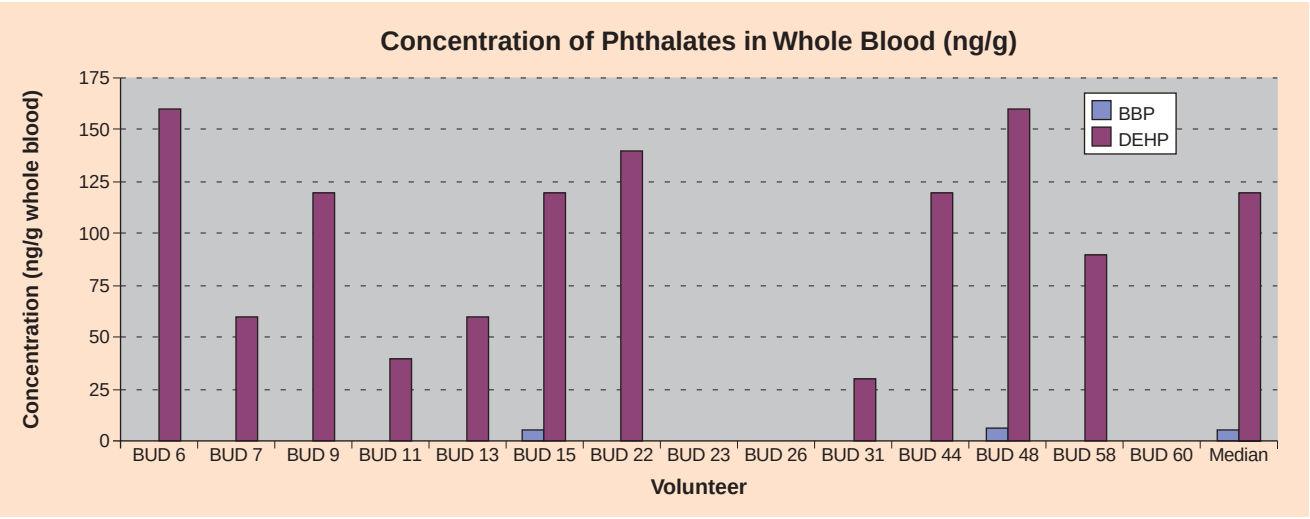
3. RESULTS

- Every volunteer tested was contaminated by a cocktail of hazardous chemicals.
- Six of the seven chemical groups tested for were detected in the survey.
- 55 of the 103 chemicals looked for were detected.
- At least 33 chemicals were found in every person tested.
- 25 of the same chemicals were found in every individual, including p,p'-DDE and HCB.
- The highest number of chemicals found in any one person was 43, whilst the average (and median) number of chemicals found was 37.
- The chemical found in the highest concentration and the highest median concentration in whole blood was the phthalate DEHP (Diethylhexyl Phthalate) at concentrations of 160 and 120 ng/g whole blood, respectively. DEHP is an endocrine disrupter and has been identified as a reproductive toxicant.
- The chemical found in the highest concentration in blood serum was p,p'-DDE (a DDT metabolite), at a concentration of 3300 pg/g. It also had the highest median concentration of 845 pg/g serum.
- Deca-BDE, a suspected neuro-toxic chemical used as a flame retardant, was found at the highest concentration of all the flame-retardants tested at 45 pg/g serum.

The chemicals found in every person's blood are shown in the table 3, and include two organochlorine pesticides: hexachlorobenzene and p,p'-DDE which is a breakdown product of DDT. The brominated flame retardant chemical (PBDE 153), which is a component of the penta- and octa- brominated diphenyl ether flame retardant products, was also found in every single person. In addition, 22 specific PCB congeners were found in everyone.

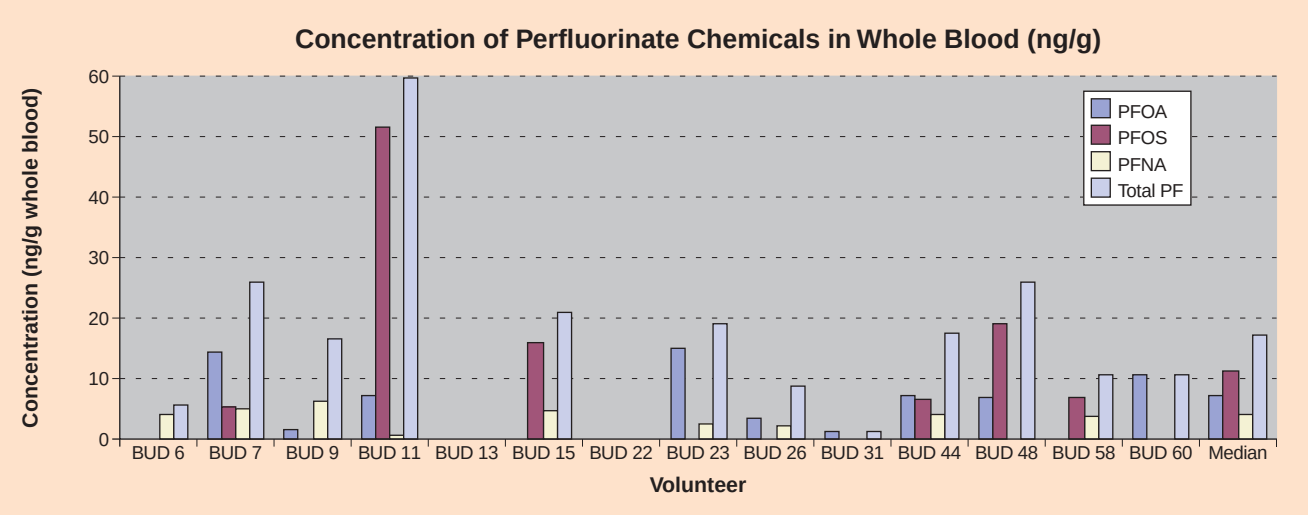
PHTHALATES

PHTHALATES (ng/g whole blood)	Min	Max	Med	Average
DMP	N/D	N/D	N/D	N/D
DEP	N/D	N/D	N/D	N/D
DisoBP	N/D	N/D	N/D	N/D
DBP	N/D	N/D	N/D	N/D
BBP	N/D	6	6	6
DEHP	N/D	160	120	100
DiNP	N/D	N/D	N/D	N/D
DiDP	N/D	N/D	N/D	N/D
Total Phthalate Concentration	**N/D**	**166**	**120**	**101**
Total number of phthalates per person	0	2	1	1



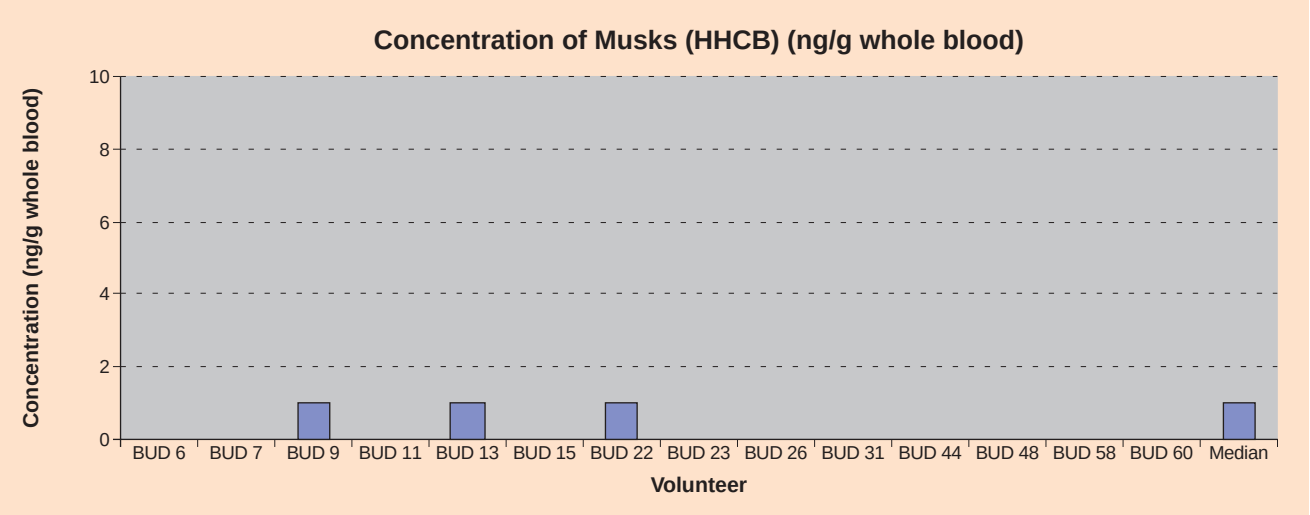
PERFLUORINATED CHEMICALS

PERFLUORINATES (ng/g whole blood)	Min	Max	Med	Average
Perfluorooctanoic acid (PFOA)	N/D	15	7	8
Perflurooctane sulphonate (PFOS)	N/D	52	11	18
Perfluorononanoic Acid (PFNA)	N/D	6	4	4
Perfluorodecanoic Acid (PFDA)	N/D	1	0	1
Perfluoroundecanoic Acid (PFUnA)	N/D	N/D	N/D	N/D
Perfluorododecanoic Acid (PFDoA)	N/D	2	1	1
Perfluorotetradecanoic Acid	N/D	8	3	4
Total Perfluorinates	**1**	**60**	**17**	**19**
Total number found per person	**1**	**4**	**2.5**	**2.3**



