Sick of Dust

Chemicals in Common Products—A Needless Health Risk in Our Homes

Pat Costner, Beverley Thorpe & Alexandra McPherson

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CLEAN PRODUCTION ACTION

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EXECUTIVE SUMMARY

Hazardous chemicals are regularly used as additives in consumer goods, yet our current system of regulation allows them to continue to be brought into our homes in products. (See page 9 for a full description of our "Chemical House.")

The first U.S. study to test household dust for a new and wide variety of chemicals found disturbing evidence of toxic chemicals in ordinary homes across the country. The study documents a range of hazardous chemicals found in household dust in 70 homes in seven states. All the chemicals found are toxic and harmful to the immune and reproductive systems in animal tests. The chemicals are used in mass quantities in electronic products, cosmetics, vinyl flooring, upholstery and other everyday products that many people wrongfully assume are safe. Babies and young children are particularly at risk from exposure to these chemicals.

This study shows that the US federal regulatory system has failed in protecting people from exposure to hazardous chemicals including toxic flame retardants, pesticides, and hormone disrupting chemicals. Exposure to these chemicals is unnecessary and avoidable. Europe is overhauling chemical legislation to protect public health and promote the production of safer chemicals and products. Some US states across the country are working to pass protective legislation for safer alternatives. Progressive companies such as Dell, IKEA, Herman Miller and Shaw Carpets have achieved success in finding safer chemicals for their product lines. But to date, the U.S. federal government has taken little action and the majority of US companies have no policies in place to favor safer chemicals and production methods.

This report documents the presence of hazardous chemicals in household dust, the health risks associated with the chemicals and the products they are found in. The report also ranks brand name companies and retailers on their use of hazardous chemicals and reveals the fundamental changes that are needed to bring American chemical regulation up to a level that will protect our basic health and that of future generations.

Key Findings

1. All composite samples were contaminated by all six of the chemical classes we investigated: phthalates, pesticides, alkylphenols, brominated flame retardants, organotins and perfluorinated compounds. This is the first U.S. study to document levels of organotins and perfluorinated compounds in household dust.

2. Toxic chemicals are brought into our homes through ordinary consumer products including vinyl flooring, foam cushions, pest control products, fabrics, and cookware. Most of the chemicals found in this study have also been detected in breast milk as well as blood and/or urine.

3. Hazardous chemicals in house dust adds to our ongoing exposure to synthetic chemical contaminants in water, air and food. Each composite sample contained hormone disrupting chemicals together with chemicals associated with allergies, impaired nervous and immune systems, cancer, reproductive and developmental effects.

4. Some companies have demonstrated that the transition to safer chemicals and material use is feasible and profitable. The report showcases four companies that searched for and found safer chemicals for their product lines. A transition to safe chemical use should be a priority across all product sectors.

This study provides solid evidence that the federal government, US states, and US industry must take immediate action to replace harmful chemicals with safe substitutes.

The study participants cannot be blamed for contaminating their homes with these toxic chemicals. Rather, blame must be placed squarely on the shoulders of the U.S. regulatory system, which allows dangerous chemicals to be put into consumer products, does not require even minimal safety testing for the majority of chemicals currently in use, and has virtually no prohibitions in place to reduce exposure to chemicals known to cause harm. The U.S. chemical industry must also take responsibility for failing to replace chemicals of known toxicity with safer substitutes. Manufacturers of cosmetics, furniture, computers, flooring and other products must also take responsibility to ensure that their products are safe and free of harmful chemicals.

The American people deserve to be safe in our own homes, and should be able to purchase products without unwittingly exposing ourselves and our children to substances that can cause cancer and disrupt development. This study provides solid evidence that the federal government, US states, and US industry must take immediate action to replace harmful chemicals with safe substitutes.

Recommended Actions

1. The federal government must phase out the most hazardous chemicals from production and use. Comprehensive data on chemicals used in commerce should be required and toxicity information should be used as a basis to replace the most hazardous chemicals with safer substitutes. These include chemicals linked to cancer, hormone disruption, developmental and reproductive harm.

2. States should take strong action now to phase out chemicals with known or likely hazards. A number of states are currently considering bans on the toxic flame retardants PBDEs, which have been found in house dust as well as in breast milk. States should also support businesses using safer processes and chemicals.

3. The chemical industry should supply environmental and human health data for untested chemicals currently in production and immediately phase out the production of those chemicals linked to cancer, hormone disruption, developmental or reproductive harm. The chemical industry should begin an aggressive adoption of Green Chemistry Principles.

4. Retailers and product manufacturers should establish substitution plans for all high risk chemicals, placing a priority on chemicals detected in this study. Design strategies exist to help companies use safe chemicals.

WHY WE TESTED FOR CHEMICALS IN HOUSE DUST

> ***“Household dust is a potentially significant source for both dermal and ingestion exposure to hazardous chemicals present in the home.”*** [1]

Chemical contamination is now global—reaching even polar regions where no chemical production or use takes place. Hazardous chemicals are in our rain, rivers, oceans, air and food. Our exposures routes are many. Toxic chemicals in our environment build up in the food chain. We can be particularly exposed through chemicals in food at the top of the food chain such as meat, eggs, fish and dairy which can be contaminated from pesticide use on crops and chemically contaminated sewage sludge spread on land, as two examples. Communities can be exposed more directly and in greater volumes from manufacturing plant emissions or pesticide use on farms. Children are the most vulnerable because they are more exposed and their nervous, immune and reproductive systems are still developing. Their responses to hormone signals from endocrine disruptors can lead to permanent alterations of their organ systems.

Once upon a time, household dust was just a nuisance. In a pinch, it was swept under the rug. No more. Today house dust is a toxic menace. House dust is a time capsule of chemical contaminants that come into the home. Since most people spend about 69–90 percent of their time indoors,[2,3] there is ample opportunity for frequent and prolonged exposure to the dust and its load of contaminants.

