WWF

DETOX CAMPAIGN

The CO-OPERATIVE BANK

Customer led, ethically guided

Chemical Check Up

An analysis of chemicals in the blood of Members of the European Parliament

TOXIC CHEMICALS

A THREAT TO WILDLIFE AND HUMANS

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

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- all of the volunteers for giving their blood for this survey.
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- Marie Morice at WWF-UK for her tireless energy and enthusiasm in co-ordinating the sampling for this survey and the Campaign in general.
- Giles Watson at WWF-UK for his co-ordination of the project

April 2004

Dear reader,

It's a frightening fact that the contamination of our bodies with man-made chemicals is a reality. I know this because I took part in WWF's UK biomonitoring tests, along with over 150 other volunteers, including Co-operative Bank staff from all around the UK.

I read my own results with a growing sense of unease, in the knowledge that there is little or nothing we can do to reduce our own contamination levels. But that doesn't mean we can't act now to reduce levels of exposure and risk for our children and future generations.

It's no comfort to know that MEPs and others are in the same position as myself. The results of these tests show that everyone tested is contaminated with a cocktail of industrial chemicals, including pesticides outlawed many years ago and chemicals still in use today, no matter where they live and what they do for a living. And, as yet, we don't know what effect they're having on our own bodies, our children or wildlife.

The Co-operative Bank is a UK bank, but we have global concerns, and our decision to support WWF's biomonitoring work in the UK and to fund this testing in Europe was a natural progression for our own Safer Chemicals campaign (in partnership with WWF) and a reflection of our ethical investment policy.

The Co-operative Bank is the only high street bank in the UK with a published Ethical Policy, clearly stating where we will and will not invest our customers' money.

The Ethical Policy reflects our customers' concerns and is based upon ongoing consultation with them. Our policy position on persistent and bio-accumulative chemicals has been in place for over 5 years and is supported by 88% of our customers:

'We will not invest in any business whose core activity contributes to the manufacture of chemicals which are persistent in the environment and linked to long term health concerns.'

All the MEPs who volunteered to take part in these tests deserve our thanks for contributing to a growing bank of knowledge on our exposure to industrial chemicals.

Sheila Macdonald
Chief Operating Officer
The Co-operative Bank

WWF DETOX CAMPAIGN

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EXECUTIVE SUMMARY

In December 2003, WWF's DetoX Campaign took blood samples from 47 volunteers from 17 European countries, comprising 39 Members of the European Parliament (MEPs), 4 Observers from Accession Countries, 1 former MEP and 3 WWF staff members. The samples were analysed for 101 predominantly persistent, bioaccumulative and toxic man-made chemicals, including: 12 organochlorine pesticides (including DDT and lindane), 45 poly chlorinated biphenyls (PCBs), 21 polybrominated diphenyl ether (PBDE) flame retardants (including those found in the commercially traded penta-, octa- and deca-BDE- flame retardant formulations), 2 other brominated flame retardants hexabromocyclododecane (HBCD), Tetrabromobisphenol A (TBBP-A), 8 phthalates and 13 perfluorinated chemicals. Whilst many of these chemicals have been banned, many others are of ongoing relevance and concern as they are found in everyday products, from which we can become exposed.

WWF believes that this is the first survey ever to provide comprehensive data on the concentrations of this range of chemicals in concurrent samples and to investigate the findings in relation to peoples' personal and lifestyle factors.

FINDINGS

- Every volunteer tested was contaminated by a cocktail of hazardous chemicals from each of the five chemical groups tested.

- Thirteen chemicals were found in every single person tested (for that chemical). They are presented in the table below.

Table 1: Chemicals detected in 100% of volunteers tested

Chemical	Percentage of volunteers contaminated
p,p'-DDE (a metabolite of DDT)	100
HCB (HexaChloroBenzene – a pesticide)	100
BDE 153 (a Brominated Diphenyl Ether – a component of flame retardant products)	100
PCB 52	100
PCB 74	100
7 different perfluorinated compounds	100% of the 45 analysed (2 not analysed)
DEHP (Di Ethyl Hexyl Phthalate)	100% of the 45 analysed (2 not analysed)

- 76 of the 101 chemicals analysed for were detected.

- The highest number of chemicals found in any one person was 54 – over half of the chemicals investigated, whilst the median (mid point) number of chemicals detected was 41.

- The chemical found in the highest concentration and the highest median concentration in whole blood was the phthalate DEHP (Di Ethyl Hexyl Phthalate) at concentrations of 1,152,000 and 155,000 pg/g 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 the deca-BDE – a brominated flame retardant, at a concentration 18,431 pg/g serum, whilst that found with the highest median concentration was p,p'-DDE (a DDT metabolite) which had a median detected concentration of 1265 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 (18,431 pg/g serum). It is also what we believe to be the highest concentration ever detected in human serum. Most alarming of all, this level is approximately ten times higher than the highest levels measured in workers occupationally exposed to deca-BDE. The median (midpoint) concentrations (of detects) was also higher than found in occupational studies. This is particularly worrying as it was found at higher concentrations than two other related flame retardants that have recently been banned in Europe, in part due to their widespread and increasing concentrations in humans and wildlife. Thirty four percent of the volunteers (16 volunteers from 10 different countries) were contaminated with deca-BDE. This proportion is almost five times higher than the 7 percent found in WWF's UK survey in 2003.

- TBBP-A (tetrabromobisphenol A) a brominated flame retardant, was found in what we believe to be the highest concentration ever detected in Europe. Even more worrying is that it was found in whole blood at levels up to roughly ten times higher that found in studies on the blood serum of occupational workers. It was detected in over two thirds (68%) of samples analysed for TBBP-A (27 of 40).

- HBCD (hexabromocyclododecane) a brominated flame retardant chemical was found in one volunteer, WWF believes that this is the first time that this chemical has ever been found in human blood.

- The degree of contamination varied widely between volunteers from the different European countries. However, the small number of volunteers from each country prevents any conclusions being drawn regarding the influence of nationality on contamination levels.

- Certain personal or lifestyle factors appeared to affect the level of contamination by individual chemicals:
  Gender: Male volunteers appeared to have a higher range of PFOS concentrations in their blood than the female volunteers.
  Age: Levels of certain PCBs increased with age. This is consistent with findings from the UK biomonitoring survey conducted by WWF-UK in 2003.
  Recent purchases:There appeared to be a relationship between increased levels of the deca-BDE flame-retardants in the blood and the recent purchase of consumer articles likely to contains flame retardants.

CONCLUSIONS

The survey highlights the ubiquitous contamination of every single person tested, even non-occupationally exposed people.

The detection of the phthalate DEHP and 7 different perfluorinated chemicals in every single person tested is very significant, as it illustrates that chemicals, that have not been phased out, are contaminating us to the same extent as older, banned chemicals such as DDT, HCB and PCBs. 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 demonstrate the nonsense of industry's insistence that their chemicals are under 'adequate control' (despite the fact that the vast majority of which have no safety data). WWF believes that historic data, reinforced by the findings in this survey, show that industry have failed to protect everyday consumers from exposure to their hazardous chemicals and also highlights 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 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, to a cocktail of hazardous chemicals can be considered "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 very survey to see that current national and EU chemical regulations are proving inadequate at protecting us and the environment against contamination by persistent and bioaccumulative chemicals.

Persistent and bioaccumulative chemicals that have been banned for decades continue to contaminate people across Europe, and they are now accompanied by other chemicals with similar properties which are still being produced and released into the environmental. It appears that the concentrations of certain of the 'newer' chemicals, such as PFOS and octa-BDE, correlate well with those of the "old use" chemicals – such as PCBs and organochlorine pesticides, which have been banned in the EU for decades. This indicates that the newer chemicals may behave in similar ways in the body. This highlights the fact that Regulators have not learned the lessons from past experiences of the adverse effect that these chemicals have 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 adequate controls for these substances. The proposals could help establish a robust system of regulation that protects present and future generations from exposure to toxic chemicals. However, the proposals aren't tough enough as they stand, as the authorisation process will fail to ensure that chemicals of very high concern – such as very persistent, very bioaccumulative (vPvB) and hormone (or endocrine) disrupting chemicals (EDCs) – are phased out even when safer alternatives are available.

If the Members of the European Parliament and European Governments strengthen the proposals as we outline above, the new legislation will yield a more progressive, precautionary and science-based chemicals policy, which will encourage industry to innovate in order to produce greener and safer products.

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 whether, 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 do all in their power to protect future generations of humans and wildlife by ensuring that REACH requires persistent, bioaccumulative and other hazardous chemicals to be removed from the market. Such measures would reduce the continuing exposure of people and the environment. In particular, governments should support strict conditions for authorising chemicals under REACH. This must include:
   a) supporting the inclusion of very persistent and very bioaccumulative (vPvB) chemicals (those likely to be found in biological fluids such as blood and breast milk) and EDCs into the prior authorisation scheme of REACH; and
   b) phasing out the use of these chemicals of very high concern, such as vPvBs and EDCs, and their mandatory substitution with safer alternatives, Phase out is the best way effectively to reduce and eventually stop our exposure to hazardous chemicals
   c) the authorisation to use hazardous chemicals should only be granted when there is no safer alternative, an overwhelming societal need for them and measures to minimise exposure are put in place.

2. The best route of protection is to introduce better control of hazardous chemicals so that humans and wildlife are not contaminated in the first place. Chemicals with undesirable properties should be taken off the market. Where this "gatekeeper" approach fails, there should be adequate monitoring to determine the levels of chemicals in the environment and their effects. 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 EDCs, 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.