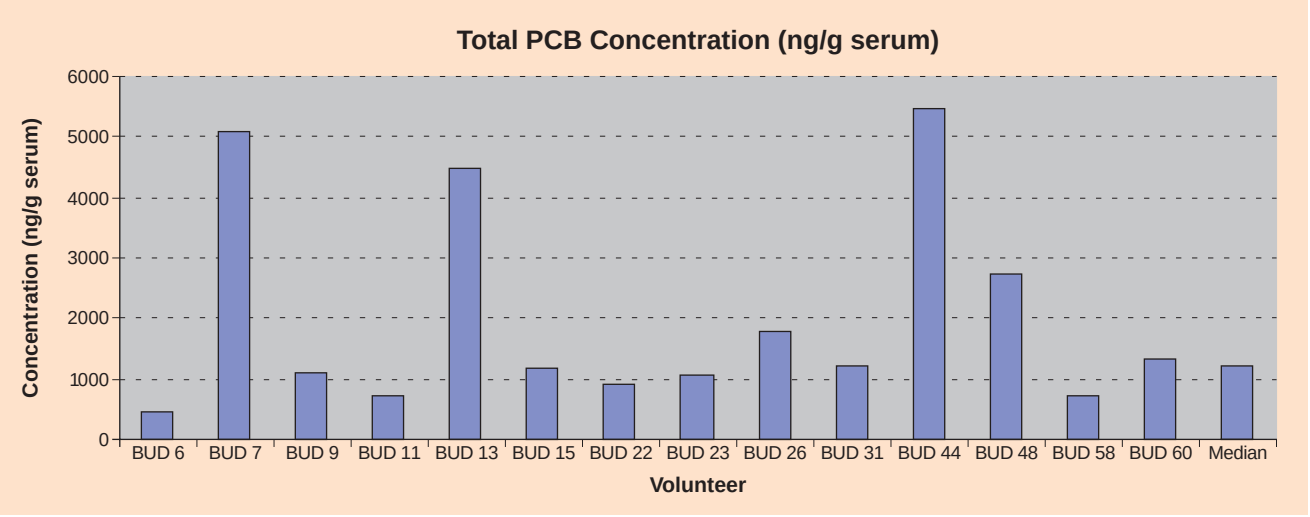
MUSKS

SYNTHETIC MUSKS (ng/g whole blood)	Min	Max	Med	Average
HHCB	N/D	1	1	1
AHTN	N/D	N/D	N/D	N/D



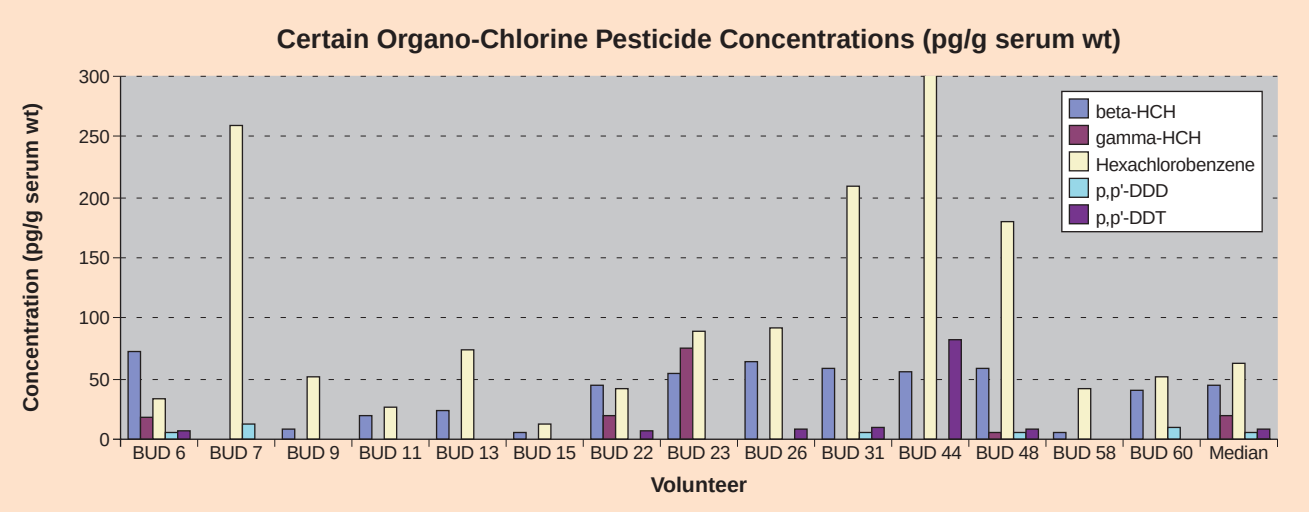
PCBS

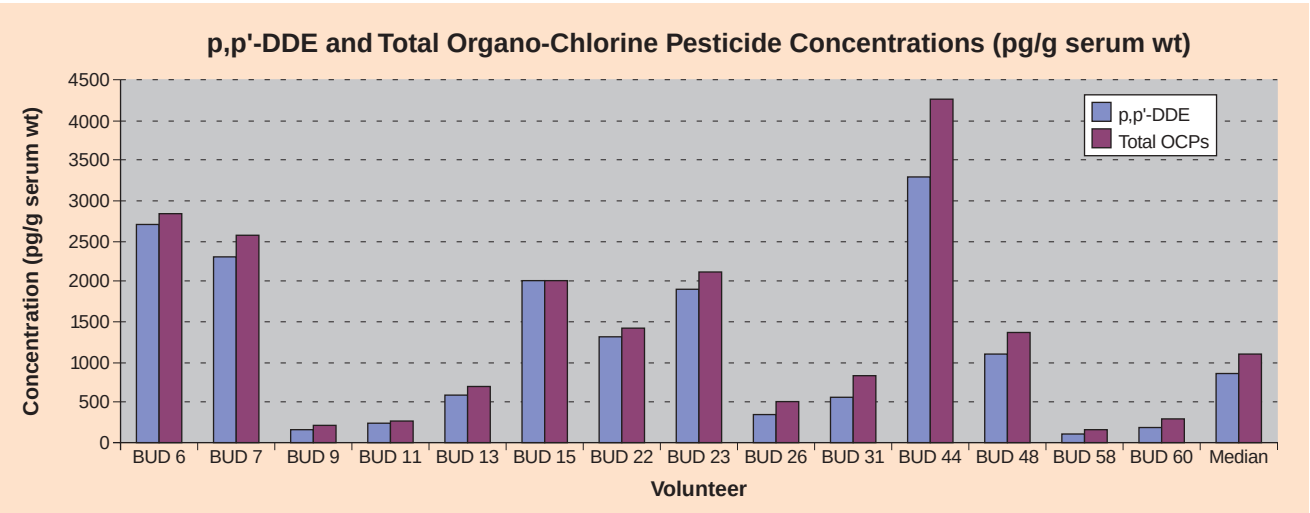
PCB	Min	Max	Med	Average
Total PCB Concentration (pg/g serum)	461	5471	1198	2022
Total number found per person	24	30	27	27



OC PESTICIDES

OC PESTICIDES (pg/g serum wt)	Min	Max	Med	Average
Alpha HCH	ND	ND	ND	ND
Beta HCH	5	73	44	39
Gamma HCH	5	75	19	30
Hexachlorobenzene	12	810	63	141
cis Chlordane	ND	ND	ND	ND
trans Chlordane	ND	ND	ND	ND
o,p' DDT	ND	ND	ND	ND
o,p' DDT	ND	ND	ND	ND
o,p' DDT	ND	ND	ND	ND
p,p' DDE	120	3300	845	1199
p,p' DDD	5	13	6	8
p,p' DDT	7	82	9	21
Total OC Pesticide Concentration	**168**	**4248**	**1097**	**1397**
Total Number Found per Person	**3**	**6**	**4**	**4**

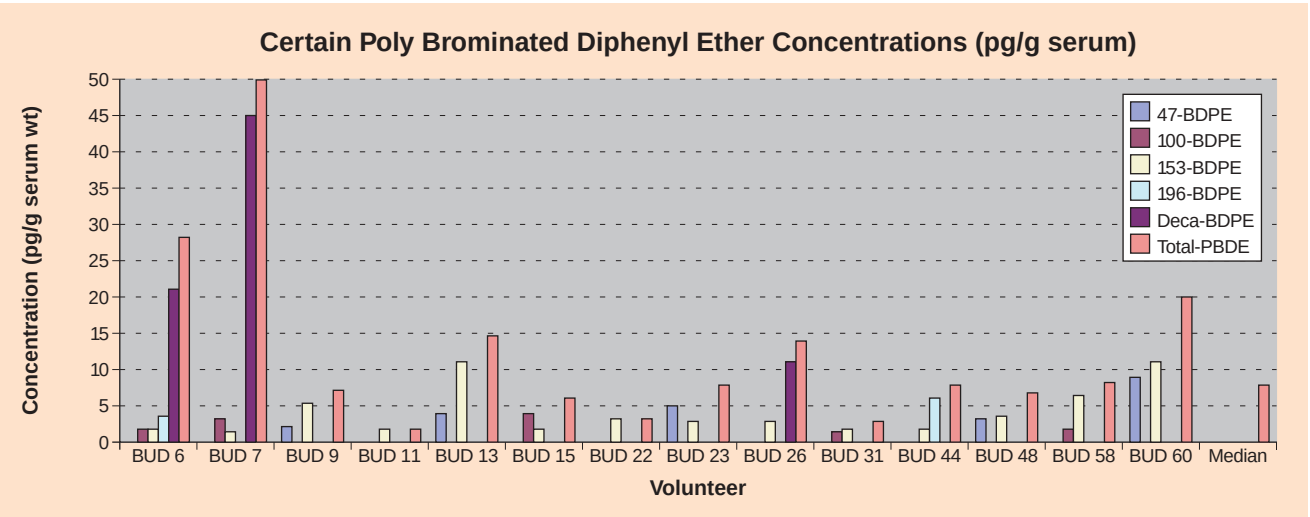




BROMINATED FLAME RETARDANTS

Poly Brominated Diphenyl Ethers (PBDEs)

BDPE Congener (pg/g serum wt)	Min	Max	Med	Average
17-TriBDPE	ND	ND	ND	ND
28-TriBDPE	ND	ND	ND	ND
32-TriBDPE	ND	ND	ND	ND
35-TriBDPE	ND	ND	ND	ND
37-TriBDPE	ND	ND	ND	ND
47-TetraBDPE	2	9	0	5
49/71-TetraBDPE	ND	ND	ND	ND
66-TetraBDPE	ND	ND	ND	ND
75-TetraBDPE	ND	ND	ND	ND
77-TetraBDPE	ND	ND	ND	ND
85-PentaBDPE	ND	ND	ND	ND
99-PentaBDPE	ND	ND	ND	ND
100-PentaBDPE	1	4	0	2
119-PentaBDPE	ND	ND	ND	ND
126-PentaBDPE	ND	ND	ND	ND
138-HexaBDPE	ND	ND	ND	ND
153-HexaBDPE	1	11	3	4
154-HexaBDPE	1	2	0	2
156-HexaBDPE	ND	ND	ND	ND
166-HexaBDPE	ND	ND	ND	ND
181-HeptaBDPE	ND	ND	ND	ND
183-HeptaBDPE	ND	ND	ND	ND
184-HeptaBDPE	ND	ND	ND	ND
190-HeptaBDPE	ND	ND	ND	ND
191-HeptaBDPE	ND	ND	ND	ND
196-OctaBDPE	4	6	0	5
197-OctaBDPE	3	3	0	3
206-NonaBDPE	ND	ND	ND	ND
207-NonaBDPE	ND	ND	ND	ND
209-DecaBDPE	11	45	0	26
Total BDPE Concentration	**2**	**50**	**8**	**13**
Total Number of BDPEs found per person	**1**	**4**	**2**	**2**



HBCD / TBBPA

It was not possible to get the sensitivity of the analysis sufficient for the results of TBBPA and HBCD to be reported with a satisfactory degree of confidence. Therefore, the results for these compounds are not reported.