This dust study and previous others provide evidence of the widespread presence of hazardous chemicals in household products. Chemicals migrate, leach out of, or otherwise escape from consumer products during normal use leading to their accumulation in the dust of every household tested.

Plasticizers, flame retardants, and surfactants are just some examples of chemicals that are brought home in everyday products

> **People have no way of knowing that these contaminants are in the products they buy and bring home, much less that these “stealth” contaminants will end up in the air and dust in their homes.**

as ingredients that are seldom listed on the labels. These products that are presumed to pose no toxic threat include furniture, carpets, televisions, computers, shampoos, and flooring. People have no way of knowing that these contaminants are in the products they buy and bring home, much less that these “stealth” contaminants will end up in the air and dust of their homes. Why are manufacturers putting toxic chemicals in and on the products they sell for household and personal use when, sooner or later, those chemicals become household contaminants that threaten the health of their customers? Why don’t the government agencies that are supposed to protect public health stop the sale of such products?

North Americans spend about 69–90 percent of their time indoors, most of that at home.[4] A study in the Seattle area found that children spent 66 percent of their time indoors at home and 21 percent indoors away from home, while the elderly spent 83–88 percent of their time indoors at home.[5] No wonder house dust is an important pathway of toxic exposures especially for children whose risk from dust-borne contaminants may be 40 times higher than that of adults. As they play and crawl on the floor, children may take in five times as much dust while their immature organs and immune system make them more vulnerable to toxic insults.[6]

All of these chemicals migrate, leach out of, or otherwise escape from consumer products during normal use. Most have been reported as contaminants in indoor air and household dust as well as in the breast milk, blood and other tissues of humans.

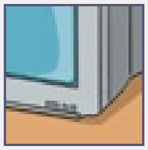
What are the chemical intruders in the dust? For this study, we chose six chemical classes for analysis beause they are all listed as Chemicals for Priority Action within the OSPAR Convention. This international convention represents 15 countries in the North East Atlantic and includes international observers such as the Organization for Economic Cooperation and Development (OECD). The mission of the OSPAR convention is to protect the marine environment through measures which include "every endeavour to move towards the target of the cessation of discharges, emissions and losses of hazardous substances by the year 2020." OSPAR and previous international conventions have monitored the increase of the most hazardous chemicals in the marine environment for almost two decades, collected data on effects, and continued to advocate pollution prevention measures within industry sectors that use these chemicals.

These chemicals are listed as Chemical for Priority Action because most, if not all, are toxic in various ways. For example, all six groups we tested include chemicals that are endocrine disruptors or hormone disruptors which can cause adverse health effects in humans and animals or their offspring.[7] Many of the chemicals are associated with allergic responses; suppressed or hyperactive immune systems; impaired respiratory, cardiovascular; nervous, and reproductive systems; irritated or inflamed skin and mucous membranes; cancer of a variety of tissues and organs; and developmental effects.[8]

For this study, six groups of contaminants were selected that represent only a small portion of the wide range of chemicals that may be found in our homes. The chemical intruders that were detected are:

- **Phthalates** are used primarily as plasticizers in flexible polyvinyl chloride (PVC) plastic (commonly known as vinyl), which accounts for 80–90 percent of the world plasticizer consumption.[9] Phthalates are also used in nail polishes, hair sprays, and as solvents and perfume fixatives in various other products,[10] as well as in the enteric coatings of some medications.[11]
- **Alkylphenols** are mainly used to make alkylphenol ethoxylates found in household and industrial cleaners, paints, textile and leather treatments, pulp and paper processing, and agricultural chemicals.[12,13]
- **Pesticides** are directly released, indoors and outdoors, to get rid of insects, weeds and molds. They are also incorporated into soaps and household cleaning products, paints, wall papers, etc. They are also applied to carpets, textiles, and other products prior to sale.
- **Polybrominated diphenyl ethers** are used as flame retardants primarily in plastics, especially polyurethane foam and high impact polystyrene, but also in paints, textiles and electronics.[14,15]
- **Organotins** are used as additives for polyvinyl chloride (PVC); as stabilizers in PVC pips, as catalysts in the production of rigid polyurethanes and silicones; as fungicides and miticides in agriculture; and as preservatives/antifoulants on wood surfaces, in closed-circuit cooling towers and in marine paints.[16] Additives for PVC account for about 70 percent of organotin use.[17]
- **Perfluorinated surfactants:** Perfluorooctanyl sulfate (PFOS) and perfluorooctanoic acid (PFOA) are used in floor polishes, photographic film, denture

TVs & Computers



Electronic products can contain brominated flame retardants (PBDEs) which disrupt the nervous system. American women have the highest global levels of PBDEs tested for in breast milk. Electronic products and cables can be made of PVC (vinyl) which contains phthalates. Phthalates can be toxic to the reproductive system and are linked to increased incidences of childhood asthma. PVC also uses organotins which are toxic to the immune and reproductive system.

Mattresses

Mattresses can contain PBDEs—a brominated flame retardant. PBDEs are found widely in the environment. They disrupt the nervous system and American women now have the highest levels tested for in breast milk.