1 INTRODUCTION

The contamination of the environment by man-made hazardous chemicals will probably not come as a surprise to most people. Over the years, WWF has highlighted the global nature of chemical contamination. Now, from polar bears in the once pristine Arctic through to seals and dolphins around the coast of EU countries, wildlife throughout the world is contaminated.

But chemical contamination is not only a global or even a local issue: it is a personal issue, affecting everyone from all walks of life, male or female, young and old, rich or poor, factory worker, housewife or office worker. 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.

Some surveys show that up to 30 per cent of our food is contaminated by man-made hazardous chemicals (DEFRA 2000). Others show that the air and dust in our homes is also contaminated. The presence of chemicals in these environmental "compartments" is a clear indication that humans could be exposed through these routes. The next logical step is therefore investigating the contamination of our own bodies. To this end, WWF-UK tested the blood of 155 UK volunteers in 2003 for the presence and levels of a range of 78 hazardous man-made chemicals. That study revealed the startling extent of chemical contamination in the bodies of people from across the UK. This study is a continuation of this research and investigates the contamination by a further 23 chemicals of the blood of 47 volunteers (comprising 39 Members of the European Parliament (MEPs), 4 Observers from Accession Countries, 1 former MEP and 3 WWF staff members) from 17 countries across Europe.

This biomonitoring survey was commissioned to determine the levels of 101 industrial chemicals in the blood of 47 European volunteers. Its objectives are:

- to determine the occurrence and concentrations of a range of persistent and bioaccumulative chemicals in human blood; and
- to investigate links between levels of chemical contamination and people's life history or lifestyle parameters.

OUR CHEMICAL ENVIRONMENT

The European environment is contaminated by increasingly large numbers of industrial chemicals, the vast majority of which have not been tested for their effects on human health. The global production of chemicals has increased from 1 million tonnes in 1930 to 400 million tonnes today. Some 100,000 different substances are registered in the EU market, 10,000 of which are marketed in volumes of more than 10 tonnes and a further 20,000 at 1-10 tonnes.

We are exposed to these through the air we breathe, the food we eat and the water we drink. We are exposed to chemicals released directly into the environment from industry, agriculture or other sources of environmental pollution such as vehicle and diesel exhaust, incinerators and tobacco smoke. In addition, many commercial products used in or around the home contain chemicals that pose a potential risk to humans. Due to inadequate chemical regulations, very few of these chemicals have had their risks to humans, wildlife or the environment sufficiently assessed. The EU has admitted that 99% of the volume of chemicals on the market are inadequately regulated. Only 14 per cent of EU high production volume chemicals have even the minimum "base-set" amount of data and 21 per cent have no data at all (Allanou et al 1999).

Although very little is known about the relationship between exposure to most chemicals and the risks they pose, there are exceptions. It is known that organochlorines, a class of chlorine-containing compounds including polychlorinated biphenyls (PCBs) and certain pesticides such as DDT, tend to persist in the environment and become concentrated in animal tissues. Many organochlorines have the ability to disrupt the endocrine system, the body's hormonal signalling system which is crucially important for regulating reproduction and development. The developing foetus, infant and child are particularly vulnerable to many of these compounds. Birth defects and developmental disabilities are increasingly common, and chemical toxicants are known to play a role in causing some of these conditions.

WWF is particularly concerned that very persistent (vP) (those that aren't broken down in the environment and therefore linger for long periods of time), very bioaccumulative (vB) chemicals (those that build up in the tissues of living organisms) and endocrine disrupting chemicals (EDCs) are not adequately addressed in the new regulations. These types of chemicals are of particular concern because once released into the environment, they cannot be recalled like products on a supermarket shelf. Instead, they will persist and build up in people, wildlife and the environment, and may reach levels that cause adverse effects. For example:

- Polar bears, seals and dolphins are suffering decreased immune system function due to the immunotoxic effects of accumulated PCBs;

- Dog-whelk populations crashed in coastal waters around Europe and other parts of the world due to tributyltin (TBT) masculinsing female dog-whelks, making them unable to reproduce. TBT is used in anti-fouling paints on ship hulls to prevent organisms from growing on the bottom of boats.

- Populations of many birds of prey crashed in the EU as a result of their contamination with DDT, which caused the birds' eggshells to thin so much that they broke during incubation

WWF is not alone in wanting urgent action to stop our exposure to such hazardous man-made chemicals:
- In May 2003, 60 European environmental and human health scientists signed a declaration highlighting the urgent need to reduce human exposure to persistent and bioaccumulative chemicals and endocrine disrupting chemicals; and
- In June 2003, the UK's Royal Commission on Environmental Pollution published a report recommending to the UK government that "where chemicals are found in elevated concentrations in biological fluids such as breast milk, they should be removed from the market immediately".

POLICY CONTEXT

Current Chemical Regulations

The current system in Europe for regulating chemicals is widely acknowledged to be inadequate, failing and in need of a radical overhaul. Among the tens of thousands of industrial chemicals marketed in Europe (called Existing Substances), 140 have been prioritised by the EU Member States for evaluation in order to determine whether measures are needed to reduce the risks they pose to humans or the environmental because of their hazardous nature. Nevertheless, in the 10 years since this process was started, fewer than half of the substances have had their evaluations completed and fewer still have been the subject of regulatory action to limit their known threat.

Several of the chemicals investigated in this survey were phased out in an uncoordinated manner, country by country and year by year, before they were finally subjected to widespread international bans. Experience with the world's "dirty dozen" POP chemicals serves to highlight the inadequate protection we get against known toxic chemicals from EU and international regulations.

Persistent Organic Pollutants (POPs) are defined as being persistent, bioaccumulative and able to travel great distances. After years of painfully slow negotiation, the POPs Convention was finally signed by more than 100 countries in Stockholm in 2001. This year, France became the 50th country to ratify the convention –but the EU has not ratified the treaty. Four chemicals, or groups of chemicals, that are classified as POPs (i.e. DDT, PCBs, HCB and chlordane) were analysed in this study.

This illustrates the unacceptably slow pace of regulation currently in place to protect our lives and the environment from some of the world's most hazardous chemicals. Usually it takes many years from the first warning signs of a chemical's hazardous nature to it being regulated (adequately or otherwise).

The Proposed New EU Chemical Regulation (REACH)

The EU is currently developing and negotiating a new chemical regulation, known as REACH. This stands for the: Registration, Evaluation and Authorisation of Chemicals). The Regulation was initially developed in an attempt to address widely perceived legislative failures and inadequacies of current chemicals regulations. Under the proposals, the chemical industry will have to provide safety data on their chemicals, which will then need to be evaluated to determine their safety for use in different applications.

The development of this EU legislation presents a once in a generation opportunity to phase out chemicals of very high concern. The last major overhaul of chemical legislation was in 1981, 23 years, or a generation ago. The proposals could help establish a robust system of regulation that protects present and future generations from exposure to toxic chemicals. However, the proposals aren't tough enough as they stand, as the authorisation process will fail to ensure that chemicals of very high concern – such as very persistent, very bioaccumulative (vPvB) and hormone (or endocrine) disrupting chemicals (EDCs) – are phased out even when safer alternatives are available. It is important that the new EU chemical regulation requires the phase-out of such chemicals, and their mandatory substitution with safer alternatives. Phasing out is the best way effectively to reduce and eventually stop our exposure to hazardous chemicals.

If the EU strengthens the proposals as we outline above, the new legislation will yield a more progressive, precautionary and science-based chemicals policy, which will encourage industry to innovate in order to produce greener and safer products.

HEALTH EFFECTS OF CHEMICALS

The data are inadequate to assess the safety of the vast majority of chemicals in use, including many of the chemicals we tested for (e.g. certain brominated flame retardants and the perfluorinated chemicals). However, data are available for some of the chemicals analysed in this survey. PCBs, for instance, are known carcinogens and reproductive and neurological toxicants. (For further specific information, including toxicity information on each of the chemicals, refer to the chemical factsheets in Appendix 2.)

In addition to the toxicity data already available on some of these chemicals, new studies are frequently being published in the scientific literature which show that chemicals are able to produce subtle adverse effects at lower levels than previously ever thought.

Furthermore, ongoing developments in understanding how chemicals exert their toxic effects show that the current approach to chemical risk assessment, whereby substances are assessed individually, does not adequately predict their risks. For instance, chemical risk assessments do not take account of the fact that:

- no chemical is ever present as a single contaminant – we are all exposed to a cocktail of chemicals, and there is therefore a potential for interaction between chemicals; and
- the unborn child is exquisitely sensitive to chemicals, so that exposure in the womb can produce adverse effects at lower concentrations than would affect adults.

Taken together, there are great uncertainties surrounding what might be considered a safe level of exposure to hazardous man-made chemicals, especially when they persist in the body for long periods. While WWF does not claim that exposure to a certain chemical at a certain concentration will cause a particular adverse effect in a particular individual, neither do we accept that continuing exposure, especially of foetuses, to a cocktail of hazardous chemicals can be considered "safe".

Regulators should learn the lessons of recent experiences with chemicals such as DDT and PCBs. In WWF's view, phasing-out the use of very persistent and very bioaccumulative chemicals and of EDCs, and their substitution with safer alternatives, is the only way to stop the contamination of future generations of humans and wildlife.