ANTI- BACTERIALS

It was not possible to get the sensitivity of the analysis sufficient for the results to be reported with a satisfactory degree of confidence. Therefore, the results for these compounds are not reported.

SUMMARY TABLE

	Serum			Whole Blood			
	PCBs	**OC Pesticides**	**Brominated flame retardants**	**Phthalates**	**Perfluorinated chemicals**	**Synthetic Musks**	**Anti-bacterials**
Number looked for	40	12	32	8	7	2	2
Number found	33	6	7	2	6	1	0
Maximum number found in one person	30	6	4	2	4	1	0
Most frequent detect	100% 22 different PCB congeners	100% p,p'-DDE & HCB	100% PBDE-153	79% DEHP	75% (9 of 12 analysed) PFOA & PFNA	21% HHCB	N/A
Maximum level of individual chemical found	1300 pg/g (PCB 180)	3300 pg/g p,p'-DDE	45 pg/g (PBDE 209 -(deca))	DEHP 160 ng/g	52 ng/g PFOS	HHCB (1 ng/g)	0
Highest median level found	295 pg/g (PCB 153/168)	845 pg/g (p,p'-DDE)	21 pg/g (PBDE 209 -(deca))	120 ng/g (DEHP)	11 ng/g (PFOS)	1 ng/g (HHCB)	0
Maximum group total in one individual	5471 pg/g	4248 pg/g	49.7 pg/g	166 ng/g	60 ng/g	1 ng/g	0

4. CONCLUSIONS

The detection of at least 33 different chemicals in every person tested is very significant. Whilst many of the chemicals detected such as DDT, HCB and PCBs have been banned in Europe, several of the chemicals detected, such as phthalates, perfluorinated chemicals and certain flame retardants have not. This highlights that chemicals that have not been phased out are contaminating us to the same extent as older, banned chemicals. We have shown that the chemicals that industry insists are safe are in fact accumulating in our bodies in the same way as hazardous chemicals have in the past.

The findings call into question the claim that chemicals are under 'adequate control', a claim made despite the fact that the vast majority of chemicals have no publicly available safety data. WWF believes that historic data, reinforced by the findings in this survey, show that industry have failed to protect consumers from exposure to hazardous chemicals. The findings also highlight that it is impossible to adequately control chemicals that are persistent and bioaccumulative.

It is extremely difficult to determine what the potential health effects may be of exposure to the levels and cocktail of chemicals identified in this study. There are great uncertainties in assessing what might be considered a safe level of exposure to hazardous man-made chemicals, especially when they persist in the body for long periods. This is due in part to the lack of toxicity data and exposure data for the vast majority of chemicals to which people are exposed. WWF does not suggest that exposure to a certain chemical at a certain concentration will cause a particular adverse effect, neither do we accept that continuing exposure of the whole population, and especially of unborn children and developing infants, or the wider environment, to a cocktail of hazardous chemicals can be considered either "safe" or acceptable.

WWF believes that the best way to stop this ongoing chemical contamination and the threat to future generations is to prevent the manufacture and use of chemicals that are found in elevated concentrations in biological fluids such as blood and breast milk.

LEARNING THE LESSONS?

We need look no further than this or previous WWF biomonitoring surveys to see that current national and EU chemical regulations are proving inadequate at protecting people and the environment from contamination by persistent and bioaccumulative chemicals.

Persistent and bioaccumulative chemicals that have been banned for decades continue to contaminate people across Europe, and are now accompanied by other chemicals with similar properties which are still being produced and released into the environment. This suggests that Regulators have not learned the lessons of past experiences of the adverse effects that these chemicals have had on people and wildlife.

THE CURRENT EU REGULATORY OPPORTUNITY - REACH

The proposed new EU chemicals regulation known as REACH – the Registration, Evaluation and Authorisation of Chemicals – provides a once in a generation opportunity to secure proper control for substances that accumulate, and other problem chemicals. The proposals could help establish a robust system of regulation that identifies and phases out the worst chemicals and protects present and future generations from exposure to harmful chemicals. However, the current proposals require strengthening in certain key areas.

RECOMMENDATIONS

The number, types and concentrations of chemicals found in this survey, and by extrapolation the European population in general, are unacceptable. It appears to be a lottery as to where, when, how and to what extent we are exposed to chemicals that accumulate in our bodies and potentially interfere with our hormone systems. More needs to be done to protect ourselves and future generations of people and wildlife from the insidious threat of chemical contamination. WWF recommends that:

1. The governments of the EU should adopt a strengthened REACH. Specifically REACH needs to be strengthened in order to
    a) Phase out the use of hazardous chemicals, only allowing their continued use if no safer alternatives are available and their use is essential to society
    b) Strengthen registration procedures to close the existing gap in safety information for chemicals produced in 1-10 tonne per annum quantities.
    c) Ensure that industry information receives an independent quality audit

d) Require chemicals used in imported articles to undergo the same information requirements as those in EU-made articles, so as to protect consumers and avoid distortion of competition
e) Make sufficient information on chemicals publicly available so that downstream users, retailers and consumers can find out which chemicals are contained in the products they purchase and make their own risk judgements.

2. In addition to restrictions on the use of hazardous chemicals, monitoring schemes ought to be set up to determine the levels and effects of chemicals in the environment. European governments should therefore set up co-ordinated biomonitoring programmes to determine trends in the levels of hazardous chemical in humans, wildlife and the environment. These programmes should be integrated into the risk assessment process so that the detection of chemicals in monitoring surveys should be considered unacceptable and would initiate rapid investigation and the phase-out of a chemical, if appropriate.

Everyone – not least the next generation – should have the right to a clean, healthy and uncontaminated body so that they achieve their maximum potential without the ever-present worry of their lives being blighted due to exposure to hazardous man-made chemicals. Phasing out the use of very persistent and very bioaccumulative chemicals and of hormone-disrupting chemicals, and their substitution with safer alternatives, is the only way to stop the insidious threat of such chemicals and the contamination of future generations of humans and wildlife.

APPENDIX A: ANALYTICAL DATA

		Sample Number	BUD 06	BUD 07	BUD 09	BUD 11	BUD 13	BUD 15	BUD 22	BUD 23	BUD 26	BUD 31	BUD 44	BUD 48	BUD 58	BUD 60	Max	Med	Average
		PERFLUORINATES (ng/g whole blood)																	
1	1	Perfluorooctanoic Acid (PFOA)	N/d	14.44	1.61	7.25	-	N/d	-	15	3.49	1.22	7.07	7.02	N/d	10.6	15	7.07	7.5
2	2	Perfluorooctane sulphonate (PFOS)	N/d	5.27	N/d	51.7	-	16	-	N/d	N/d	N/d	6.49	18.9	6.74	N/d	51.7	11.4	17.5
3	3	Perfluorononanoic Acid (PFNA)	3.98	4.99	6.2	0.61	-	4.55	-	2.65	2.16	N/d	4.08	N/d	3.85	N/d	6.2	3.98	3.7
4	4	Perfluorodecanoic Acid (PFDA)	N/d	1.13	N/d	N/d	-	0.34	-	0.25	N/d	N/d	N/d	N/d	N/d	N/d	1.13	0.34	0.6
5	5	Perfluoroundecanoic Acid (PFUnA)	N/d	N/d	N/d	N/d	-	N/d	-	N/d	N/d	N/d	N/d	N/d	N/d	N/d	0	0	0
6	6	Perfluorododecanoic Acid (PFDoA)	1.62	N/d	1.04	N/d	-	N/d	-	N/d	N/d	N/d	N/d	N/d	N/d	N/d	1.62	1.33	1.3
7	7	Perfluorotetradecanoic Acid	N/d	N/d	7.71	N/d	-	N/d	-	1.04	3.22	N/d	N/d	N/d	N/d	N/d	7.71	3.22	4.0
		Total PF	5.6	25.83	16.6	59.5	-	20.9	-	18.9	8.87	1.22	17.6	25.9	10.6	10.6	59.5	17.1	18.5
		Count	2	4	4	3	0	3	0	4	3	1	3	2	2	1			

		Sample Number	BUD 06	BUD 07	BUD 09	BUD 11	BUD 13	BUD 15	BUD 22	BUD 23	BUD 26	BUD 31	BUD 44	BUD 48	BUD 58	BUD 60	Max	Med	Average
		OC PESTICIDES (pg/g serum wt)																	
8	1	Alpha HCH	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	0	0	0
9	2	Beta HCH	73	<5	9	19	24	5	44	55	64	59	56	58	6	40	73	44	39.4
10	3	Gamma HCH	18	<5	<5	<5	<5	<5	20	75	<5	<5	<5	5	<5	<5	75	19	29.5
11	4	Hexachlorobenzene	34	260	51	27	74	12	42	90	92	210	810	180	42	51	810	62.5	141.1
12	5	cis Chlordane	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	0	0	0
13	6	trans Chlordane	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	0	0	0
14	7	o,p' DDT	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	0	0	0
15	8	o,p' DDT	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	0	0	0
16	9	o,p' DDT	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	0	0	0
17	10	p,p' DDE	2700	2300	160	230	590	2000	1300	1900	350	550	3300	1100	120	190	3300	845	1199.3
18	11	p,p' DDD	5	13	<5	<5	<5	<5	<5	<5	<5	6	<5	6	<5	10	13	6	8.0
19	12	p,p' DDT	7	<5	<5	<5	<5	<5	7	<5	9	10	82	9	<5	<5	82	9	20.7
		Total OCPs	2837	2573	220	276	688	2017	1413	2120	515	835	4248	1358	168	291	4248	1097	1397.1
		Count	6	3	3	3	3	3	5	4	4	5	4	6	3	4			