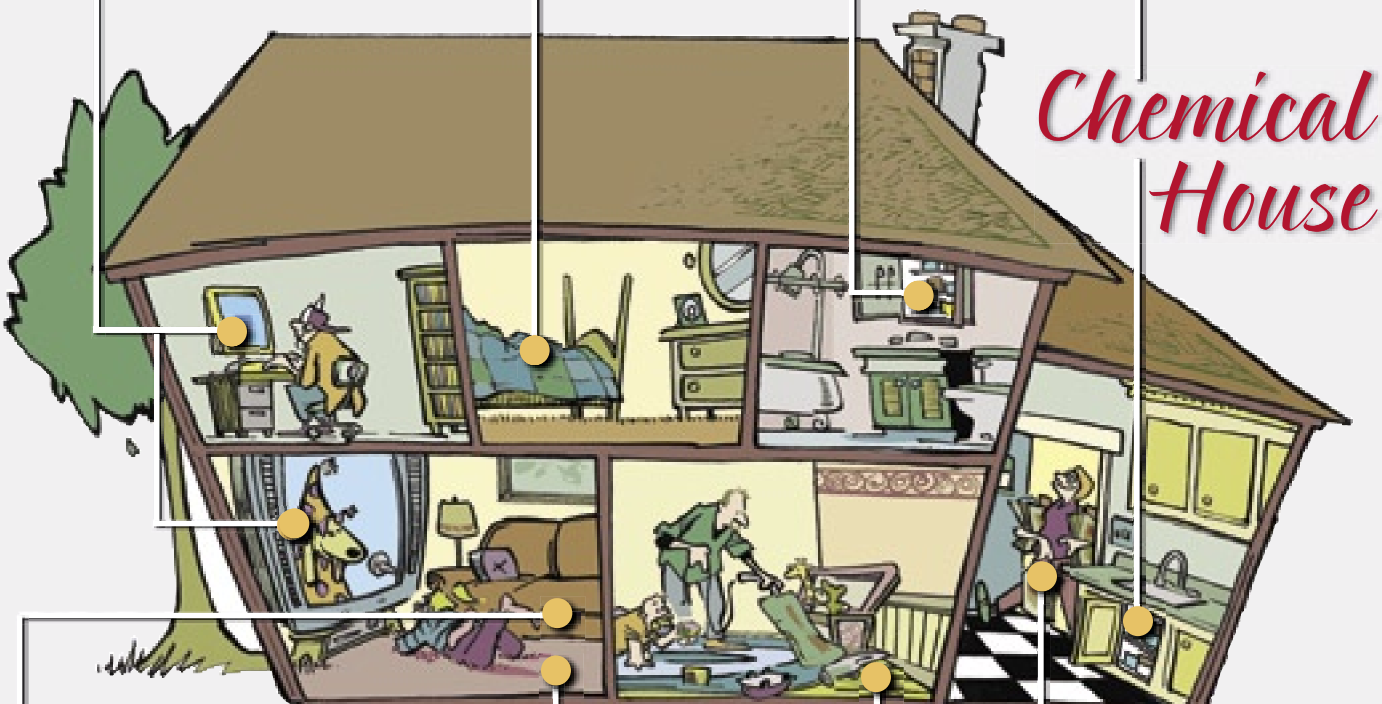
Personal Care/Cosmetics

Many personal care products (shampoo, perfume, soap, make up) contain and release phthalates and alkylphenols. Phthalates can be toxic to the reproductive system and are linked to increased incidences of childhood asthma. Alkylphenols can disrupt the hormone and reproductive system.

Pesticides

Pesticides are used in pet products and applied in and around homes for insect control. They are also used in carpets to prevent infestations of insects and dust mites. Many pesticides previously taken off the market are still present in our food and bodies. Many pesticides sold today are linked to disruption of the hormone and reproductive system as well as being suspected carcinogens.

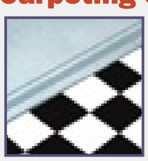
Chemical House



Furniture

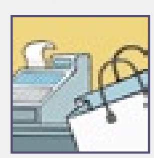
Furniture foam and textiles can contain PBDEs and PFOAs – perfluorinated chemicals. Both are global contaminants. PBDEs disrupt the nervous system and American women now have the highest levels tested for in breast milk. PFOAs are highly persistent and known to cause cancer in animal tests.

Carpeting & Flooring



Kitchen and bathroom floors are often made of vinyl (Polyvinyl Chloride —PVC). Carpets can also be backed with PVC. PVC releases phthalates, reproductive toxins, which are linked to increased incidences of childhood asthma. PVC can also contain organotins which are toxic to the immune and reproductive system. Carpets can contain PBDEs, a brominated flame retardant, and PFOAs, a perfluorinated chemical. Both are global contaminants. PBDEs disrupt the nervous system and American women have the highest levels tested for in breast milk. PFOAs are highly persistent and known to cause cancer in animal tests.

Retailers



Many retailers who sell household products do not screen their products for chemicals known to present risks to the environment or human health. Retailers currently sell pesticides, electronics, rugs, furniture, and vinyl that contain chemicals known to adversely affect the reproductive sytem or cause cancer in animal studies. Some retailers have drawn up lists of prohibited chemicals which they instruct their suppliers to avoid but most retailers have no chemical policy.

cleaners, shampoos, herbicides, insecticides, and adhesives in a wide range of products, as well as for surface treatment of clothing and carpets and cookware. PFOA is the best-known of the PFCs because it is used to make Teflon, Goretex, and other oil-, water- and stain-resistant materials used in many common items including nonstick frying pans, utensils, stove hoods, stainproofed carpets, furniture, and clothes. PFOA is also used in fire-fighting foams, mining and oil well surfactants, and the manufacture of other fluoropolymers.[18, 19, 20, 21] PFOS is considered to be the final degradation product of many of the commercially used perfluorinated chemicals and is the predominant perfluorinated acid found in most environments that have been studied.[22]

The majority of these chemicals are also persistent: they don't break down readily in the environment, especially in indoor environments, or in people's bodies. Those that do break down relatively quickly are released into the environment in quantities so large that they are constantly present. For example, an adult's body will metabolize 50 percent of a single dose of phthalates in about 12 hours. Nevertheless, Hoppin et al. (2002) found little variation in the day-to-day concentrations of phthalate metabolites in women's urine apparently because of their constant daily exposure to phthalates.[23]

Many of these chemicals are also bioaccumulative: they accumulate in the bodies of organisms, some in fat tissues, others in specific organs such as the liver and kidney. As a result, they build up and biomagnify in the food chain. This means that organisms at the top of the food chain have the highest exposure. This includes humans, especially the developing fetus exposed in its mother's womb, and the nursing infant exposed by its mother's breastmilk.