2 METHODOLOGY

VOLUNTEERS

Our budget allowed us to survey 47 volunteers in total (39 MEPs, 1 former MEP, 4 Accession country observers in the European Parliament and 3 WWF staff members. All volunteers were citizens of European countries and lived and worked in Europe. The volunteers were from the following countries: Austria, Belgium, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Luxembourg, the Netherlands, Poland, Spain, Sweden and the UK.

Of the 47 volunteers studied, 24 (51%) were male and 23 (49%) female. The age range was 35 to 66 years with a median age of 52 years.

Table 2: Number of volunteers tested for the different chemical groups

Chemical	Number of volunteers analysed
PCBs, OCPs, PBDEs	47
Phthalates	45
Perfluorinated chemicals	45
HBCD & TBBP-A	40

CHOICE OF BIOLOGICAL MATERIAL

WWF believes that contamination of the body is a matter of great importance to all people of both sexes and all ages, therefore we chose to analyse chemicals in blood and not breast milk. Because comparatively little information is available on blood contamination, we felt this would be a useful addition to the scientific literature.

PCBs, organochlorine pesticides and PBDEs were analysed in blood serum, and their levels are expressed in terms of pg/g serum (pg/g = picograms per gram (1 pg/g is 1 10-12 of a gram, or 1 part per trillion).
The perfluorinated compounds, phthalates and HBCD/TBBP-A were analysed in whole blood and are expressed in terms of pg/g whole blood.

There is evidence that in a given body there is a standard relationship between the levels of PCBs or OCPs in adipose and blood serum or plasma (expressed as a chemical concentration per gram lipid). This also appears to be true for PCBs between human milk and blood. It is also considered likely that PBDEs follow this pattern, at least for the less brominated congeners. Therefore the levels of these chemicals in blood serum (with the exception of deca-BDE (BDE-209)) can, with calculation, be compared to levels in adipose or milk fat.

CHEMICAL ANALYSIS

For details, please see the technical analytical report in Appendix 3.

CHOICE OF CHEMICALS

Chemicals were chosen on the basis of technical feasibility and relevance to the issue of regulating persistent, bioaccumulative and endocrine disrupting chemicals. Several of the chemicals are well known for both their persistence and bioaccumulation in the environment. PCBs, OCPs and PBDEs were analysed in WWF's UK biomonitoring survey and were included again in the present survey. In addition to these, we looked for several new chemicals of concern that have been shown to accumulate in people and wildlife (perfluorinated chemicals, phthalates and two further brominated flame-retardants).

Due to the limited volume collected from some volunteers, some chemicals were not analysed in some volunteers.

The information on many of these chemicals is limited, both in terms of their toxic effects on humans and wildlife and of their behaviour in the environment. Most of these chemicals have inadequate safety data and regulations governing their manufacture and use are insufficient. Brief summaries are given below on each of the chemicals, or groups of chemicals analysed for. More comprehensive information is provided in the chemical factsheets found in Appendix 2.

Polychlorinated biphenyls (PCBs)

PCBs are a group of man-made chemicals first manufactured in the 1920s. They occur in 209 different forms, known as congeners. 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 soil and water and can be carried long distances. They are now found all over the world, far away from where they were released into the environment – for example in Arctic snow and seawater,. They enter the bodies of small organisms and fish in water and are then ingested 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 millions 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. Now, it is thought that virtually everyone must have been exposed to PCBs because they are found throughout the environment, and we are all likely to have detectable amounts of PCBs in our blood, fat and breast milk.

Organochlorine pesticides (OCPs) – for example, DDT, HCB and HCHs

We analysed for a range of OCPs, which are typically older types of pesticides. They are characterised as very persistent and bioaccumulative, and toxic. Some of these were banned from use in the EU in the 1970s however others continued to be used up until the 1990s e.g. HCH, but even so, many are still found widely in the environment.

Polybrominated diphenyl ether (PBDE) flame retardants

These are a family of structurally related chemicals used as flame-retardants. They have been used widely as a safeguard against fire taking hold quickly in products. However, they have a high potential for uptake and accumulation by organisms, are now widely dispersed in the environment and have been found to be accumulating in human breast milk as well as in the tissues of several animal species at very high rates and to worryingly high levels. Both penta- and octa-commercial BDE flame-retardant products have recently been banned in the EU because they were found to be widespread in humans and wildlife and because of uncertainties about their toxicity. However, they continue to be used widely elsewhere in the world, including the US. However, recently California decided to introduce restrictions on the use of the penta_BDE product, due to the discovery of very high levels of human contamination.

Deca-BDE (BDE-209)

Deca-BDE is related to the less brominated penta- and octa- BDEs. It has been found in humans in a limited number of studies, particularly of occupationally exposed people. However, prior to WWF's UK survey it was not know whether it would be found in "non-occupationally exposed" populations, but it was found in 7 percent of the volunteers in that survey. Globally, some 30,000 tonnes of the compound are sold annually, and it accounts for a substantial proportion of the European market for brominated flame retardants worth some £174 million. It is currently undergoing risk assessment in the EU, where there are continuing concerns about its potential neuro-toxicity. Deca was found in the dust of every household sampled in a recent EU study and at higher levels than any other chemical/flame retardant.

HBCD and TBBP-A

In addition to the PBDEs, the brominated flame-retardants hexabromocyclododecane (HBCD) and tetrabromobisphenol-A (TBBP-A) were analysed for in blood samples. HBCD is produced in high volumes and used to fireproof polymers and textiles, construction materials, furniture and electronic equipment. Evidence is emerging that it accumulates in the environment, wildlife and in humans and may have negative health impacts. HBCD has been detected in breast milk in Sweden, but generally there is limited data on HBCD levels in humans. HBCD has been found in foodstuffs (meat, eggs, milk, fish) and in the dust of all households sampled in a recent EU study.
Of all the brominated flame-retardants manufactured globally, TBBP-A is produced in the largest volume and is primarily used in printed circuit boards in electronic devices. There is limited information on the fate and behaviour of TBBP-A in the environment, but it has been found in air, household dust, soil, water, human blood and human breast milk.

Phthalates

Phthalates are widely used as additives in many plastics and consumer products. Di(2-ethylhexyl)phthalate (DEHP) is the most commonly used phthalate and is a ubiquitous environmental contaminant. Phthalates 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.

Phthalates are used predominantly as "plasticisers" to make plastics, mainly PVC, more flexible. Flexible PVC, and thus phthalates, are 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. Phthalates are endocrine disrupters and there is evidence that they might be linked to reproductive abnormalities, decreasing sperm counts, reductions in sperm quality, and other toxic effects on the kidney and liver. In 1999, a (time-limited) EU wide ban was introduced on the use of six different phthalates in toys intended to be sucked by children under 3 years old.

Perfluorinated chemicals (including PFOS/PFOA)

The perfluoroalkyl acids, such as perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), are members of a chemical group known as perfluorinated chemicals characterised by chains of carbon atoms of varying lengths, to which fluorine atoms are strongly bonded. Perfluorinated chemicals 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). PFOS is 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 and in the human blood world-wide.

There are also concerns over the potential developmental, reproductive and systemic toxicity of perfluorinated chemicals, with most work focussing on PFOS. PFOS has been shown to accumulate in the liver and to cause toxicity in this organ and there is also evidence that exposure to PFOS and PFOA may cause thyroid dysfunction, which, during pregnancy, can lead to many developmental problems. PFOS has also been correlated with increased incidence of bladder cancer.

In 2002, the American company 3M phased out the manufacture of perfluorinated compounds, used in its Scotchguard products, due to grave concerns over their widespread distribution and persistence in wildlife and humans. However, perfluorinated compounds continue to be manufactured by other companies, including those in the EU.

PERSONAL AND LIFESTYLE QUESTIONNAIRE

Volunteers were asked to complete a lifestyle questionnaire concerning:

- gender;
- age;
- height and weight (used to calculate body mass index (BMI));
- diet (vegan, dairy and egg eating vegetarian, fish-eating vegetarian or omnivore);
- proportion of diet that is organic;
- weight – whether their weight was stable, gaining or losing;
- Place of longest residence.
- recent purchases of consumer products likely to contain brominated flame retardants – for example a new carpet, mattress, sofa or car;
- for women: the number of children carried and the total period they breast fed their children.

The results of the personal and lifestyle questionnaire were then analysed to determine whether there were any relationships between such factors and the findings of the chemical analysis. Please see the technical report in Appendix 3 for further details.

3 RESULTS AND DISCUSSION

Many of the chemicals in this survey have been detected in previous human blood surveys. However, WWF believes that this survey is the first to provide comprehensive data on the concentrations of this range of PCBs, organochlorine pesticides, brominated flame-retardants, phthalates and perfluorinated compounds in concurrent blood samples anywhere in the world

Table 3: Summary of most frequently detected chemicals

Chemical	Percentage of volunteers contaminated
p,p'-DDE (a DDT Metabolite)	100
HCB (hexachlorobenzene – a pesticide)	100
BDE 153	
(component of penta- & octa-BDE)	100
PCB 52	100
PCB 74	100
7 different perfluorinated chemicals	100% of the 45 analysed
Diethylhexyl phthalate (DEHP)	100% of the 45 analysed

Table 4: Top 10 chemical maximum levels detected in serum and whole blood (pg/g).