		Sample Number	BUD 06	BUD 07	BUD 09	BUD 11	BUD 13	BUD 15	BUD 22	BUD 23	BUD 26	BUD 31	BUD 44	BUD 48	BUD 58	BUD 60	Max	Med	Average
		BDPE Congener (pg/g serum wt)																	
20	1	17-TriBDPE	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0	0	0
21	2	28-TriBDPE	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0	0	0
22	3	32-TriBDPE	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0	0	0
23	4	35-TriBDPE	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0	0	0
24	5	37-TriBDPE	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0	0	0
25	6	47-TetraBDPE	< 1	< 1	2	< 1	3.8	< 1	< 1	5	< 1	< 1	< 1	3.2	< 1	9	9	3.8	4.6
26	7	49/71-TetraBDPE	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0	0	0
27	8	66-TetraBDPE	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0	0	0
28	9	75-TetraBDPE	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0	0	0
29	10	77-TetraBDPE	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0	0	0
30	11	85-PentaBDPE	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0	0	0
31	12	99-PentaBDPE	< 3.5	< 3.5	< 3.5	< 3.5	< 3.5	< 3.5	< 3.5	< 3.5	< 3.5	< 3.5	< 3.5	< 3.5	< 3.5	< 3.5	0	0	0
32	13	100-PentaBDPE	2	3.3	<0.5	<0.5	<0.5	4	<0.5	<0.5	<0.5	1.3	<0.5	<0.5	1.7	<0.5	4	2	2.5
33	14	119-PentaBDPE	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0	0	0
34	15	126-PentaBDPE	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0	0	0
35	16	138-HexaBDPE	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0	0	0
36	17	153-HexaBDPE	2	1.4	5.3	1.7	11	1.9	3.1	2.7	2.8	1.7	1.9	3.5	6.4	11	11	2.75	4.0
37	18	154-HexaBDPE	<0.5	<0.5	1.4	<0.5	1.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.6	1.9	1.6	1.6
38	19	156-HexaBDPE	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	0	0	0
39	20	166-HexaBDPE	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	0	0	0
40	21	181-HeptaBDPE	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	0	0	0
41	22	183-HeptaBDPE	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	0	0	0
42	23	184-HeptaBDPE	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	0	0	0
43	24	190-HeptaBDPE	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	0	0	0
44	25	191-HeptaBDPE	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	0	0	0
45	26	196-OctaBDPE	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	6.1	< 1	< 1	< 1	6.1	5.05	5.1
46	27	197-OctaBDPE	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	2.8	< 1	< 1	2.8	2.8	2.8
47	28	206-NonaBDPE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	0	0	0
48	29	207-NonaBDPE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	0	0	0
49	30	209-DecaBDPE	21	45	< 5	< 5	< 5	< 5	< 5	< 5	11	< 5	< 5	< 5	< 5	< 5	45	21	25.7
		Total BDPE Concentration	29	49.7	8.7	1.7	16.7	5.9	3.1	7.7	13.8	3	8	9.5	8.1	21.6	49.7	8.4	13.3
		Count	4	3	3	1	3	2	1	2	2	2	2	3	2	3			

		Sample Number	BUD 06	BUD 07	BUD 09	BUD 11	BUD 13	BUD 15	BUD 22	BUD 23	BUD 26	BUD 31	BUD 44	BUD 48	BUD 58	BUD 60	Max	Med	Average
		OTHER FLAME RETARDANTS																	
50	1	TBBPA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
51	2	HBCD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			

		Sample Number	BUD 06	BUD 07	BUD 09	BUD 11	BUD 13	BUD 15	BUD 22	BUD 23	BUD 26	BUD 31	BUD 44	BUD 48	BUD 58	BUD 60	Max	Med	Average
		PCB (pg/g serum wt)																	
52	1	Trichloro,#18	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	0	0	0
53	2	Trichloro,#28/31	21	25	7	<5	11	4.6	5.1	6.6	6.2	13	17	11	7.6	37	37	11	13.2
54	3	Trichloro,#22	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0	0
55	4	Trichloro,#41	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0	0
56	5	Tetrachloro,#44	1.6	<1	<1	<1	2.3	<1	<1	1.3	<1	0.99	1.3	<1	<1	<1	2.3	1.3	1.5
57	6	Tetrachloro,#49	<1	1	<1	<1	1.4	<1	<1	<1	<1	1	<1	1.2	<1	<1	1.4	1.1	1.2
58	7	Tetrachloro,#52	1.2	1.4	<1	<1	3.4	1.6	<1	1.4	1	2.4	2.4	2.3	1	1.8	3.4	1.6	1.8
59	8	Tetrachloro,#54	<0.5	1.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.59	<0.5	<0.5	1.3	0.95	0.9
60	9	Tetrachloro,#56/60	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0	0	0
61	10	Tetrachloro,#64	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0	0	0
62	11	Tetrachloro,#70	1.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.1	1.1	1.1
63	12	Tetrachloro,#74	16	54	15	10	44	13	17	21	24	45	44	30	15	55	55	22.5	28.8
64	13	Pentachloro,#87	<1	<1	<1	1.8	11	2.6	<1	1.2	1.7	2.6	<1	1.5	<1	<1	11	1.8	3.2
65	14	Pentachloro,#90	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0	0	0
66	15	Pentachloro,#99	5.8	21	20	32	120	20	14	21	30	64	19	47	12	20	120	20.5	31.8
67	16	Pentachloro,#101	2.1	8.3	2.3	3.6	13	3.5	2.4	3.4	3.9	12	7.7	10	4	3.9	13	3.9	5.7
68	17	Pentachloro,#104	<0.5	<0.5	<0.5	<0.5	0.59	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.73	<0.5	<0.5	0.73	0.66	0.7
69	18	Pentachloro,#105	3.7	8.5	5.6	8.1	34	6.8	4.5	6.6	9.8	23	11	19	6.7	9.3	34	8.3	11.2
70	19	Pentachloro,#110	<2	<2	<2	2.2	4.5	2.2	<2	<2	<2	2.5	<2	2.2	<2	<2	4.5	2.2	2.7
71	20	Pentachloro,#114	1.4	2.3	1.6	1.9	5.7	1.9	1.1	1.9	3.6	4.4	1.5	2.8	1.1	2.8	5.7	1.9	2.4
72	21	Pentachloro,#118	20	69	31	37	160	38	25	41	55	99	73	94	35	43	160	42	58.6
73	22	Pentachloro,#123	1.3	3.6	1.5	1.5	7.7	1.5	1.2	2	2.1	5.4	1.9	5.6	2.2	2	7.7	2	2.8
74	23	Hexachloro,#138/158	55	820	170	140	840	160	130	180	250	220	850	380	94	170	850	175	318.5
75	24	Hexachloro,#141	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.72	<0.5	<0.5	1.1	1.8	<0.5	<0.5	<0.5	1.8	1.1	1.2
76	25	Hexachloro,#149	1.1	4.2	1.2	2.3	7.3	2.5	1.9	2.1	1.9	2.8	4.7	6	1.4	1.3	7.3	2.2	2.9
77	26	Hexachloro,#151	<1	4.3	1.5	1.7	7.5	2.6	2.2	2.2	3.2	3.9	16	8.2	2	1.6	16	2.6	4.4
78	27	Hexachloro,#153/168	99	1200	290	200	1200	300	220	270	410	300	1200	580	160	260	1200	295	477.8
79	28	Hexachloro,#156	11	76	24	17	97	20	17	20	41	36	66	33	12	30	97	27	35.7
80	29	Hexachloro,#157	3.2	7.9	5.8	4.9	24	5	3.2	5	10	9.5	6.2	7.9	2.9	7.3	24	6	7.3
81	30	Hexachloro,#167	4.4	26	6.1	5.1	28	7.9	5.1	10	13	9.4	24	17	5.7	7.5	28	8.65	12.1
82	31	Heptachloro,#170	40	580	110	45	340	110	85	100	180	63	570	240	59	120	580	110	188.7
83	32	Heptachloro,#177	5.8	81	10	9.6	55	11	13	17	20	15	190	47	8.8	15	190	15	35.6
84	33	Heptachloro,#180	99	1300	270	120	840	300	210	230	460	160	1200	640	160	310	1300	285	449.9
85	34	Heptachloro,#183	7.6	150	15	11	69	20	20	21	26	16	210	76	13	20	210	20	48.2
86	35	Heptachloro,#187	23	250	52	38	290	42	71	47	90	62	490	250	46	78	490	66.5	130.6
87	36	Heptachloro,#188	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0	0
88	37	Heptachloro,#189	1.9	14	4.2	2.1	15	4.1	3.5	3.9	6.4	2.9	13	6.3	3.3	4.9	15	4.15	6.1
89	38	Octachloro,#194	11	120	24	9.9	85	37	20	18	50	12	110	75	21	42	120	30.5	45.4
90	39	Octachloro,#199	13	95	23	15	85	20	24	16	54	23	160	78	24	47	160	24	48.4
91	40	Octachloro,#203	11	150	23	13	71	29	23	18	48	18	180	73	22	44	180	26	51.6
		Total PCB	461	5074	1114	733	4472	1167	920	1068	1801	1230	5471	2745	720	1333	5471	1198	2022.0
		Count	26	27	24	25	30	27	25	27	26	30	27	30	25	25			

		Sample Number	BUD 06	BUD 07	BUD 09	BUD 11	BUD 13	BUD 15	BUD 22	BUD 23	BUD 26	BUD 31	BUD 44	BUD 48	BUD 58	BUD 60	Max	Med	Average
		PHTHALATES (ng/g whole blood)																	
92	1	DMP	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0	0
93	2	DEP	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	0	0	0
94	3	DisoBP	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	0	0	0
95	4	DBP	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	0	0	0
96	5	BBP	<3	<3	<3	<3	<3	5	<3	<3	<3	<3	<3	6	<3	<3	6	5.5	5.5
97	6	DEHP	160	60	120	40	60	120	140	<30	<30	30	120	160	90	<30	160	120	100.0
98	7	DiNP	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	0	0	0
99	8	DiDP	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	0	0	0
		Total Phthalates	160	60	121	40	61	125	141	<30	<30	30	120	166	90	<30	166	120	101.3
		Count	1	1	1	1	1	2	1	0	0	1	1	2	1	0			