All of these chemicals migrate, leach out of or otherwise escape from consumer products during normal use and most have been reported as contaminants in indoor air and household dust as well as in the breastmilk, blood and other tissues of humans. They are also known to occur in other media such as sewage sludge, water resources, sediments, and freshwater and in other living creatures, such as ocean fish, birds, and marine mammals.

No one can say for sure what effects these chemicals have on human populations. But effects noted in animal tests and the pervasiveness of these chemicals in our environment give us ample warning that we must immediately substitute these chemicals. The inherent hazards of these chemicals may be contributing to the increase in cancers and in some childhood diseases, and to observed changes in fertility.

The degree to which these trends can be linked to hazardous chemicals exposure is not the main issue. The real question is why should we take chances when safer chemicals and substitute materials exist?

For example, it is estimated that nearly 12 million children (17%) in the United States under age 18 suffer from one or more learning, developmental, or behavioral disabilities.

These are clearly the result of complex interactions among chemical, genetic and social-environmental factors that influence children as they develop. But whatever the combination of causes, the fact is that many disabilities such as asthma, and attention deficit disorder are increasing among our children.

- **Asthma** is the second most prevalent chronic condition among children. It results in approximately 14 million days of missed school each year. In 1980, 3.6% of children had asthma. By 1995, the prevalence had increased to 7.5%, or approximately 5 million children.[24]

TABLE 1

Chemicals Tested for In Dust, Their Product Use and Health Concerns

Chemical Class	Product Use	Health Concerns
Polybrominated diphenyl ethers (Brominate Flame Retardants)	PBDEs are applied to textiles or incorporated into plastics, foams and components of electrical goods to prevent or retard the spread of fire. They are found in polyurethane foam products, foam padding in furniture, textiles, electrical appliances, televisions and computers.	These global contaminants persist for long periods of time in the environment, build up in the body, mimic thyroid hormones, and accumulate in breast milk. US women have highest global levels of these chemicals in breast milk.
Phthalates	80–90% of Phthalates are used in flexible PVC (vinyl) products such as wall coverings, flooring, furniture, shower curtains, clothing, raincoats, shoes, and toys. They are also used to make paint, medical equipment, pesticides, and personal care products such as perfume, nail polish, hairspray.	These global contaminants build up in the body and disrupt the reproductive system in animals studies, particularly in male offspring. They are found in higher concentrations in infertile men and contribute to asthma and respiratory problems in children.
Organotin Compounds	Organotins are used primarily as heat and light stabilizers in PVC. They are found in PVC water pipes, PVC food packing materials, glass coatings, polyurethane foams and many other consumer products.	Very poisonous even in small amounts, these can disrupt the hormone and reproductive system and are toxic to the immune system. Early life exposure in animals can disrupt brain devlopment.
Alkylphenols	Alkylphenols are used primarily as raw materials for the manufacture of alkylphenol ethoxylates. Alkylphenol ethoxylates are used as non-ionic surfactants, emulsifiers, lubricants or anti-oxidants in laundry detergents, textiles, leather, paints, disinfecting cleaners, all-purpose cleaners, spot removers, hair-coloring, cosmetics, adhesives, some plastics and pesticides. Nonylphenol is used as a spermicide.	These chemicals are widely recognized to mimic natural estrogen hormones leading to altered sexual development in some organisms. They can affect sperm production in mammals and may disrupt the human immune system.
Perfluorinated Organics (PFOA/PFOS)	PFOA is used to make Teflon, Goretex, and other oil-, water- and stain-resistant materials that are used in many common items, including nonstick frying pans, utensils, stove hoods, stainproofed carpets, furniture and clothes. PFOS is thought to be the main, final degradation product of many of the perfluorinated chemicals released into the environment.	These chemicals are pervasive in the blood of the general US population and are now global contaminants. They are potentially carcinogenic and caused damage to organ function and sexual development in lab animals. It takes over four years to excrete half the amount of this chemical from organs and human tissue, therefore continuous exposure adds high concern.
Pesticides	Pesticides are applied in and around homes for controlling infestations of various insects. They are applied to carpets, pre- and post-sale, to prevent or retard infestations of insects and dust mites.	Pesticides are global contaminants that can persist for long periods of time in the environment. They can have adverse effects on the hormone system and be carcinogenic.

TABLE 2
Contaminant Groups and Their Member Chemicals

Alkylphenols and alkylphenol ethoxylates
4-nonylphenol
nonylphenol monoethoxylate
nonylphenol diethoxylate
4-octylphenol
octylphenol monoethoxylate
octylphenol diethoxylate
4-*tert*-methylbutylphenol

Pesticides and related chemicals
chlorpyrifos
α-chlordane (alpha-chlordane)
γ-chlordane (gamma-chlordane)
2-bis(4-chlorophenyl)-1,1,1-trichloroethane
4,4-DDT
diazinon
dicofol + 4,4'-dichlorobenzophenone
(breakdown product)
dieldrin
methoxychlor
pentachloronitrobenzene
pentachlorophenol
cis-permethrin
trans-permethrin
piperonyl butoxide
propoxur

Perfluorinated chemicals
perfluorooctanoic acid
perfluorooctanyl sulfonate

Phthalate esters
dimethyl phthalate
diethyl phthalate
di-*n*-propyl phthalate
diisobutyl phthalate
di-*n*-butyl phthalate
butylbenzyl phthalate
di(2-ethylhexyl) phthalate
[bis(2-ethylhexyl)phthalate]