	Top 10 (pg/g serum)		Top 10 (pg/g whole blood)	
Rank	Chemical	Maximum level	Chemical	Maximum level
1	Deca-BDE	18,431	DEHP	1,152,000
2	p,p'-DDE	7,976	DiDP	550,000
3	PCB153	1,954	DEP	335,000
4	PCB 180	1,887	DiNP	140,000
5	PCB 138	1,492	DiBP	65,000
6	PCB 50/66	1,107	PFOS	55,036
7	HCB	1,058	DMP	34,000
8	PCB 170	968	BzBP	29,000
9	p,p'-DDT	648	DBP	27,000
10	ß-HCH	566	PFOA	9,848

Table 5: Top 10 chemical median levels detected in serum and whole blood (pg/g).

	Top 10 (pg/g serum)		Top 10 (pg/g whole blood)	
Rank	Chemical	Median level (of detected levels)	Chemical	Median level (of detected levels)
1	p,p'-DDE	1265	DEHP	155,000
2	PCB 153	719	DiDP	94,500
3	PCB 180	642	DMP	34,000
4	PCB 138	478	DiNP	31,000
5	PCB 60/56	432	DBP	24,500
6	BDE 209 deca	407	BzBP	18,000
7	PCB 170	285	PFOS	16,960
8	HCB	203	DiBP	7,000
9	PCB 187	150	DEP	5,000
10	PCB 118	106	PFOA	3,250

Table 6: Summary of the Chemical Findings of the Whole Survey

	Minimum detected in any individual (pg/g serum)	Maximum detected in any individual (pg/g serum)	Median (pg/g serum)
Total PCBs	160	8,240	2,830
Total organochlorine pesticides	455	9,690	1,700
Total HCH pesticide	Not detected	570	90
Total DDT and metabolites	250	8,060	1,330
Total PBDE flame retardants	6.5	18,470	60
	Minimum detected in any individual (pg/g whole blood)	Maximum detected in any individual (pg/g whole blood)	Median (pg/g whole blood)
TBBP-A	Not detected	330	36
HBCD	Not detected	60	-
Total phthalates	44,000	1,117,000	165,500
Total perfluorinated chemicals	11,870	70,900	24,330
Total number of chemicals detected	25	54	41

POLY CHLORINATED BIPHENYLS (PCBs)

All volunteers tested were contaminated with PCBs to varying degrees. PCBs 153, 180 and 138 (in that order), were the dominant congeners each contributing, where detected, more than 10% to the total PCB concentration. This pattern has been seen regularly in past studies (for example WWF's UK biomonitoring survey). The median and range of total PCB concentrations are similar to concentrations reported in serum from the Netherlands and Belgium since 1991 (Covaci et al., 2002, Koppen et al., 2002).

ORGANOCHLORINE PESTICIDES

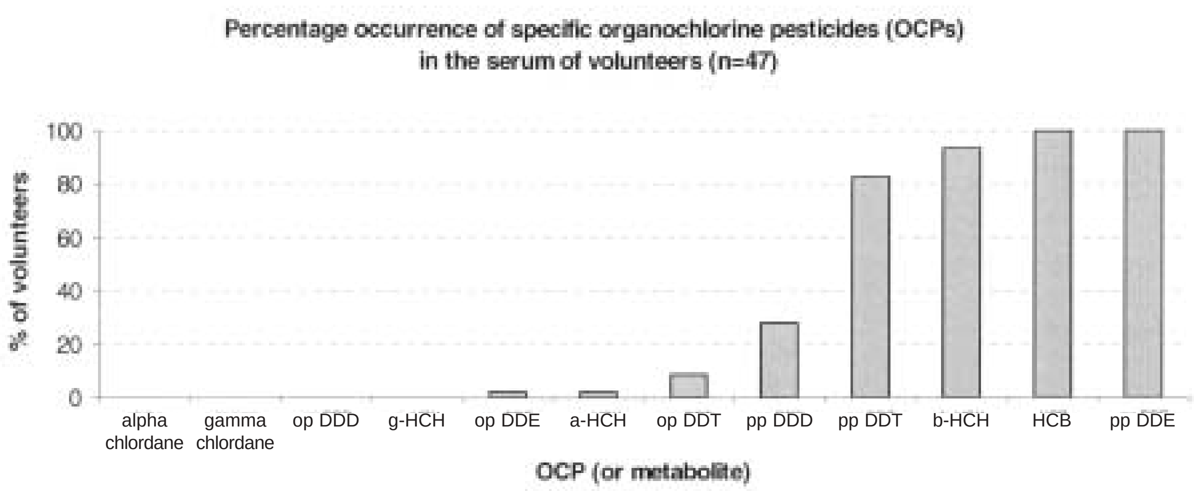

Figure 1: Occurrence of different organochlorine pesticides (OCPs) in volunteers

The predominant pesticides detected in all samples were HCB and p,p'-DDE, with p,p'-DDT and b-HCH detected in almost all samples. p,p'-DDD was found in only a little over a quarter of volunteers (28%). Of the remaining organochlorines, o,p'-DDD, o,p'-DDT, o,p'-DDE, and alpha (a)-HCH and gamma (g)-HCH (lindane) were detected rarely, if at all. None of the samples was found to contain any alpha (a)-chlordane or gamma (g)-chlordane.
Median levels of p,p'-DDE and HCB were almost double those found in WWF's UK biomonitoring survey in 2003, but lower than those from a Belgian study on serum in 1999 (Covaci et al 2002).

DDT

In the vast majority of the volunteers with both p,p'-DDE and p,p'-DDT in their blood, the concentration of p,p'-DDE (the predominant metabolite of DDT) greatly exceeded (by one or more orders of magnitude) the p,p'-DDT concentration. This indicates that exposure to the DDT pesticide was either through the indirect route (diet, for example) or some time in the past. The former is most likely in those volunteers who had not spent time in malarial areas, which was approximately a third (15 out of 47). In four cases, however, the concentration of p,p'-DDE was close to or less than ten times the concentration of p,p'-DDT, which may indicate that these volunteer were more recently exposed to DDT. The lifestyle questionnaires revealed, however, that only one of these volunteers had spent time in a malarial area where DDT might have been used as means of mosquito control. All volunteers who had visited a malarial country were contaminated with higher levels of p,p'-DDE relative to p,p'-DDT, This could be explained by the fact that DDT has been banned from use in most countries and alternatives are now used.

ß-HCH

The median, maximum and minimum levels of b-HCH found in serum in this survey were very similar to those found in WWF's UK biomonitoring survey. The median level of b-HCH was again similar to levels found in surveys of UK breast milk in 2001 and 2003 (Kalantzi et al., 2003).

POLY BROMINATED DIPHENYL ETHER (PBDE) FLAME RETARDANTS

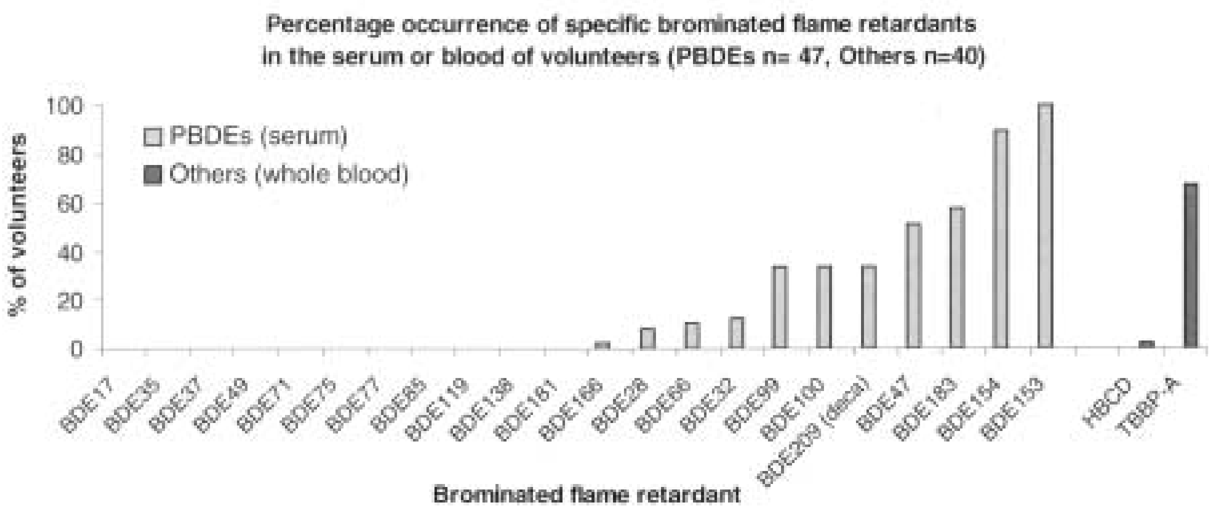

Figure 2: Occurrence of different brominated flame retardants in volunteers

The dominant constituents of the commercial flame-retardant products are:
penta: BDEs 47, 99, 100, 153 and 154
octa: BDEs 153 and 183
deca: BDE 209

Penta- and Octa-BDEs

These results indicate widespread contamination of European citizens by both penta- and octa-BDE flame-retardants. The median concentration of total PBDE congeners – representing the penta-BDE technical product – are somewhat lower than various European studies, with the exception of a recent study on serum in Norway (Thomsen et al., 2002). These dropping levels might reflect the recent decline in the use of penta- and octa-BDEs ahead of their EU-wide ban. However, the BDE congener 183 (indicative of octa-BDE brominated flame retardant usage) was found in this survey at a similar median concentration to several studies of occupationally exposed workers in Sweden between 1997 and 2000 (Jakobsson et al., 2003) and the WWF UK survey.