		Sample Number	BUD 06	BUD 07	BUD 09	BUD 11	BUD 13	BUD 15	BUD 22	BUD 23	BUD 26	BUD 31	BUD 44	BUD 48	BUD 58	BUD 60	Max	Med	Average
		MUSKS (ng/g whole blood)																	
100	1	HHCB	<1	<1	1	<1	1	<1	1	<1	<1	<1	<1	<1	<1	<1	1	1	1.0
101	2	AHTN	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0	0
		Total	0	0	1	0	1	0	1	0	0	0	0	0	0	0	1	0	0.2
		Count	0	0	1	0	1	0	1	0	0	0	0	0	0	0			

		Sample Number	BUD 06	BUD 07	BUD 09	BUD 11	BUD 13	BUD 15	BUD 22	BUD 23	BUD 26	BUD 31	BUD 44	BUD 48	BUD 58	BUD 60	Max	Med	Average
		ANTI-BACTERIALS																	
102	1	Triclosan	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
103	2	Methyl triclosan	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			

TOTAL COUNT OF CHEMICALS

Total Count		**39**	**38**	**36**	**33**	**38**	**37**	**33**	**37**	**35**	**39**	**37**	**43**	**33**	**33**		**37**	**36.5**

Sum whole blood (ng/g)	**166**	**85.83**	**139**	**99.5**	**62**	**146**	**142**	**18.9**	**8.87**	**31.2**	**138**	**192**	**101**	**10.6**	**192**	**100**	**95.7**
sum serum (pg/g)	**3327**	**7697**	**1343**	**1010**	**5177**	**3190**	**2336**	**3195**	**2330**	**2068**	**9727**	**4113**	**896**	**1646**	**9727**	**2763**	**3432.4**

APPENDIX B: GLOSSARY

Congener	An specific configuration of a chemical when many are possible with a given chemical formula or chemical family.
Median	The middle value in a set of values arranged in order of size.
Not Detected	The concentration of a chemical was below the limit of detection of the analytical method.
Serum	The straw coloured liquid fraction of blood separated from the blood cells during centrifugation.

PHTHALATES

DMP	Dimethyl-phthalate
DEP	Diethyl phthalate
DBP	Dibutyl phthalate
DEHP	Diethylhexyl phthalate
BBP	Butyl benzyl phthalate
DiDP	Di(isodecyl) phthalate
DiNP	Di(isononyl) phthalate
DisoBP	Di(isobutyl) phthalate

SYNTHETIC MUSKS

HHCB	1,3,4,6,7,8 Hexahydro-4,6,6,7,8,8-Hexamethyl-Cyclopenta-λ-2-Benzopyran
AHTN	6-Acetyl-1,1,2,4,4,7-HexamethylTetraline

BROMINATED FLAME RETARDANTS

TBBPA	Tetrabromobisphenol A
HBCD	Hexabromocyclo dodecane

APPENDIX C: CHEMICAL FACT SHEETS

DDT (AND DDE, DDD) – AN ORGANOCHLORINE PESTICIDE

Persistent	✔
Bioaccumulative	✔
Endocrine disrupter	✔

BACKGROUND

DDT (dichlorodiphenyltrichloroethane) is a man-made chemical developed in the 1940s and used as an insecticide against a very wide range of insect pests, particularly malarial mosquitoes, and as an agricultural insecticide. Technical-grade DDT may also contain DDE (dichlorodiphenyldichloro- ethylene) and DDD (dichlorodiphenyldichloroethane) which are breakdown products of DDT.

DDT is a long-lasting, toxic chemical which builds up in the tissues of living organisms. It has been banned in many countries, including the UK and other members of the European Union. It is, however, still used in some developing countries. It is regulated under international treaty as a "POP" – a persistent organic pollutant.

MAJOR USES

DDT was first used as an insecticide in 1939. It was widely employed during the Second World War against insects spreading malaria, typhus and other diseases. In the early 1960s, it was used widely to control agricultural pests as well as human and farm animal diseases. DDT was banned in the UK in 1986 but is still used in developing countries for controlling insect-borne diseases such as malaria.

WHERE IS IT USUALLY RELEASED FROM?

In countries where DDT is still in use, most release is due to its use as an insecticide. It can enter the atmosphere by evaporation and can contaminate surface water from soil run-off. It may also escape into the environment as a result of accidental discharges during use or manufacture. There are no natural sources of DDT.

Because of its chemical characteristics, DDT can travel long distances through the atmosphere. This results in the wide dispersion of DDT and its metabolites throughout the world, even into remote areas such as the Arctic or Antarctic. The persistence of DDT and its breakdown products has contributed to their bioaccumulation (higher concentration of a chemical in an organism than the surrounding environment) and biomagnification (increasing concentration of a chemical in organisms higher up the food chain) in the environment. DDT and its breakdown products are ubiquitous in food and the environment.

HOW MIGHT I BE EXPOSED TO DDT, DDE AND DDD?

Food

Exposure to DDT, DDE and DDD has been declining since the ban on the use of DDT in the 1970s. The predominant route of exposure is through the diet. The amount of DDT in food has greatly decreased since the insecticide was banned, and it should continue to decline. The actual amounts of DDT, DDE and DDD absorbed from food depends on the concentration of chemical in the food and the amount of food eaten.

Although DDT and its breakdown products are ubiquitous in the atmosphere, they are present in such low concentrations that exposure through inhalation or skin contact is considered to be negligible. In terms of diet, the main exposure route is through consumption of food such as meat, fish, poultry, dairy products imported from areas of the world where DDT is still used. Leafy vegetables generally contain more DDT than other vegetables, possibly because DDT in the air is deposited on the leaves.

In 2001 the UK Pesticide Residues Committee found DDT residues in 24 per cent of canned salmon samples tested. DDT residues were also found in 71 samples of fresh salmon, including two organic samples. The committee was informed that the presence of DDE in nearly all the samples suggested environmental contamination. The canned salmon contained lower residues than fresh salmon. Infants may be exposed by drinking breast milk.

Air and Water
Exposure to DDT in air and drinking water is considered negligible.

Once inside the body, DDT can break down to DDE or DDD. These in turn break down to other substances (called metabolites). DDT, DDD and especially DDE are stored most readily in fatty tissue. Some of these stored amounts leave the body very slowly, and levels in fatty tissues may increase with continued exposure. However, as exposure decreases, the amount of DDT in the body also decreases. DDT metabolites leave the body mostly in urine, but may also leave by breast milk and pass directly to nursing infants.

HOW MIGHT DDT, DDE, AND DDD AFFECT MY HEALTH?

No effects have been reported in adults given small daily doses of DDT by capsule for 18 months (up to 35 milligrams [mg] every day). People exposed for a long time to small amounts of DDT (less than 20 mg per day), such as those who worked in factories where DDT was made, had some minor changes in the levels of liver enzymes in the blood. A study in humans showed that increasing concentrations of p,p'-DDE in human breast milk were associated with reductions in the duration of lactation. A study in humans found that as the DDE levels in the blood of pregnant women increased, the chances of having a pre-term baby also increased. However, the levels of DDE in the blood at which this was noticed were higher than those currently found in women from generally in the United States, but not higher than those that may be found in women in countries where DDT is still being used.

In recent years, concern has been raised over the fact that many pesticides and industrial chemicals are hormone-disrupting chemicals, also known as endocrine-disrupting chemicals. Hormones influence the growth, differentiation and functioning of many tissues, including male and female reproductive organs and ducts such as the mammary gland, uterus, vagina, ovary, testes, epididymis and prostate. Therefore, mimicking or blocking the effects of hormones can potentially affect a number of organs and systems, especially if this occurs at vulnerable times such as during foetal development. Developing organisms respond to endocrine-disrupting chemicals very differently from adults. Low levels of hormone-disrupting chemicals may induce effects in the development of the reproductive organs. So far, there is no conclusive evidence that exposure to DDT and its breakdown products at the levels found in the environment has affected reproduction and development in humans, but there is sufficient information from animal studies to show that these chemicals have the potential for doing so. The possible association between exposure to DDT and various types of cancers in humans, particularly breast cancer, has been studied extensively. So far, there is no conclusive evidence linking DDT and related compounds to cancer in humans.

HOW CAN DDT, DDE AND DDD AFFECT CHILDREN?

DDT from the mother can enter her unborn baby through the placenta. DDT has been found in amniotic fluid, human placentas, foetuses, and umbilical cord blood. DDT has been measured in human milk; therefore, nursing infants are also exposed to DDT. In most cases, however, the benefits of breast-feeding outweigh any risks from exposure to DDT in the mother's milk.
Because of their smaller weight, intake of an equivalent amount of DDT by children and adults would result in a higher dose (amount of DDT ingested per kilogram of body weight) in children than in adults. In the United States between 1985 and 1991, the average 8_-month-old baby consumed four times as much DDT for each pound of body weight than the average adult.

HOW CAN I REDUCE MY RISK OF EXPOSURE TO DDT, DDE AND DDD?

Some countries still use DDT, so food brought from these countries may contain DDT. Washing fruit and vegetables before eating them is a good practice. Cooking can reduce the levels of DDT in fish.

FURTHER INFORMATION

Further information on DDT and other hazardous chemicals can be found on the following websites.

Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov/toxprofiles/

Healthehouse – The Resource for Environmental Health Risks Affecting Your Children
www.checnet.org/healthehouse/home/index.asp

HCB (HexaChloroBenzene) – AN ORGANOCHLORINE PESTICIDE

Persistent	✔
Bioaccumulative	✔
Endocrine disrupter	✔

BACKGROUND

HCB (hexachlorobenzene) is a fully chlorinated hydrocarbon industrial chemical that is practically insoluble in water, but very soluble in fat, oils and organic solvents. HCB was widely used as a pesticide until 1965. It was also used to make fireworks, ammunition and synthetic rubber. Virtually all commercial production ended in the late 1970s. HCB is one of the most persistent environmental pollutants, due to its chemical stability and resistance to biodegradation. Its persistence and tendency to bioaccumulate means HCB can travel around the globe. It has been found in air, water and organisms as far away as the Arctic. The US Environmental Protection Agency has classified HCB as a probable human carcinogen.