Polybrominated diphenyl ethers (PBDEs)
2,2',4,4'-tetrabromodiphenyl ether (BDE 47)
2,2'4,4',5-pentabromodiphenyl ether (BDE 99)
2,2',4,4',6-pentabromodiphenyl ether (BDE 100)
2,2', 4,4', 5,5'-hexabromodiphenyl ether (BDE 153)
2,2',4,4'5,6'-hexabromodiphenyl ether (BDE 154)
2,2',3,4,4',5',6-heptabromodiphenyl ether (BDE 183)
decabromodiphenyl ether (BDE 209)

Organotins
monobutyltin
dibutyltin
tributyltin
tetrabutyltin
dioctyltin
tricyclohexyltin
triphenyltin

- **Attention deficit hyperactivity disorder** (ADHD) is the most commonly diagnosed childhood psychiatric disorder in the United States. Recent evidence suggests the prevalence may be as high as 17% for all school children. In effect, the US has seen a 6-fold increase in ADHD between the years 1985 (0.7 million cases) and 2000 (4–5 million cases).[25] The use of Ritalin, a stimulant widely prescribed to treat hyperactivity and attention deficits, has increased from 2.5 times to 5 times between 1990 and 1995. By 2000 it was estimated that 15% of school age children, or an estimated 8 million children, use Ritalin.[26]

Over the last decade, there has been a wealth of research on changes in sexual maturation and fertility

- It has been suggested that girls in the United States are entering puberty earlier than the age suggested in standard pediatric textbooks and earlier than previous studies.[27]
- A 1992 study reported a 40% decline in sperm count over the second half of the 20th century and generated much controversy.[28] Subsequent studies show sperm counts have decreased significantly in some areas and held steady in others. There are no reports of significant increases in sperm count. Mathematically this means there has been an overall average decline.[29]

The degree to which these trends can be linked to hazardous chemicals exposure is not the main issue. The real question is why should we take chances? It makes no sense to continue to use known toxic and persistent chemicals in commerce when safer chemicals and substitute materials exist. Where is our country's innovation in safe chemical production and sustainable product design?

WHAT WE FOUND

To investigate the presence of hazardous chemicals in common house dust we took dust samples from vacuum bags in ten homes in each of seven states (California, Maine, Massachusetts, Michigan, New York, Oregon, and Washington) to analyze for six classes of well known hazardous chemicals. In all samples 44 chemicals were tested for:

- seven phthalate esters,
- seven polybrominated diphenyl ethers (PBDEs),
- 14 pesticides (including pentachlorophenol),
- seven alkylphenol compounds,
- seven organotin compounds, and
- two perfluorinated chemicals.

To our knowledge, the results presented in this study for organotins and perfluorinated chemicals are the first to be reported for dust collected from U.S. homes.

House dust is an important indicator of indoor semi-volatile and non-volatile contaminants.[30] It is also a very heterogeneous material. Concentrations of chemical contaminants in house dust can vary dramatically from home to home, room to room, season to season, with frequency and intensity of cleaning, with the type of flooring, etc.[31,32,33,34] Consequently, it is not surprising that the concentrations of each of the contaminant groups and their member chemicals varied considerably in this study, as shown in Tables 3 and 4.

Thirty-five of the 44 target chemicals were measured in one or more of the seven composite dust samples. In addition to these target chemicals, it is virtually certain that many other toxic contaminants, such as linear alkylbenzene sulfonates,[35] polyaromatic hydrocarbons (PAHs), heavy metals,[36] dioxins,[37] PCBs,[38,39] etc., were present in these samples and would have been detected if they had been tested for in dust samples. These chemicals have been detected in other house dust studies.

The average contribution of each of the six contaminant groups to the total concentration of target contaminants in the dust is shown in Figure 1. In each of the seven dust samples, phthalates were highest in concentration, followed, in descending order, by alkylphenols, pesticides, polybrominated diphenyl ethers (PBDEs), organotins and perfluorinated chemicals.

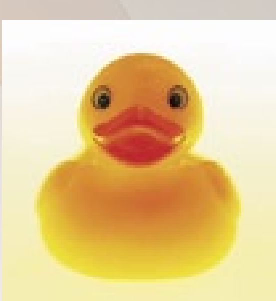


TABLE 3

Summary of Analytical Results by Contaminant Group, Across All Samples

	Total Concentration µg/g, parts per million (ppm)		
Contaminant Group	**Maximum**	**Minimum**	**Average**
Phthalate esters	552	294	424
Alkylphenols and alkylphenol ethoxylates	51.4	14.6	26.7
Pesticides	33.9	5.7	12.6
Polybrominated diphenyl ethers	12.5	3.6	8.9
Organotins	0.911	0.388	0.631

TABLE 4

Summary Analytical Results for Individual Contaminants in All Samples

	Occurrence	Average concentration	Minimum concentration	Maximum concentration
		μg/g, parts per million (ppm)		
Phthalates				
dimethyl phthalate	1/7	0.038*	<rl	0.272
diethyl phthalate	7/7	1.41	0.74	3.58
di-n-propyl phthalate	0/7	<rl	<rl	<rl
diisobutyl phthalate	7/7	3.79	1.61	8.35
di-n-butyl phthalate	7/7	20.15	7.80	49.5
butylbenzyl phthalate	7/7	69.37	42.1	137
di(2-ethylhexyl) phthalate	7/7	329.45	215	425
Alkylphenols				
4-Nonylphenol	7/7	5.141	3.740	10.500
Nonylphenol monoethoxylate	7/7	7.611	3.720	14.800
Nonylphenol diethoxylate	7/7	9.890	5.850	17.900
4-Octylphenol	0/7	<rl	<rl	<rl
Octylphenol monoethoxylate	7/7	1.003	0.394	3.410
Octylphenol diethoxylate	7/7	1.870	0.395	8.550
4-t-methylbutylphenol	7/7	0.373	0.154	0.962
Pesticides				
4,4'-DDT	7/7	0.504	0.0913	1.89
alpha-chlordane	1/7	0.020*	<rl	0.138
gamma-chlordane	1/7	0.020*	<rl	0.140
chlorpyrifos	1/7	0.029*	<rl	0.205
diazinon	0/7	<rl	<rl	<rl
dicofol	0/7	<rl	<rl	<rl
dieldrin	1/7	0.103	<rl	0.720
methoxychlor	4/7	0.191	<rl	0.532
pentachloronitrobenzene	0/7	<rl	<rl	<rl
pentachlorophenol	7/7	1.246	0.0481	7.310
cis-permethrin	7/7	3.34	0.607	11.6
trans-permethrin	7/7	6.41	1.30	21.0
piperonyl butoxide	7/7	0.69	0.147	2.18
propoxur	2/7	0.037*	<rl	0.13