Deca-BDE

We were surprised and shocked to discover deca-BDE in 16 out of 47 (34 per cent) of the volunteers (from 10 different countries, from Scandinavia to the Mediterranean), revealing that deca-BDE, which is currently undergoing risk assessment in the EU, is contaminating people from all over Europe. The percent of people contaminated is almost five times higher than the 7 percent found in WWF's UK survey. But is consistent with studies which have found deca in 30 and 80 per cent of breast milk samples taken from volunteers in the US (Schecter et al (2003), Lunder and Sharp (2003).

Of all the flame-retardants tested, deca-BDE was found in the highest concentration (18,430 pg/g serum) and some levels were an order of magnitude higher than those found in blood or serum in any other previous study.

To our knowledge, the two highest levels of deca-BDE found in this study (18430 and 8665 pg/g serum respectively) are higher than any other level reported in blood or serum from studies of European volunteers exposed occupationally or otherwise. Most alarming of all, the highest level of deca-BDE in this survey was approximately ten times higher than the levels typically measured in the blood of occupationally exposed workers. Furthermore, the median and range of concentrations were higher than found in workers occupationally exposed to deca-BDE (Jakobsson et al., 2003). The highest level of deca-BDE detected was approximately ten times higher than the highest level detected in our UK survey, however the median level detected in the UK study was slightly higher than found here.

The extent of deca-BDE contamination in this survey contradicts the stance taken by industry regarding this chemical. They have long insisted that deca-BDE can be used without risk to health or the environment and that it cannot bioaccumulate because the molecule is too large to cross biological membranes. More over they have tried to limit any discussion about human exposure to occupationally exposed workers, suggesting that any potential problems with exposure or toxicity might be restricted to the workplace. The results of this and WWF's UK survey are evidence that not only does deca-BDE cross biological membranes, but it does so in a large population of the general public, not simply in workers.

While there appears to be a suggestion of a relationship between recent purchases of flame retarded goods and blood levels of deca-BDE, this is does not seem to sufficiently explain the high levels found in this study. An additional exposure route may house dust, since Greenpeace found that deca-BDE was the most abundant brominated flame retardant in its EU national house dust survey (Greenpeace, 2003). However, this survey found far higher levels (10 to 100 times higher) in UK dust samples than European samples, which might indicate that dust may not be the main source of exposure, at least for those showing the greatest degree of contamination.

HBCD AND TBBP-A

See the previous figure, Figure 2, on the comparative frequency of detection of HBCD and TBBP-A compared to the PBDE flame retardants.

While HBCD has been detected in breast milk in Norway (Thomsen et al., 2003), it is WWF's belief that this study is the first to report the detection of HBCD in human blood. It was detected in one of the volunteers at a level of 63 pg/g whole blood.

Due to lack of sufficient blood being available from seven volunteers, TBBP-A was analysed in only 40 volunteers. TBBP-A was detected in the blood of 68% (27/40) of samples analysed and the highest concentration of this chemical (330 pg/g whole blood) was roughly ten times higher than in a previous European study on serum samples from occupationally exposed computer technicians (Jakobsson et al., 2002). Similarly, the highest level found in the present survey is a factor of ten higher than a Norwegian study on blood plasma (Thomsen et al., 2001).

PHTHALATES

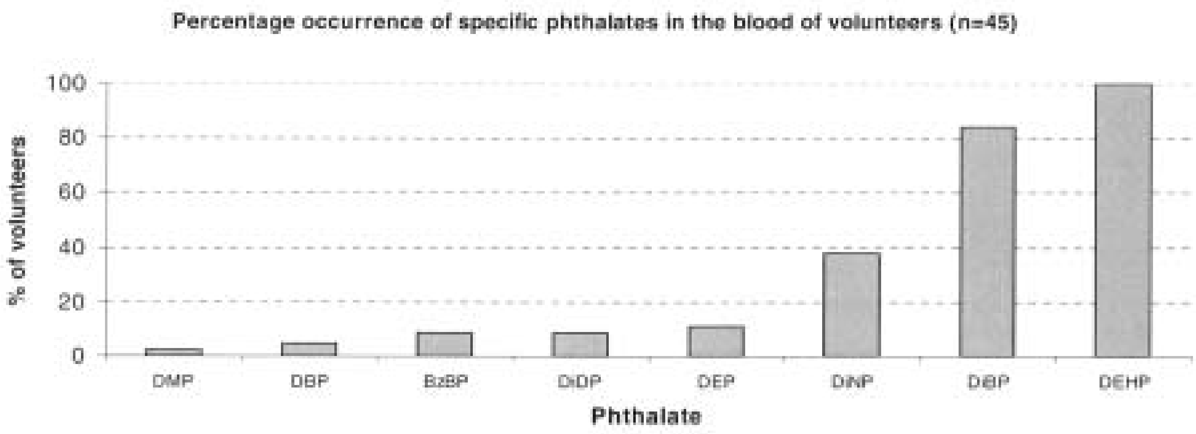

Figure 3: Occurrence of different phthalates in volunteers

For two volunteers, insufficient blood was available for phthalate analysis, but in all samples analysed, phthalates were detected. DEHP was found in all samples, DiBP in 84% of samples (38/45) and DiNP in 38% (17/45).

Whilst there are lots of data on levels of phthalates in human urine, generally there is far less information available on levels in human blood. A previous study reports on levels of DEHP in cord blood taken from new born babies in Italy (Latini et al., 2003) and DEHP concentrations (median and range) similar to those found in the present study have been found in women in an Italian study (Cobellis et al., 2003).

PERFLUORINATED CHEMICALS

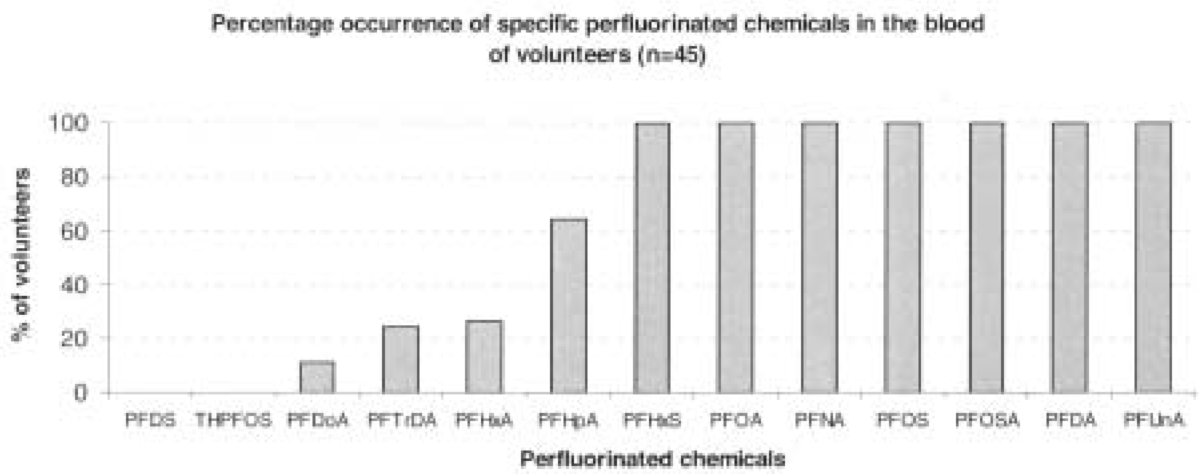

Figure 4: Occurrence of perfluorinated chemicals in volunteers

For two volunteers, there was insufficient blood to analyse for perfluorinated chemicals, but all the samples analysed for perfluorinated chemicals contained them. Seven of the 9 perfluorinated chemicals were found in all of the samples analysed (45/45) and an eighth was found in 64%. Other perfluorinated chemicals were found in trace levels. PFOS and PFOA were the dominant compounds found at the highest levels in all samples (55,000 and 9,800 pg/g, respectively) and their levels are comparable to levels found in the serum of the general population of the US and Europe, as seen below.

Source	Mean (ppb)	Range (ppb)	
European Blood Banks (1999)			
Belgium (6 pooled samples)	17	4.9 – 22.2	
Netherlands (5 pooled samples)	53	39 – 61	
Germany (6 pooled samples)	37	32 – 45.6	(OECD 2002)

The detection of DEHP and 7 different perfluorinated chemicals in all samples is very important, as it illustrates that newer chemicals of concern, that have not been phased out, are contaminating us to the same extent as older, banned chemicals such as DDT, HCB and PCBs. 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.

STATISTICAL ANALYSIS OF FACTORS AFFECTING LEVELS OF CONTAMINATION

The data from the volunteer's lifestyle and personal information questionnaire were used to investigate potential relationships between types and levels of contamination and personal and lifestyle factors. For further information please see the technical report in Appendix 3. Certain parameters were shown to correlate with elevated levels of certain chemicals.

PFOS and gender

The range of PFOS concentrations (minimum and maximum values) was slightly higher in the male volunteers than the females.

Age

There is often a correlation between a person's age and the level of contamination by certain chemicals, as their concentrations in the body increase with age. This is typically the case with PCBs and certain OCPs.
β-HCH and PCB congeners within the groupings 41-74, 87-123 and 170-189, were found at higher concentrations in older volunteers. These findings are consistent with WWF's UK biomonitoring survey.

Number of children carried/breastfed

WWF's UK survey, showed that a woman's body burden of certain chemicals (HCH, BDE153 and PCBs 118, 180 and 194) became lower with the number of children she had carried and breastfed. It has been suggested that this is because women "offload" some of their persistent chemical body-burden to their children during pregnancy and lactation. There was no such finding in the present survey, however the sample group was relatively small. Twenty-three women were analysed and only 14 of these had borne children and only 1 had had more than 2 children.