MAJOR USES

HCB was widely employed as a fungicide on seeds, but its marketing and use as a plant protection product has been banned in the UK since 1975 and in the European Union since 1988. HCB is still used in the manufacture of chlorinated organic solvents.

WHERE IS HCB USUALLY RELEASED FROM?

Although HCB is no longer manufactured or used as a commercial product in the UK, it is formed as a by-product or impurity in the manufacture of chlorinated solvents and other chlorinated compounds including several pesticides currently in use. Its presence in the environment is mostly due to its previous use as a fungicide. HCB is also released into the environment due to ongoing use in agricultural products in developing countries and improper storage or disposal in developed countries. HCB is also released into the atmosphere as an accidental product from the combustion of coal, waste incineration and certain metal processes. Natural fires and volcanoes may serve as natural sources. About 0.9 tonnes of HCB were released into the atmosphere in the UK in 1998.

HOW MIGHT I BE EXPOSED TO HCB?

Most people are unlikely to be exposed to large amounts of HCB, but many studies have detected small amounts in food and air samples, so some exposure is likely. Traces of HCB have been found in almost all people tested.

Air and Water

You may be exposed to HCB if you live near an industrial site where it is produced as an unintentional by-product or as a minor part of another chemical product. You may also be exposed if you live near a hazardous waste site where HCB has been discarded. HCB has a very low solubility in water, so exposure by water is not likely to be significant.

Food

Most exposure is likely to be the result of consumption of low levels in food. Eating shellfish, fish and certain vegetables can expose people to HCB. You can also be exposed to HCB by eating and drinking food and liquids such as milk, other dairy products, meat and poultry, if the animals from which these products are obtained have been exposed to it through their feed or other sources of contamination. Additionally, fat and oil in food may increase the amount of HCB that enters the body from food. Low levels of HCB have been found in the fatty tissues of almost all people tested. Once in your body HCB will remain there, especially in fat, for years. However, a large portion of HCB in the fat of a mother can be transferred to her baby in breast milk. During pregnancy, this substance can also transfer to the unborn child through the mother's blood.

HOW MIGHT HCB AFFECT MY HEALTH?

Excessive exposure may affect the adrenal gland, blood, bone, brain, immune system, kidney, liver, lung, parathyroid gland, peripheral nerve, reproductive system, skin, thyroid gland, the unborn child and the breast-fed baby, and may cause cancer. Unborn and young children may be more sensitive to these effects than adults. The International Agency for Research on Cancer (IARC) has determined that HCB is possibly carcinogenic to humans.

HOW CAN HCB AFFECT CHILDREN?

Young animals exposed to HCB before and soon after birth are especially sensitive to HCB. Effects on the liver, nervous system and immune function occurred at lower doses in young developing animals than in adults. Animal studies also showed that HCB affects various endocrine organs, including the thyroid gland, parathyroid gland, adrenal gland and ovaries. These tissues produce hormones that are important to normal growth and development of the organism.

HOW CAN I REDUCE MY RISK OF EXPOSURE TO HCB?

The primary way most people are exposed is through food. Fatty food may contain higher levels of HCB than less fatty food, and also be more readily absorbed. Therefore, eating less fatty food may reduce the risk of exposure to HCB.

FURTHER INFORMATION

Further information on HCB and other hazardous chemicals can be found on the following websites.

Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov/toxprofiles/tp90-c2.pdf

Healthehouse – The Resource for Environmental Health Risks Affecting Your Children
www.checnet.org/healthehouse/home/index.asp

LINDANE – (GAMMA-HCH) AND OTHER HCH ISOMERS – AN ORGANOCHLORINE PESTICIDE

Persistent	✔
Bioaccumulative	✔
Endocrine disrupter	✔

BACKGROUND

Hexachlorocyclohexane (HCH) is the name for a family of related man-made compounds. They differ only slightly, and have different prefixes, for example alpha (α)-HCH and beta (β)-HCH. The most important member of the family is gamma-HCH, which is more commonly known as lindane. This datasheet generally refers to lindane but the data is equally applicable to the other forms of HCH.

MAJOR USES

Lindane was widely used as an insecticide. It is no longer used in the UK as an agricultural and domestic insecticide and in 2003 the EU agreed to ban all its agricultural uses. Lindane can be still be found in lotions, creams and shampoos used to control head lice and scabies, a contagious skin disease caused by mites.

WHERE IS LINDANE USUALLY RELEASED FROM?

Lindane is released into the environment as a result of its use as an insecticide and during its manufacture, storage and transport. There are no natural sources of lindane.
About 36 tonnes of lindane were released into the air in the UK in 1998, of which some 29 tonnes came from timber treatment or evaporation from treated wood. A further six tonnes came from agricultural uses and the remaining one tonne from domestic use.

HOW MIGHT I BE EXPOSED TO LINDANE?

Air

Lindane can be present in the air as vapour or attached to tiny dust particles. We can be exposed to lindane in workplace air and in the air surrounding factories where lindane is used. It can remain in the air for several months and travel long distances, so exposure can occur far from the original source.

Food
Lindane can enter your body when you eat lindane-contaminated food or drink water. In the UK in April and May 2001, low levels of lindane were found in four purchased samples of cow's milk (whole milk). It was most likely to have originated in lindane-contaminated animal feed. Lindane has also been detected in breast milk and this is a possible exposure pathway for infants and children.

Skin
People, especially children, may be exposed to lindane when it is applied to the skin as a lotion or shampoo for the control of lice and scabies.

HOW CAN LINDANE AFFECT MY HEALTH?
Lindane is classified by the EU as a possible human carcinogen. The US Environment Protection Agency has assigned:

alpha -HCH as a probable human carcinogen;
beta -HCH as a possible human carcinogen; and
gamma -HCH is being evaluated for evidence of human carcinogenicity.

HOW CAN I REDUCE MY RISK OF EXPOSURE TO LINDANE?
Eat less fatty food and avoid shampoos or lotions containing lindane. Alternatives are available including non-chemical techniques.

FURTHER INFORMATION
Further information on lindane and other hazardous chemicals can be found on the following websites.

Environment Agency's Pollution Inventory
www.environment-agency.gov.uk/business/444255/446867/255244/

Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov/ToxProfiles/phs8914.html

National Atmospheric Emissions Inventory
www.aeat.co.uk/netcen/airqual/naei/annreport/annrep98/naei98.html

The Pesticides Directorate
www.pesticides.gov.uk/committees/wppr/wppr99/prleaflt2.htm

OSPAR Commission Website
www.ospar.org/

Helsinki Commission Website
www.helcom.fi/

PBDES – POLY-BROMINATED DIPHENYL ETHER – FLAME RETARDANTS

Persistent	✔
Bioaccumulative	✔
Endocrine disrupter	✔

This fact sheet concentrates on the penta brominated substance, since it is the most studied PBDE.

BACKGROUND

PBDEs are man-made chemicals containing bromine. Three main commercial types of PBDEs are distinguished by the number of bromine atoms present in each molecule: penta-BDE (five bromine atoms), octa-BDE (eight bromine atoms) and deca-BDE (ten bromine atoms). Penta is itself a mixture of related substances, some of which contain four or six atoms of bromine per molecule. There are a total of 209 individual chemicals, known as congeners, within the family of PBDEs.

PBDEs are very long-lasting (persistent) and bioaccumulative (they build up in the tissues of living organisms) and some are also endocrine disrupters. PBDEs have been measured in animal tissue water and sediment far from sources of release, raising concern over the possible global impacts of releases. PBDE concentrations have increased markedly and now approach those of PCBs in some parts of the world. There are concerns about their toxicity. PBDEs may decompose in fire, to produce highly toxic brominated chemicals.

MAJOR USES

PBDEs are used extensively as flame retardants in manufacturing textiles and plastics. Penta is widely used in this role in flexible polyurethane foam for furniture and upholstery, and to a lesser extent in rigid plastics and textiles, and may make up 10 per cent by weight of the finished foam. Octa and deca are used in conjunction with antimony trioxide as flame retardants in rigid plastics used in making cars and consumer goods such as electrical appliances.

WHERE ARE PBDES USUALLY RELEASED FROM?

PBDEs may be released into the environment during manufacture of the chemical itself, incorporation into plastic products (mostly polyurethane foam), processing of the foam into finished articles, release during the lifetime of the article and finally disposal in landfill or incineration. In general, only small amounts of the substance are released because of its very low volatility and low water solubility. Dust produced from foam product materials to which they are added to as flame retardants is usually the main form of release from products.

In 1994, the UK used under 2,000 tonnes. In 1997, manufacture of penta in the EU ceased and usage rates have fallen steadily in the past decade.

HOW MIGHT I BE EXPOSED TO PBDES?

The main source of exposure to PBDEs may be the diet, particularly foods with high fat content such as fatty fish. PBDEs have been detected in air samples, indicating that people can also be exposed through inhalation. Once PBDEs are in your body, they can change into breakdown products called metabolites, some of which might be harmful. Some metabolites and some unchanged PBDEs may leave your body, mainly in the faeces and in very small amounts in the urine, within a few days. Other unchanged PBDEs may stay in your body for many years. PBDEs are stored mainly in your body fat, tend to concentrate in breast milk fat, and can enter the bodies of children through breast feeding. PBDEs also can enter the bodies of unborn babies through the placenta.

HOW MIGHT PBDES AFFECT MY HEALTH?

If your PBDE levels are higher than the normal levels, this will show that you have been exposed to high levels of the chemicals. However, these measurements cannot determine the exact amount or type of PBDEs to which you have been exposed, or how long you have been exposed. Although these tests can indicate whether you have been exposed to PBDEs to a greater extent than the general population, they do not predict whether you will develop harmful health effects.

Long-term exposure to these chemicals has a greater potential to cause health effects than short-term exposure to low levels because of their tendency to build up in your body over many years.

It is unclear if PBDEs can cause cancer in people. Based on the evidence of cancer in animals, deca-bromodiphenyl ether is classified as a possible human carcinogen by EPA. The International Agency for Research on Cancer (IARC) has not classified the carcinogenicity of any PBDEs.