TABLE 4

Summary Analytical Results for Individual Contaminants in All Samples CONTINUED

	Occurrence	Average concentration	Minimum concentration	Maximum concentration
		μg/g, parts per million (ppm)		
Polybrominated Diphenyl Ethers				
TetraBDE (BDE 47)	7/7	2.10	0.550	5.24
PentaBDE (BDE 99)	7/7	1.70	0.474	4.129
PentaBDE (BDE 100)	4/7	0.259	<rl	0.762
HexaBDE (BDE 153)	2/7	0.314	<rl	0.376
HexaBDE (BDE 154)	2/7	0.278	<rl	0.325
HeptaBDE (BDE 183)	0/7	<rl	<rl	<rl
DecBDE (BDE 209)	7/7	4.66	0.901	10.0
Organotins				
Monobutyltin	7/7	0.2063	0.1060	0.3614
Dibutyltin	7/7	0.2493	0.1158	0.3215
Tributyltin	7/7	0.0798	0.0447	0.1931
Tetrabutyltin	0/7	<rl	<rl	<rl
Di-n-octyltin	7/7	0.1096	0.0717	0.1985
Tricyclohexyltin	0/7	<rl	<rl	<rl
Triphenyltin	0/7	<rl	<rl	<rl
Perfluorinated Chemicals				
Perfluorooctanoic acid	7/7	0.0787	0.0185	0.2051
Perfluorooctanyl sulfonate	7/7	0.4244	0.0764	1.1709

* The mean value cannot be regarded as representative with such a small number of determinations.
<rl = less than limit of quantification

FIGURE 1

Average Contribution of Each Group of Chemical Contaminants in the Total Concentration of All Chemicals Tested for in Seven Composite House dust Samples

Note: This graph represents only the contributions of the six categories of chemicals tested in this study to the sum total concentration of all 44 chemicals detected. The percentages are not an indication of content in total dust quantity nor of all chemicals potentially present in house dust.

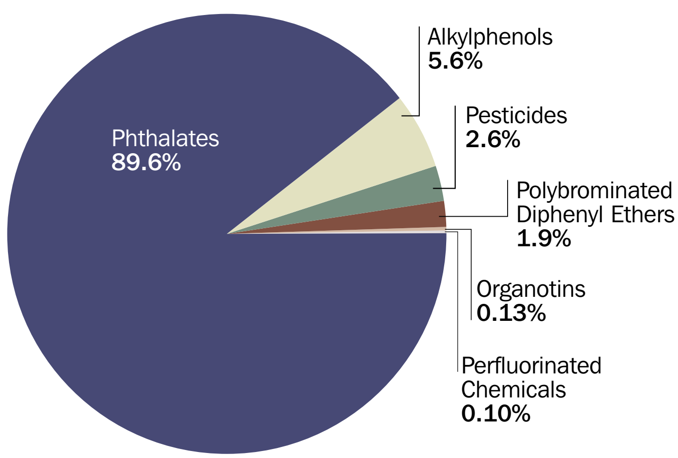
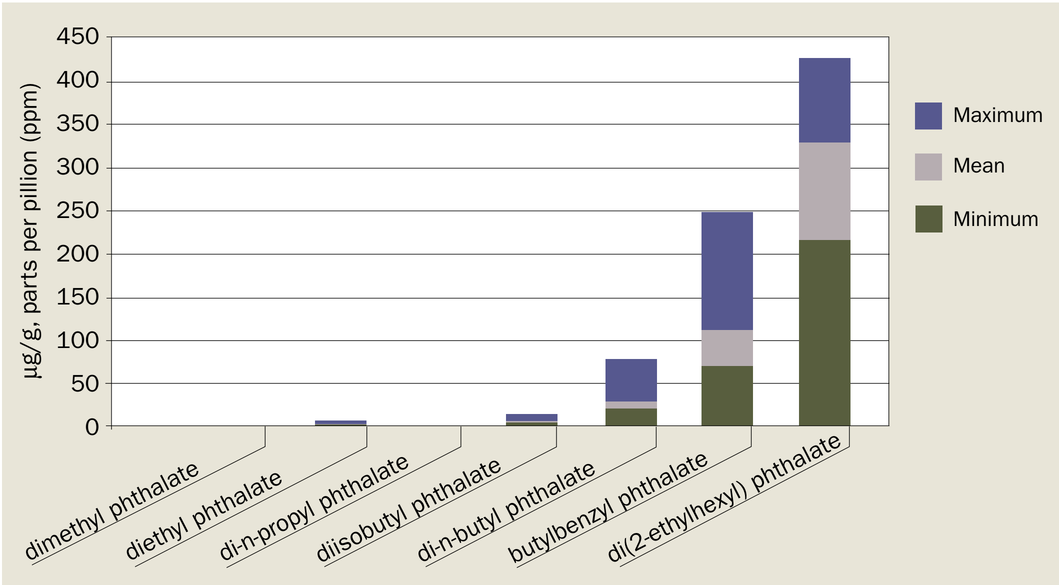


FIGURE 2

Occurrence of Phthalates in All Dust Samples: The Minimum and Maximum Concentrations Are Indicated by the Range Bar



> ***"PVC is neither a biological nor technical nutrient. It is a nightmare."***
>
> *Michael Braungart, Director, McDonough Braungart Design Chemistry and EPA Green Chemistry Award Winner quoted in Healthy Building News. March, 2005*

Phthalates

Five of the seven phthalates selected for analysis were present at quantifiable concentrations in all of the dust samples, as shown in Table 3.