Purchase of flame retarded goods

The lifestyle questionnaires revealed that there is potential link between recent purchases of flame-retarded goods and elevated blood concentrations of deca-BDE. This was not observed for the other flame-retardants however. It should be emphasised that purchasing flame-retarded goods is not the only exposure route for such chemicals, as evidenced by the fact that the volunteer with the highest level of deca-BDE in their blood had not made any such purchases.

Nationality

For reasons of confidentiality, an analysis of volunteers' results with respect to their nationality is not included here, as several countries were represented by only one individual. Additionally, and importantly from a statistical standpoint, due to the small number of representatives from each country, conclusions regarding the influence of nationality on contamination levels would not be statistically valid. Much larger sample numbers would be needed from each country before distinctions between those countries could be made confidently.

Correlations between different chemical groups

The correlation between the levels of the different chemicals groups was investigated. It appears that, roughly speaking, the concentrations in volunteers of "old use" chemicals – such as PCBs and organochlorine pesticides, which have been banned in the EU for decades – correlate well with certain newer "chemicals of concern" such as PFOS and octa-BDE. This indicates that the volunteers are exposed to old and new chemicals through similar routes and that the newer chemicals may behave in similar ways in the body.

Reducing exposure to toxic/persistent chemicals

It can take long periods of time before legislative controls leads to a reduction in the risk of contamination by certain classes of hazardous chemicals, especially very persistent and very bioaccumulative chemicals. This is highlighted by our results which show that several years after a chemical has been banned, it can still be found to contaminate people and the environment. The process of reducing exposure takes many years and, in some instances, many decades. For example, all volunteers in this survey were contaminated with DDT (or one of its metabolites, e.g. p,p'-DDE), despite these chemicals being banned in the EU since the 1970s. Similarly, PCBs, banned over 20 years ago, were detected in all volunteers and the median and range of total PCB concentrations were similar to those previously reported in serum from volunteers in the Netherlands and Belgium in 1991. Nevertheless, where legislation is strictly enforced, levels of hazardous chemical contamination can begin to come down. For instance, this survey failed to find the organochlorine pesticide chlordane, which has been banned from use in the UK and EU since 1981.

Whilst legislation may not entirely rid our environment and bodies of persistent and toxic chemicals, it can facilitate the gradual reduction. Also, while PCBs can still be detected in people's blood, WWF's UK biomonitoring survey showed that contaminant levels are reducing compared to studies in the past. In this respect strict regulations could be considered to be working, over many years, of their levels. It is for this reason that WWF is calling for such chemicals to be phased out sooner rather than later, meaning that in the future it will be possible for our children to live in a world less contaminated by toxic chemicals.

Summary

Generally, the lifestyle questionnaire identified few statistically significant trends in people's lifestyle habits to explain the results. This is not entirely unexpected because the sample number was relatively small and contamination can occur via many different routes. For example, exposure can occur through the food chain or indoor air, and could even occur on a single occasion. Purchase of goods containing flame retardants may lead to exposure to these compounds, but equally, exposure to flame retardant chemicals may occur through everyday activities, such as working in an office using a computer or sitting on a treated sofa in a newly carpeted room. Some exposure is seemingly unavoidable, as the products containing certain chemicals are integral parts of our lifestyle. Phthalates, for example, are used in an innumerable array of consumer products (including plastics, cosmetics, personal care products, toys, kitchen flooring) that many of use without even thinking. Similarly, perfluorinated compounds have numerous applications which make use of their non-stick, water/stain repellent properties, such as in coatings for frying pans, waterproofing for clothing and footwear and stain resistant treatments for textiles and furniture.

A study by Greenpeace (2003) suggests a possible explanation as to the source of expose to certain of the chemicals that have been found in human samples. Their study found widespread chemical contamination of house dust, which might be a significant route of exposure to many people and might swamp other sources of exposure for some chemicals. The levels of chemicals found (i.e. mg/g or parts per thousand) were far higher than those found in blood (ng/g – parts per billion or pg/g – parts per trillion). This contamination is likely to be due to the fact that many hazardous man-made chemicals are used in household consumer products. These chemicals can escape (either by evaporation or through degradation of the product throughout its lifetime), and find their way into the atmosphere and accumulate in dust. This dust then exposes us to these chemicals. This route of exposure is also likely to occur in offices and the general workplace. For a number of chemicals, especially some of the brominated flame retardants, house-dust might be a significant route of exposure. For instance: Penta-BDE, deca-BDE, HBCD, and several phthalates, were all found in every single pooled house dust sample in the Greenpeace study and deca-BDE was the flame retardant found at the highest concentration, reflecting our finding in this study on human blood.

If house dust is as significant a source of chemical exposure, it might explain why the lifestyle factors considered in our survey – those traditionally associated with exposure to chemicals such as diet, but which did not include any consideration of dust exposure – found only limited associations with contaminant levels.

It therefore appears to be a lottery as to where, when, how and to what extent people are exposed to chemicals that persist and bioaccumulate in their bodies and interfere with their hormone systems. It is clear that there is a need for tighter controls of such chemicals to ensure that we minimise our risk of exposure.

WHAT ARE THE HEALTH RISKS FROM CHEMICAL CONTAMINATION ?

This survey focuses purely on the presence of a range of chemicals in human bodies and does not consider in detail the , potential adverse health effects of such multiple chemical exposures. WWF does not claim that exposure to a certain chemical at a certain concentration at a certain time will cause a particular adverse effect in a particular individual. For the vast majority of chemicals around us (and in us) every day we just do not know what the risks of adverse health effects are.

The chemical industry may argue that:

- *'the levels of chemicals we have detected are 'nothing to worry about', that 'the levels are perfectly safe or within safe limits'.*

However, there are two problems with this statement. For the vast majority of chemicals on the market and to which we are exposed on a daily basis, we do not know anything about their toxicity and or anything about our level of exposure to these chemicals.

- *'there is no evidence of harm from exposure to these chemicals or these levels of chemicals'.*

But have they looked? - Absence of proof of harm is not proof of absence of harm.

- *'the level of risk has been assessed'* for a certain chemical.

However, all chemical assessments are conducted on an individual basis, not in combination. They do not reflect the reality of multiple chemical exposures. In this study the median number of chemicals we detected was 44 and many of the chemicals detected were from the same family groups, such as phthalates, PCBs, brominated diphenyl ethers and perfluorinated acids. It is highly probable that chemicals in the same families have similar toxicities and have at least additive effects. Has industry proof that this is not the case ?

Nevertheless, elevated levels of some of the different chemicals analysed here have been linked to a range of adverse health effects in humans and/or wildlife such as cancers, immune deficiencies, neurological problems (behavioural disorders and depressed intelligence), depressed muscle co-ordination and reduced birth weight leading to increased infant mortality. Some of these effects have been observed at concentrations currently found as "background concentrations" in some EU countries including the Netherlands. For further information see WWF's Chemicals and Health in Humans briefing report (WWF 2003).
WWF do not accept that the continuing exposure, especially of the unborn child and developing infants, to a cocktail of hazardous, chemicals can ever be considered "safe".
Phasing out the use of very persistent and very bioaccumulative chemicals and of EDCs, 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.

THE IMPORTANCE OF ENVIRONMENTAL MONITORING

One way of calculating the risk from a chemical is simply = hazard x exposure

As highlighted above, extremely little is known about the hazard (e.g. toxicity) of the majority of chemicals to which we are exposed on a daily basis.

One of the factors critical in evaluating the risk posed by a chemical is the level of exposure. For many of the chemicals identified in this survey we do not know the exact source of exposure, therefore one cannot prevent ones exposure. Consequently, it is almost a lottery as to where, when and how one becomes exposed and ones consequent level of contamination. WWF believes that such a chemical lottery is unacceptable.

In addition to determining the hazard of chemicals. WWF believes that chemical monitoring should be an integral part of any chemicals management policy. We believe that the environment, water, soils, sediments, foods, air, humans and other species should all be monitored to give advance warning about the extent of a chemical's occurrence. WWF was dismayed to see that the proposal for monitoring of wildlife was recently dropped from the proposed EU Environment and Health Strategy. We believe that the findings in this survey highlight the importance of monitoring to highlight chemicals of potential concern. If such a monitoring strategy has been in place we could have avoided the extensive contamination we have identified by taking action on the results of monitoring that years ago highlighted the problem with many of these chemicals.

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DETOX CAMPAIGN

APPENDIX 1: GLOSSARY AND DEFINITION OF CHEMICAL NAMES

Body mass Index	Body weight (kg) divided by height (m) squared: a general measure of one's 'fatness'
Biomonitoring	the measurement of exogenous chemicals (those from external sources) in blood, urine, breast milk, fat, hair or other tissue.
Brominated flame retardant (BFR)	See list of chemical names and chemical fact sheets
Chlordane	See list of chemical names and chemical fact sheets
Congener	An individual chemical out of a group of closely related chemicals (e.g. PCB153 is a congener in the PCB chemical 'family')
Correlate / correlation	A connection between two or more things, often one in which one of them causes or influences the other
DDT, DDE, DDD	See list of chemical names and chemical fact sheets
Limit of detection	The lowest quantity reliably detected in a sample
Lindane	See list of chemical names and chemical fact sheets
Median	The middle value in a set of values arranged in order of size
Not detected	Below the limit of detection
Organohalogen / Organochlorine	Organic chemical whose molecules contain halogen/chlorine atoms
Organochlorine pesticide (OCP)	Group of chemicals that includes DDT, chlordane, lindane and HCB.
PCB	See list of chemical names and chemical fact sheets
PBDE	See list of chemical names and chemical fact sheets
Perfluorinated chemicals	See list of chemical names and chemical fact sheets
Phthalates	See list of chemical names and chemical fact sheets
Serum	The straw coloured liquid separated from clotted blood after centrifugation.