HOW MIGHT I REDUCE MY RISK OF EXPOSURE TO PBDES?

When buying new household goods such as sofas, cushions, mattresses etc, avoid those treated with PBDEs. Octa- and penta-BDEs have recently been banned in the EU so alternatives will be more readily available.

FURTHER INFORMATION

Further information on PBDEs and other hazardous chemicals can be found on the following websites.

Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov/toxprofiles/tp68.html

Healthehouse – The Resource for Environmental Health Risks Affecting Your Children
www.checnet.org/healthehouse/home/index.asp

PCBS – Polychlorinated Biphenyls

Persistent	✔
Bioaccumulative	✔
Endocrine disrupter	✔

BACKGROUND

PCBs are a group of man-made chemicals first manufactured in the 1920s. They occur as mixtures of individual components, known as congeners. There are 209 different PCB congeners and in their pure form they are either oily liquids or solids and range from colourless to light yellow.
Once in the environment, PCBs do not readily break down and therefore remain for very long periods of time. PCBs can enter the air by evaporation from both soil and water. PCBs can be carried long distances through the air and have been found in snow and sea water in areas such as the Arctic, far away from where they were released into the environment.

PCBs are found all over the world. They are taken up into the bodies of small organisms and fish in water. They are taken up by other animals that eat these aquatic creatures as food. PCBs especially accumulate in fish and marine mammals such as seals and whales, reaching levels that may be many thousands of times higher than in water. PCB levels are highest in animals high up the food chain. Particularly high levels have been found in polar bears.
The manufacture of PCBs stopped in the 1970s because there was evidence that they build up in the environment and may cause harmful effects. Now, nearly everyone in industrial countries has been exposed to PCBs because they are found throughout the environment, and people are likely to have detectable amounts of PCBs in their blood, fat, and breast milk.

MAJOR USES

Because they don't burn easily and are good insulating materials, they were used widely as coolants and lubricants in electrical equipment such as transformers and capacitors, as heat exchange fluids and as flame retardants. They were also used as paint additives, in carbonless copy paper and as a flame retardant additive in plastics.

WHERE ARE PCBS USUALLY RELEASED FROM?

Before 1977, PCBs entered the air, water and soil during their manufacture and use. Waste containing PCBs was generated at that time, and was often placed in landfills. PCBs also entered the environment from accidental spills and leaks during the transport of the chemicals, or from leaks or fires in transformers, capacitors or other products containing PCBs. Today, PCBs can still be released into the environment from poorly maintained hazardous waste sites, illegal or improper dumping of PCB wastes, and disposal of PCB-containing consumer products into municipal or other landfills not designed to handle hazardous waste. PCBs may be released into the environment by some waste burning in municipal and industrial incinerators.

Leakage and spills from equipment containing PCBs accounted for about 89 per cent of UK releases in 1990. Disposal of waste products containing PCBs and emissions from industrial processes – power stations, iron and steel works, sewage sludge applications to land – contributed most of the remainder.

HOW MIGHT I BE EXPOSED TO PCBS?

Although PCBs are no longer made in the UK, people can still be exposed to them, primarily through contaminated food and by breathing contaminated air. The major dietary sources of PCBs are fish (especially those caught in contaminated lakes or rivers), fish oils, meat and dairy products.

Once PCBs are in your body, some may be changed by your natural functions into other related chemicals called metabolites. Some metabolites may leave your body in faeces in a few days, but others may remain in your body fat for months. Unchanged PCBs may be stored for years, mainly in the fat and liver, but smaller amounts can be found in other organs as well. PCBs collect in milk fat and can enter the bodies of infants through breast-feeding.

HOW CAN PCBS AFFECT MY HEALTH?

If your PCB levels are higher than the background levels, this will show that you have been exposed to high levels of PCBs. However, tests do not predict whether you will develop harmful health effects.

It is difficult for scientists to establish a clear association between PCB exposure levels and health effects. However, excessive exposure to PCBs may affect the brain, eye, heart, immune system, kidney, liver, reproductive system, skin, thyroid gland and the unborn child, and may cause cancer. Both the US Environmental Protection Agency and the International Agency for Research on Cancer (IARC) have determined that PCBs are probably carcinogenic to humans.

HOW CAN PCBS AFFECT CHILDREN?

Because of their smaller weight, children's intake of PCBs per kilogram of body weight may be greater than that of adults. Children are exposed to PCBs in the same way as are adults: by eating contaminated food, breathing indoor air in buildings that have electrical devices containing PCBs, and drinking contaminated water. In addition, children can be exposed to PCBs both prenatally in the womb, and from breast milk. Nevertheless, the balance of scientific evidence confirms that the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

Because the brain, nervous system, immune system, thyroid, and reproductive organs are still developing in the foetus and child, the effects of PCBs (possibly acting as endocrine disrupters) on these target systems may be more profound after exposure during the prenatal and neonatal periods, making foetuses and children more susceptible to PCBs than adults.

HOW CAN I REDUCE MY RISK OF EXPOSURE TO PCBS?

You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations.

FURTHER INFORMATION

Further information on PCBs and other hazardous chemicals can be found on the following websites.

Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov/

Healthehouse – The Resource for Environmental Health Risks Affecting Your Children
www.checnet.org/healthehouse/home/index.asp

PERFLUORINATED CHEMICALS - (INCLUDING PFOS/PFOA)

Persistent	✔
Bioaccumulative	✔
Endocrine disrupter	✔

BACKGROUND

This study looked for 7 different perfluorinated chemicals in blood samples. However, due to the lack of available information on these chemicals, the content of this fact sheet is almost exclusively based on the information available on PFOS/PFOA.

Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) are members of a chemical group known as perfluorinated chemicals (PFCs), characterised by chains of carbon atoms of varying lengths, to which fluorine atoms are strongly bonded. PFOS and PFOA can be produced synthetically or by the breakdown/metabolism of other PFCs. PFCs are heat stable, extremely resistant to degradation and environmental breakdown, and repel both water and oil. It is these properties that are exploited in their various applications, ranging from non-stick pans, stain/water repellents for clothing/furniture to floor waxes and paper coatings (for instance Teflon, Gortex, Stainmaster and Scotchguard).

The properties that make PFCs so effective in these products are also the reason why they tend to persist in the environment. Research has revealed that PFOS is now a ubiquitous environmental contaminant, bioaccumulating in wildlife and humans. PFOS has been detected in polar bears in the arctic, dolphins in Florida, seals in the Baltic Sea, otters in California, eagles and albatross in the mid-Pacific, whales in the North sea, in the blood of loggerhead turtles and in the blood of humans world-wide.

In May 2000, under pressure from the US Environmental Protection Agency (EPA), US company 3M announced that by the end of 2001, PFCs used in its extremely successful Scotchguard products would be phased out, due to the accumulation of PFOS from the product in humans and wildlife. However, PFOA is still being produced by Du Pont, as are a group of perfluorinated chemicals called telomers which break down into PFOA. PFOA has been found to contaminate wildlife and humans.

MAJOR USES

PFCs have been widely used as industrial surfactants and emulsifiers and their stain/water resistant properties have meant that they have found themselves widely employed in numerous consumer products. Non-stick pans, carpets, furniture, household cleaners, shampoos, shoes/clothing and packaged food containers are just some of the products that can contain PFCs. A vast array of industrial products and processes also make use of the heat stable, non-stick properties of PFCs.

HOW MIGHT I BE EXPOSED TO PERFLUORINATED CHEMICALS?

You might be exposed to perfluorinated compounds through the use of the myriad consumer products that contain them (see above). Due to lack of regulation, chemical companies have not been required by law to monitor or report emissions of PFOA, PFOS or other PFCs into air, water or landfills, so environmental contamination is widespread, and exposure by some route is almost inevitable. PFOS and PFOA have been detected in food, including fish, so dietary exposure is also possible.

HOW CAN PFOS/PFOA AFFECT MY HEALTH?

The unique physical properties of perfluorinated chemicals that make them such good waterproofers and stain repellents (i.e. they repel water and oil) mean that they do not accumulate in fat, like many other persistent bioaccumulative chemicals, but in protein. This does not mean however, that they are more easily eliminated, and PFCs such as PFOS can therefore build up to high levels in our bodies and those of wildlife. The half-life (the time taken for half the amount of a chemical to be metabolised or eliminated) of PFOS in humans is in the region of 8-9 years. Continued exposure also means that levels of PFCs in our bodies may never be completely removed over our lifetimes.

Information has come to light recently, concerning the potential developmental, reproductive and systemic toxicity of PFOS. PFOS has been shown to effect the neuroendocrine system in rats and other rodent studies have demonstrated maternal and developmental toxicity due to PFOS, with a host of birth defects and compromised survival in newborns. PFOS has been shown to accumulate in the liver and to cause toxicity in this organ (hepatotoxicity). There is also evidence that exposure to PFOS and PFOA may cause thyroid dysfunction, which, during pregnancy, can lead to many developmental problems. The US EPA also considers both PFOS and PFOA to be carcinogenic and occupational exposure to PFOS has been correlated with increased incidence of bladder cancer.

HOW CAN I REDUCE MY RISK OF EXPOSURE TO PFOS/PFOA?

Switching from non-stick pans to cast iron or non-coated pans can reduce you and your family's exposure to perfluorinated compounds that are liberated during heating. Avoid the use of stain/waterproofing products to treat furniture, shoes and clothing where possible. When you purchase furniture or carpets, decline optional treatments for stain and dirt resistance, and find products that have not been pre-treated with chemicals by questioning the retailers. Minimise packaged food and greasy fast foods in your diet as these can be held in containers that are coated with telomers to keep grease from soaking through the packaging. Avoid buying cosmetics and other personal care products with the phrase "fluoro" or "perfluoro" on the ingredient list.