Phthalates are used primarily as plasticizers for polyvinyl chloride (PVC) plastic, commonly known as vinyl. Most phthalates (80–90%) are used in vinyl products from which they continuously off-gas. On average, DEHP accounted for 78 percent of the total concentration of the target phthalates in the dust samples and 69 percent of the total concentration of the 44 contaminants.

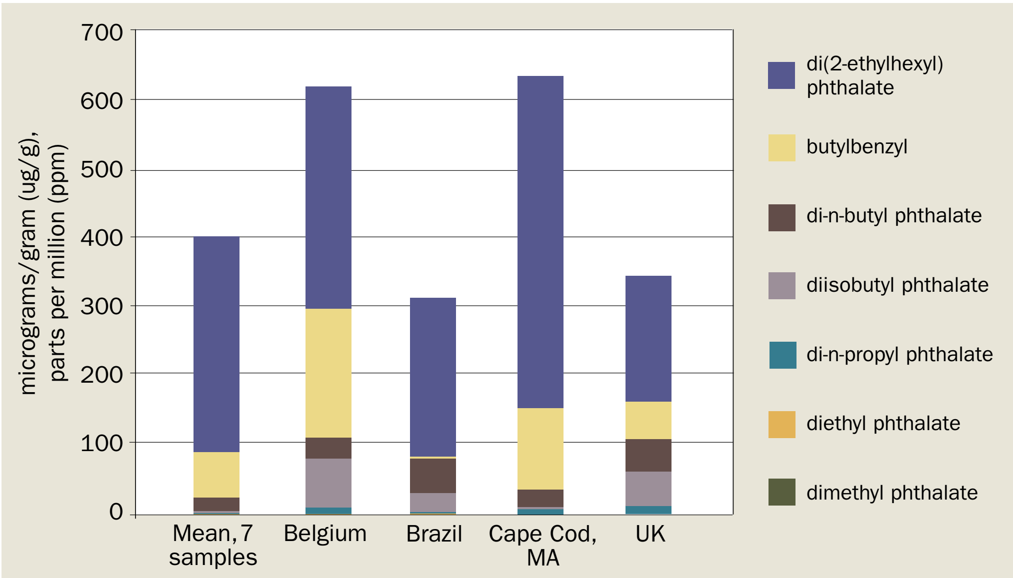
DEHP is present in PVC (vinyl) products such as wall coverings, tablecloths, floor tiles, furniture upholstery, shower curtains, garden hoses, swimming pool liners, rainwear, baby pants, dolls, some toys, shoes, automobile upholstery and tops, packaging film and sheets, sheathing for wire and cable, medical tubing, and blood storage bags.

The remaining small share of phthalates (that not added to PVC) is used in personal care products such as skin creams, hairsprays, lotions, nail polish, and fragrances, and in a variety of other products including adhesives, caulks, detergents, electrical capacitors, inks, solvents, lubricating oils, paints, and pharmaceuticals.

While environmental releases of industrial chemicals are most commonly associated with their manufacture and disposal, it is estimated that more than 75 percent of phthalate releases to the environment occurs during the use of products that contain phthalates. DEHP releases to air from PVC flooring, for example, have been documented.

- Children exposed to household dust with the greatest concentations of DEHP were more likely to have asthma than children exposed to the lowest concentrations of that phthalate.

FIGURE 3
Phthalates — Mean Concentrations of Target Pthalates in House Dust in this study and those reported by Al Bitar (2004), Costner et al. (2004), Rudel et al. (2003), and Santillo et al. (2003)



- Exposure to phthalates has also been associated with premature breast development in female children. A study on premature breast development in female children aged 6 months to 8 years found phthalate esters in 68% of serum samples from the patients.
- Phthalates have also been linked to deteriorated semen quality, low sperm counts, and poor sperm morphology in men. In a study, concentration of phthalate esters was significantly higher in infertile men compared with controls. Phthalates may be instrumental in the deterioration of semen quality in infertile men.
- Animal studies have found that phthalates pass from the mother through the placenta to the fetus, and through breastmilk to the newborn.

For a summary of occurrence and more detailed information and referenced discussion on health effects, see Appendix I.

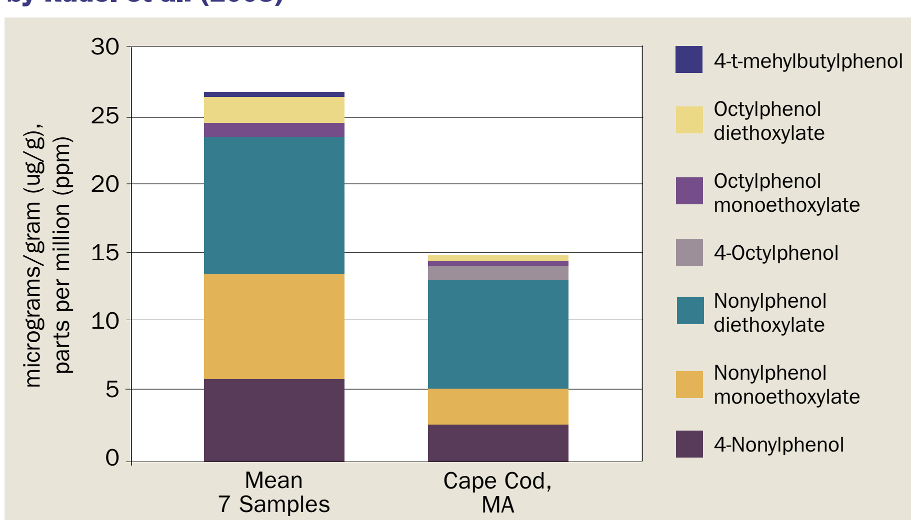
Alkylphenols

All seven alkylphenols and alkylphenol ethoxylates selected for analysis were detected in all samples. A summary of occurrence and effects is given below.