CHEMICAL NAMES

PCBs	Polychlorinated biphenyls (see below)

ORGANOCHLORINE PESTICIDES

α-chlordane	Alpha chlordane
γ-chlordane	Gamma chlordane
HCB	Hexachlorobenzene
o'p DDD	Dichlorodiphenyldichloroethane
o'p DDT	Dichlorodiphenyltrichloroethane
o'p DDE	Dichlorodiphenyldichloroethylene
α-HCH	Alpha hexachlorocyclohexane
β-HCH	Beta hexachlorocyclohexane
γ-HCH	Gamma hexachlorocyclohexane

BROMINATED FLAME RETARDANTS

PBDEs	Polybrominated diphenyl ethers
TBBP-A	Tetrabromobisphenol-A
HBCD	Hexabromocyclododecane

PHTHALATES

DMP	Dimethyl-phthalate
DEP	Diethyl-phthalate
DiBP	Di-isobutyl-phthalate
DBP	Dibutyl-phthalate
BzBP	Butylbenzyl-phthalate
DEHP	Di(ethylhexyl)-phthalate
DiNP	Di(isononyl)-phthalate
DiDP	Di(isodecyl)-phthalate

PERFLUORINATED CHEMICALS

PFHxA	Perfluorohexanoic acid
PFHpA	Perfluoroheptanoic acid
PFHxS	Perfluorohexane sulfonate
PFOA	Perfluorooctanoic acid
PFNA	Perfluorononanoic acid
PFOS	Perfluorooctane sulfonate
PFOSA	Perfluorooctane sulfonamide
PFDA	Perfluorodecanoic acid
PFUnA	Perfluroundecanoic acid
PFDoA	Perfluorododecanoic acid
PFTrDA	Perfluorotetradecanoic acid
PFDS	Perfluorodecane sulfonate
THPFOS	1H, 1H, 2H, 2H-tetrahydro-PFOS

PCB NUMBERING

PCB No.	PCB Name
18	2,2',5-Trichlorobiphenyl
22	2,3,4'-Trichlorobiphenyl
28	2,4,4'-Trichlorobiphenyl
31	2,4',5-Trichlorobiphenyl
41/64	2,2',3,4-/2,3,4',6-Tetrachlorobiphenyl
44	2,2',3,5'-Tetrachlorobiphenyl
49	2,2',4,5'-Tetrachlorobiphenyl
52	2,2',5,5'-Tetrachlorobiphenyl
54	2,2',6,6'-Tetrachlorobiphenyl
60/56	2,3,4,4'-/2,3,3',4'-Tetrachlorobiphenyl
70	2,3',4',5-Tetrachlorobiphenyl
74	2,4,4',5-Tetrachlorobiphenyl
87	2,2',3,4,5'-Pentachlorobiphenyl
90/101	2,2',3,4',5-/2,2',4,5,5'-Pentachlorobiphenyl
95	2,2',3,5',6-Pentachlorobiphenyl
99	2,2',4,4',5-Pentachlorobiphenyl
104	2,2',4,6,6'-Pentachlorobiphenyl
105	2,3,3',4,4'-Pentachlorobiphenyl
110	2,3,3',4',6-Pentachlorobiphenyl
114	2,3,4,4',5-Pentachlorobiphenyl
118	2,3',4,4',5-Pentachlorobiphenyl
123	2',3,4,4',5-Pentachlorobiphenyl
138	2,2',3,4,4',5'-Hexachlorobiphenyl
141	2,2',3,4,5,5'-Hexachlorobiphenyl
149	2,2',3,4',5',6-Hexachlorobiphenyl
151	2,2',3,5,5',6-Hexachlorobiphenyl
153	2,2',4,4',5,5'-Hexachlorobiphenyl
155	2,2',4,4',6,6'-Hexachlorobiphenyl
156	2,3,3',4,4',5-Hexachlorobiphenyl
157	2,3,3',4,4',5'-Hexachlorobiphenyl
158	2,3,3',4,4',6-Hexachlorobiphenyl
167	2,3',4,4',5,5'-Hexachlorobiphenyl
170	2,2',3,3',4,4',5-Heptachlorobiphenyl
174	2,2',3,3',4,5,6'-Heptachlorobiphenyl
180	2,2',3,4,4',5,5'-Heptachlorobiphenyl
183	2,2',3,4,4',5',6-Heptachlorobiphenyl
187	2,2',3,4',5,5',6-Heptachlorobiphenyl
188	2,2',3,4',5,6,6'-Heptachlorobiphenyl
189	2,3,3',4,4',5,5'-Heptachlorobiphenyl
194	2,2',3,3',4,4',5,5'-Octachlorobiphenyl
199*	2,2',3,3',4,5,6,6'-Octachlorobiphenyl
203	2,2',3,4,4',5,5',6-Octachlorobiphenyl

* = sometimes numbered 200

PBDE NUMBERING

PBDE Number	PBDE Name
17	2,2',4-Tribromodiphenyl ether
28	2,3',5'-Tribromodiphenyl ether
32	2,4,6-Tribromodiphenyl ether
35	3,3',4-Tribromodiphenyl ether
37	3,4,4'-Tribromodiphenyl ether
47	2,2',4,4'-Tetrabromodiphenyl ether
49	2,2',4,5'-Tetrabromodiphenyl ether
66	2,3',4,4'-Tetrabromodiphenyl ether
71	2,3',4',5'-Tetrabromodiphenyl ether
75	2,4,4',5-Tetrabromodiphenyl ether
77	3,3',4,4'-Tetrabromodiphenyl ether
85	2,2',3,4,4'-Pentabromodiphenyl ether
99	2,2',4,4',5-Pentabromodiphenyl ether
100	2,2',4,4',6-Pentabromodiphenyl ether
119	2,3',4,4',5-Pentabromodiphenyl ether
138	2,2',3,4,4',5'-Hexabromodiphenyl ether
153	2,2',4,4',5,5'-Hexabromodiphenyl ether
154	2,2',4,4',5,6'-Hexabromodiphenyl ether
166	2,3,4,4',5,6-Hexabromodiphenyl ether
181	2,2',3,4,4',5,6-Heptabromodiphenyl ether
183	2,2',3,4,4',5',6-Heptabromodiphenyl ether
190	2,3,3',4,4',5,6-Heptabromodiphenyl ether
209	2,2',3,3',4,4',5,5',6,6'-Decabromodiphenyl ether

APPENDIX 2: CHEMICAL FACTSHEETS

CHLORDANE

Persistent	✔
Bioaccumulative	✔
Endocrine disrupter	✔

BACKGROUND

Chlordane is not a single chemical, but a mixture of many related organochlorine chemicals, of which about 10 are major components. Some major components are trans-chlordane, cis-chlordane, ß-chlordene, heptachlor, and trans-nonachlor.

Introduced in 1945, chlordane is a man-made chemical that was used as a pesticide until the 1980s. It was banned for agricultural use in the EU in 1981. Chlordane is a broad-spectrum insecticide known for its toxic effects and its capacity to persist and bioaccumulate in the environment. It is stable in soil and breaks down very slowly; chlordane can remain in the soil for decades. The chemical builds up in the fatty tissues of fish, birds and mammals.

MAJOR USES

Before it was banned, chlordane was used in the greatest quantities as a soil insecticide for controlling termites and soil-borne insects whose larvae feed on the roots of plants.

HOW MIGHT I BE EXPOSED TO CHLORDANE?

Exposure to chlordane may occur through several routes, including consumption of contaminated meat, fish, shellfish, root crops and other foods; maternal transfer; contact with soil around the foundations of chlordane-treated homes; and by living near chlordane-contaminated waste sites. Occupational exposure may have occurred among people in the chemical industry and among farmers, lawn-care specialists, and pest-control workers.
Over the last few years it has not been detected in pesticide residue surveys of typical foodstuffs in the UK.

HOW MIGHT CHLORDANE AFFECT MY HEALTH?

Chlordane has been linked to liver and blood disorders, severe neurological effects, and damage to the endocrine and reproductive systems. Effects on the kidneys and on the cardiovascular, respiratory and gastrointestinal systems have also been observed. These effects were seen mostly in people who swallowed chlordane mixtures.

It is not known whether chlordane will cause cancer in humans after long-term exposure. Studies of workers who made or used chlordane do not link exposure with cancer, but the information is not sufficient to know for sure. This has led chlordane to be designated a possible human carcinogen by the International Agency for Research on Cancer, and a probable human carcinogen by the US Environmental Protection Agency.

HOW MIGHT A FAMILY REDUCE THEIR EXPOSURE TO CHLORDANE?

No chlordane was found in any volunteers and none was found in recent pesticide residues in UK food surveys. Exposure already appears to be minimal.

FURTHER INFORMATION

Further information on Chlordane and other hazardous chemicals can be found on the following website.

Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov/toxprofiles/tp31.pdf

DDT (and DDE, DDD)

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 8½-month-old baby consumed four times as much DDT for each pound of body weight than the average adult.