REGULATORY STATUS

- Following intense regulatory pressure from the U.S. EPA, PFOS, the active ingredient used for decades in the original formulation of 3M's popular Scotchguard products, was taken off the market in 2000. Shortly thereafter, 3M also ceased manufacture of PFOA, and Du Pont then started manufacturing PFOA themselves.
- The US EPA also considers both PFOS and PFOA to be carcinogenic

FURTHER INFORMATION

http://www.ewg.org/reports/pfcworld/index.php

http://www.oecd.org/dataoecd/23/18/2382880.pdf

http://www.ourstolenfuture.org/NewScience/oncompounds/PFOS/2001-04pfosproblems.htm

http://www.epa.gov/oppt/pfoa/pfoara.pdf

PHTHALATES

Persistent	✔
Bioaccumulative	✕
Endocrine disrupter	✔

BACKGROUND

Phthalates are a group of man-made chemicals, produced in large volumes, which are widely used as additives in many plastics and consumer products. Examples of phthalates include di(2-ethylhexyl)phthalate (DEHP), dibutyl phthalate (DiBP), di(iso-nonyl)phthalate (DiNP) and di(iso-decyl)phthalate (DiDP). DEHP is the most commonly used phthalate and is a ubiquitous environmental contaminant. Phthalates such as DEHP are relatively persistent in the environment and have been detected in drinking water, soils, household dust, fish and other wildlife. Phthalates have also been detected in fatty foods (meat and dairy products), in human blood and breast milk and phthalate metabolites have been detected in adult and children's urine.

MAJOR USES

Phthalates are used predominantly as "plasticisers" to make plastics more flexible. In fact, 90% of the phthalates manufactured in the EU are used as plasticisers in PVC, with DEHP being the most common, accounting for up to 40% of some flexible PVC. PVC is a widely used for everything from children's toys and kitchen flooring to blood bags, medical tubing and plastic food wrappings.
Phthalates are also used as additives in cosmetics (e.g. nail polish, perfumes), personal care products (shampoos, conditioners, hair sprays), pharmaceutical products, paints, printing inks, sealants and adhesives.

HOW MIGHT I BE EXPOSED TO PHTHALATES?

You might be exposed to phthalates in consumer products and plastics. Children can be exposed by mouthing or chewing PVC toys, as phthalates can leach out into their saliva. Inhalation of household dust containing phthalates (particularly DEHP) from PVC flooring and building materials is another important exposure route. Since plasticised PVC is widely used in healthcare applications such as bloodbags and medical tubing, there is concern that hospitalised patients undergoing haemodialysis and respiratory therapy can be exposed to high levels of phthalates leaching out of such devices. Phthalates can be absorbed through the skin following the use of perfumes, cosmetics and other personal care products containing them. Ingestion of food containing phthalates that have migrated from plastic food wrappings is another way in which humans can be exposed. Fatty foods in particular (e.g, cheese and other dairy products, meat) have been shown to contain phthalates.

HOW CAN PHTHALATES AFFECT MY HEALTH?

Phthalates are endocrine disruptors and there is evidence that they might be linked to reproductive abnormalities in boys, exposed in their mother's womb. US researchers have found that DEHP can cause sexual deformities in male rats through an endocrine-disrupting mechanism. Similar effects have been found with di-butyl phthalate (DBP). Studies in humans have shown reduction in sperm quality is correlated with elevated levels of phthalates and monoethylhexylphthalate (MEHP), a breakdown product of DEHP, has been shown to induce testicular cell damage and lower sperm counts. In a recent study, 88% of new-born babies were shown to have DEHP or MEHP in their blood, and exposure to MEHP has been linked to preterm birth. Elevated levels of phthalates in blood have also been implicated in premature breast development in Puerto Rican girls. Health concerns over the exposure of children to phthalates via PVC toys have focussed on chronic effects on the kidney and liver.

HOW CAN I REDUCE MY RISK OF EXPOSURE TO PHTHALATES?

Buying children's teething toys made of phthalate-free PVC can reduce their exposure risk. This has become easier since the implementation of an EU wide ban on the use of six phthalates in toys intended to be sucked by children under 3 years old. One way to reduce your families exposure is to avoid flexible PVC products altogether, although this is difficult given it's numerous applications.

REGULATORY STATUS

- An EU wide ban on the use of six phthalates in toys intended to be sucked by children under 3 years old was introduced in 1999. Since then, his has been renewed 16 times.
- Phthalates in plastics which come into contact with food, including DINP, DEHP, DBP, DIDP and BBP, are currently being assessed for their safety to humans by the Scientific Panel on Food Contact Materials of the European Food Safety Authority.
- DEHP is a "priority hazardous substance" under the EU water Framework Directive and is classified in the EU as "toxic to reproduction".
- There is inadequate evidence in humans for the carcinogenicity of DEHP (IARC Group 3 classification for carcinogenicity). The US EPA has classified DEHP as a Group B2, probable human carcinogen.
- The recent EU risk assessment for DEHP has highlighted the need for more information on the risks to newborn babies posed by DEHP contaminated breastmilk.

FURTHER INFORMATION

http://www.atsdr.cdc.gov/toxprofiles

http://www.environment-agency.gov.uk/business/444255/446867/255244/

http://europa.eu.int/comm/food/food/chemicalsafety/foodcontact/legisl_list_en.htm

http://www.foodstandards.gov.uk/safereating/phthalates/

SYNTHETIC MUSKS (HHCB AND AHTN)

Persistent	✔
Bioaccumulative	✔
Endocrine disruptors	✔

BACKGROUND

NB: In the present biomonitoring study, the musks HHCB and AHTN are being analysed for in human blood. Reference is made to the "nitro" musks since their applications and uses are very similar.

Synthetic musks are global high volume man-made chemicals, used extensively in a vast array of fragranced consumer products, including detergents, cleaning products, air fresheners, perfumes, colognes, shampoos, cosmetics and other personal care products. Synthetic musks were created to replace the more expensive and rare natural musks, and are of 2 general types. The nitro musks, mainly musk xylene and musk ketone, which have been used for many decades, and the polycyclic musks (including HHCB and AHTN) which in recent years have become the most important commercial synthetic musks. This is due, in part, to concerns about the distribution, fate

and behaviour of nitro musks in the environment and their toxicological effects, which lead to the reduction of their use.
HHCB (1,3,4,6,7,8-hexahydro-4,6,6,7,8-hexamethylcyclopenta-ç-2-benzopyran) and AHTN (7-acetyl-1,1,3,4,4,6-hexamethyl-1,2,3,4-tetrahydronaphthalene) are two polycyclic musks being analysed for in human blood samples in this survey. They are the most commonly used polycyclic musks - in 1996, the worldwide production of polycyclic musks, 95% of which were HHCB and AHTN, was 5600 tonnes. Synthetic musks are structurally and chemically different to the compounds they were designed to replace (the natural musks). The physical and chemical properties of synthetic musks have more in common with man made persistent chemicals that are known to biomagnify (increase in concentration) through the food chain, such as PCBs and organochlorine pesticides. As a result, synthetic musks are widespread, persistent and bioaccumulative environmental contaminants. They have been measured in rainwater, river water, lakes, sediment, sewage sludge and wastewater treatment plant effluent in Canada, United States, UK and Europe. In studies in Europe and North America, synthetic musk compounds have been shown to bioaccumulate in aquatic ecosystems, and have been detected in a wide range of wildlife species (fish, crustaceans, shellfish). These compounds are consistently found in sewage discharges, and they principally find their way into the environment via waste waters, especially those from sewage treatment works. Synthetic musks have also been detected in air. Worryingly, HHCB, AHTN, and other polycylic musks have also been found in human adipose (fat) tissue and breast milk.

MAJOR USES

The major uses for synthetic musks are in perfumes, aftershaves, soaps, lotions and a wide variety of personal care products. Musks are also used in cleaning products, air fresheners, laundry detergents and practically any consumer product that is artificially fragranced. These chemicals are however not required to be listed on the ingredients of these products, and some manufacturer's fragrance formulas remain closely guarded secrets. Musks are simply covered under the terms "parfum" or "fragrance" on product labels. Any of 2,600 fragrance chemicals can be covered under this all-encompassing term.

HOW MIGHT I BE EXPOSED TO SYNTHETIC MUSKS?

The main exposure route for musks is through the skin, as they are commonly found in perfumes, cosmetics, soaps, toiletries etc. Absorption through the skin is also important from fragrances left on clothes from laundry detergents. Inhalation may also be an important route of entry into the body, since fragrances by their very nature are airborne (air fresheners, perfumes etc.) and have been detected in air.

HOW CAN SYNTHETIC MUSKS AFFECT MY HEALTH?

Very little is known about the direct effects of synthetic musks. It has been suggested that they can trigger allergies and asthma and their widespread use might be one of the causes of the increasing incidence of these afflictions. Polycyclic musks have been shown to have endocrine disrupting potential – that is, they might interrupt hormonal processes in the body. AHTN has been shown to demonstrate oestrogenic activity (mimic oestrogen) in a test using human breast cancer cells. Both HHCB and AHTN are weakly oestrogenic in humans and have been shown to be anti-oestrogenic (impair the activity of natural oestrogens) in fish. AHTN has been shown to cause acute liver damage in laboratory rodents. Although there is no definite scientific link, higher rates of miscarriage in women have been associated with elevated blood concentrations of musk xylene (although this chemical is not being analysed for in this study). Synthetic musks are also suspected of being animal carcinogens.

HOW CAN I REDUCE MY RISK OF EXPOSURE TO SYNTHETIC MUSKS?

It is very hard to avoid all exposure to synthetic musks, due to their very widespread use in the products mentioned above. It is possible, however, to minimise your exposure by using fragrance-free products, avoiding products with "parfum" or "fragrance" on the label and by choosing products containing natural scents or those fragranced with natural oils. Simple actions like opening a window or using pot-pourri to freshen a room can be good substitutes to using air fresheners containing musks.

REGULATORY STATUS

- HHCB and AHTN along with other polycyclic and nitro musks are listed on the Toxic Substances Control Act (TSCA) Inventory (US).
- HHCB is a high production volume chemical as defined by the U.S. EPA (<1 million lb produced or imported per annum).
- The use of musk xylene and musk ketone in cosmetics is restricted under the EU cosmetics directive, due to their tendency to build up in the environment. Polycyclic musks are under review.
- Certain synthetic musks are being phased out in many retailers products e.g CO-OP retail.

FURTHER INFORMATION

http://europa.eu.int/comm/enterprise/chemicals/chempol/contributions/ngo/ngo_505_consumers3_uk.pdf
http://www.greenpeace.org.uk/Products/Toxics/chemicalhouse.cfm

DETOX

CAMPAIGN

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by:

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WWF DetoX Campaign
36 Avenue de Tervuren
1040 Brussels, Belgium

http://www.panda.org/detox