HOW CAN FAMILIES REDUCE THE 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

HBCD (HexaBromoCycloDodecane), A BROMINATED FLAME RETARDANT

Persistent ✔
Bioaccumulative ✔
Potential endocrine disrupter

BACKGROUND

Hexabromocyclododecane (HBCD) is a brominated flame retardant (BFR), produced in high volumes and used to fireproof polymers and textiles, construction materials, furniture and electronic equipment. An alternative to the octa- and penta-BDE flame-retardants (which are to be phased out in 2004 due to their persistent, bioaccumulative and toxic properties), HBCD is now in widespread use and has become a chemical of concern itself. Evidence is emerging that it accumulates in the environment, wildlife and in humans and may have negative health impacts. The Government's Advisory Committee on Hazardous Substances classified it as "very persistent and very bioaccumulative" in 2003 and the compound is currently undergoing risk assessment in the EU.

HBCD contamination is widespread in the environment, being found in all environmental compartments (air, water, sediment/soil and biota). It has been found in sediments, sewage sludges and fish, with levels as high as 9.432 mg/kg fresh-weight reported in fish from the river Skerne, Co. Durham (downstream from a BFR manufacturing site). HBCD has been shown to be biomagnifiying in lake Ontario, Canada and has also been found to be bioaccumulating in whelks, cod, cormorants, seals and porpoises in the North Sea, in peregrine falcons in Sweden and in guillemot eggs in areas around the Baltic Sea. HBCD has been found in foodstuffs (meat, eggs, milk, fish) and in the dust of all households sampled in a recent EU study. HBCD has been detected in breast milk in Sweden, but generally there is limited data on HBCD levels in humans. However, given its levels in the environment, in consumer products and in wildlife, it is highly likely that humans are exposed and carrying a burden of HBCD in their bodies.

MAJOR USES

The primary use of HBCD (80% of use in the UK) is as a flame retardant in extruded (2.5% HBCD) and expanded (0.67%) polystyrene foam used as thermal insulation in the building industry. Fireproofing upholstery textiles (6-15% HBCD) is another common application and a minor use is in electrical appliances such as audio/video equipment housings e.g. VCRs.

HOW MIGHT I BE EXPOSED TO HBCD?

You may become exposed through the use of consumer products containing HBCD or working living in spaces where polystyrene foams have been used in construction. Dermal (via the skin) exposure may occur through contact with flame-retarded textiles. Inhalation of dust containing HBCD is also a likely exposure route, since a study in the EU showed that HBCD was found in the dust of all the houses tested. Inhalation of HBCD volatilised from electrical equipment is also possible. Bioaccumulation in foodstuffs, particularly fish, means ingestion is an important way in which you and your family may become exposed to HBCD.

Small amounts of HBCD may be released into the environment during its manufacture and subsequent production of retardant-containing products. There is also possibility of flame-retardants leaching from products disposed of in landfills. (Occupational exposure may occur during the manufacture, transport, processing and disposal/recycling of flame-retardants. Routes of exposure could include inhalation, dermal contact and ingestion.)

HOW CAN HBCD AFFECT MY HEALTH?

Currently, the information on the toxicity of HBCD is very limited. According to the UK Environment Agency, excessive exposure to HBCD may affect the liver, skin and thyroid gland. HBCD has been shown to be genotoxic to mammalian cell lines and may be as effective as DDT and PCBs in provoking cancer. Behavioural effects have been seen in mice exposed to HBCD and neurotoxicological effects have been observed in rats. Knowledge of the effects of HBCD in humans is limited. In the light of HBCD's widespread occurrence in the environment and its tendency to bioaccumulate, it is widely accepted that more research needs to be carried out.

HOW CAN FAMILIES REDUCE THEIR RISK OF EXPOSURE TO HBCD?

Avoid purchasing products such as upholstered furniture or textiles fire-proofed with HBCD. Details should be available from the manufacturers. If you are making home improvements, try and avoid using expanded or extruded polystyrene treated with HBCD. Purchase video/audio equipment free from brominated flame-retardants wherever possible. A recent study in EU households has shown that HBCD is consistently found in house dust, so regular airing and vacuuming is advisable to minimise this secondary route of exposure.

REGULATORY STATUS

- HBCD is currently undergoing EU risk assessment.
- Identified by the UK Chemical Stakeholders Forum as persistent, bioaccumulative and toxic. Similarly, the Government's Advisory Committee on Hazardous Substances classified it as "very persistent and very bioaccumulative".
- BFRs, including HBCD are on the OSPAR list of chemicals for priority action.

FURTHER INFORMATION

http://www.epa.gov/chemrtk/cyclodod/c13459tp.pdf

http://www.inchem.org/documents/ehc/ehc/ehc192.htm

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

HCB (HexaChloroBenzene)

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 FAMILIES REDUCE THE 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

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 FAMILIES REDUCE THE 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 Ethers

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 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 A FAMILY REDUCE THEIR 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 FAMILIES REDUCE THEIR 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

WWF DETOX CAMPAIGN

PERFLUORINATED CHEMICALS - (INCL. PFOS/PFOA)

Persistent	✔
Bioaccumulative	✔
Endocrine disrupter	✔

BACKGROUND

This study looked for 13 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. This was due to grave concerns over the widespread distribution and persistence of perfluourinated breakdown products of these PFCs (PFOS, PFOA) in 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). Use of non-stick pans has been shown to produce PFOA containing fumes which can be inhaled in the kitchen. 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 has been detected in fish, shellfish and drinking water 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 FAMILIES REDUCE THEIR 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 PFCs 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.
- 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 blood-bags 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 FAMILIES REDUCE THEIR 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/

TBBP-A (TetraBromoBisPhenol A), A BROMINATED FLAME RETARDANT

Persistent ✔
Bioaccumulative ?
Endocrine disrupter ✔

BACKGROUND

TBBP-A (tetrabromobisphenol A) is a member of the brominated flame retardant (BFR) family of chemicals and of all BFRs manufactured globally, TBBP-A is produced in the largest volume.

Primarily used in printed circuit boards in electronic devices the world over, TBBP-A is proving to be yet another chemical capable of widespread environmental contamination, due to its persistent and bioaccumulative nature. There is limited information on the environmental fate of TBBP-A (compared to more extensively studied flame retardants such as PBDEs), but it has been found in air, household dust, soil, river sediment, water, sewage sludge and human blood (serum and plasma of both children and adults).

MAJOR USES

TBBP-A is used primarily as a reactive (chemically bound) flame retardant in polymers such as epoxy and polycarbonate resins, high impact polystyrene, phenolic resins, adhesives and others. Its main application is in the manufacture of printed circuit boards, where the epoxy resins can contain up to 34% TBBP-A. It is also used as an additive flame retardant (simply mixed with the polymer) in plastics, polystyrene and phenolic resins where it constitutes approximately 14-20% of these plastics. These are used in automotive parts, refrigerators, packaging and in building and construction materials.

HOW MIGHT I BE EXPOSED TO TBBP-A?

TBBP-A has been shown to escape from products containing printed circuit boards, such as computers and other electronic devices. Particles of TBBP-A can be released from these devices and enter indoor air, where they can be inhaled by humans. Inhalation of dust containing TBBP-A is a likely exposure route, since a study in the EU showed that TBBP-A is found in household dust.

There is also a possibility of TBBP-A leaching from products disposed of in landfills and humans may come into contact with TBBP-A during the recycling or disposal of consumer products (electronic appliances, computers) containing it.

HOW CAN TBBP-A AFFECT MY HEALTH?

Data on toxicity in humans is limited, but TBBP-A has been shown to have immunotoxic and neurotoxic effects in mice. *In vitro* studies have demonstrated that TBBP-A is capable of interacting with thyroid hormone pathways, which is similar to the way in which PCBs and other BFRs (e.g. PBDEs) can cause endocrine disruption.

HOW CAN FAMILIES REDUCE THEIR RISK OF EXPOSURE TO TBBP-A?

Keeping rooms well ventilated when using computers and electronic equipment will help to minimise inhalation of any TBBP-A from these appliances.

REGULATORY STATUS

- The disposal of some products containing TBBPA, such as printed circuit boards, will be controlled under the proposed EU directive on waste electrical and electronic equipment (WEEE).
- The US EPA requires TBBPA to be reported in its Toxic Release Inventory (TRI).
- TBBP-A is listed on the UK Environment Agency's Pollution Inventory
- TBBP-A is on the OSPAR list of chemicals of concern.
- TBBP-A is listed as a EU 4th priority substance (http://cs3-hq.oecd.org/scripts/hpv)

FURTHER INFORMATION

Swedish Environmental Protection Agency Brominated Flame Retardants report
http://www.svtc.org/hu_health/edcs/bfrs/tbbpa/swedishpage.pdf

UK Environment Agency Pollution Inventory
http://www.environment-agency.gov.uk/business/444255/446867/255244/

Environmental Health Criteria Monographs
http://www.inchem.org/documents/ehc/ehc/ehc172.htm

OSPAR Commission website
http://www.ospar.org

WWF

DETOX CAMPAIGN

Chemical Check Up funded by The Co-operative Bank

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Customer led, ethically guided

Through its Customers Who Care campaign
The Co-operative Bank is calling for the phase out of
persistent and bioaccumulative chemicals.

www.co-operativebank.co.uk/cwc

CHEMICAL

CONTAMINATION

WWF

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:

- conserving the world's biological diversity
- ensuring that the use of renewable natural resources is sustainable
- promoting the reduction of pollution and wasteful consumption

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http://www.panda.org/detox