Alkylphenols (APs) are used primarily as raw materials for the manufacture of alkylphenol ethoxylates (APEs).

The major uses of APEs are as industrial and institutional cleaning products and household cleaning products. They are also used

FIGURE 4
Alkylphenols and Alkylphenol Ethoxylates — Mean Concentrations of Target Compounds in House Dust in this study and those reported by Rudel et al. (2003)



in paper and pulp production and de-inking agents in paper recycling; emulsifying agents in latex paints, pesticide and herbicide formulations, and fiberglass and polystyrene products; as additives in cosmetics and in polyvinyl chloride used for food packaging; flotation agents, industrial cleaners, cold cleaners for cars, and in the textile industry. Nonylphenol (NP) is the active ingredient in spermicides and NP or a derivative is also apparently used in food wrapping films, food-contacting plastics, and some toys, because the chemical has been found to leach from these materials and products.

Nonylphenol is regarded as a ubiquitous environmental contaminant. Nonylphenol has also been detected in umbilical cords in Japan confirming that this chemical is passed from the mother to the developing fetus through the placenta. A very recent study in Germany has found nonylphenol in breastmilk confirming that this chemical also passes from mother to nursing infant.

- The most widely recognized hazard associated with alkylphenols is their ability to mimic natural estrogen hormones. The estrogenicity of alkylphenols has been known for years. As estrogenic compounds, alkylphenols have been shown to reduce testicular function in rats potentially leading to altered sexual development. This may have implications for other organisms as well.
- Preliminary studies suggest that nonylphenol may also disrupt the human immune system.

For a more detailed and referenced discussion see Appendix I.

"We have now acqired a fateful power to alter and destroy nature. But man is a part of nature, and his war against nature is inevitably a war against himself."

Rachel Carson, author of Silent Spring, who first raised awareness of the toxicity and persistence of DDT pesticides, quoted on CBS News, 1964

Pesticides

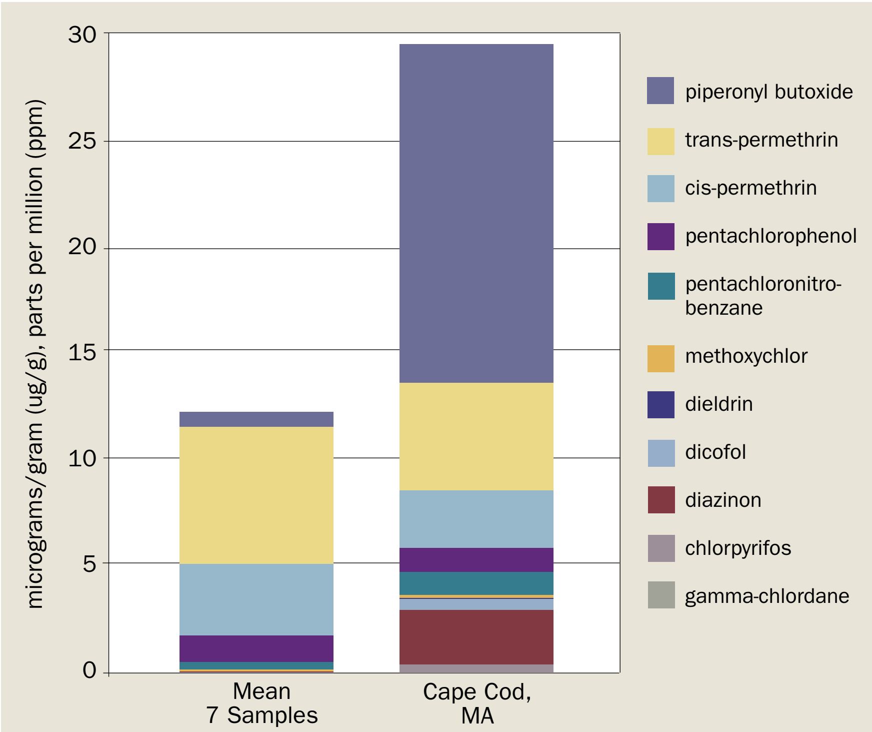
This group of target chemicals included eleven pesticides and one synergist (piperonyl butoxide). Each of the dust samples contained quantifiable concentrations of five compounds: 4,4'-DDT, pentachlorophenol, cis-permethrin, trans-permethrin, and piperonyl butoxide. A summary of occurrence and effects is given below. For a more detailed and referenced discussion see Appendix I.

Permethrin

Permethrin, a synthetic pyrethroid, is used to kill pest insects in agriculture, home pest control, forestry, and in public health programs, including head lice control. It was first marketed in 1973. Worldwide, the dominant use of permethrin is on cotton, accounting for about 60 percent (by weight) of the permethrin used. In the U.S., almost 70 percent of the permethrin used in agriculture is used on corn, wheat, and alfalfa It is widely used in U.S. homes, yards and gardens. Permethrin, like all synthetic pyre-

FIGURE 5

Pesticides — Mean Concentrations of Targeted Pesticides in House Dust in this study and those reported by Rudel et al. (2003)



In 2001, DDT was the most commonly detected pesticide on food despite being banned in 1972.

throids, kills insects by strongly exciting their nervous systems.

Because of its ubiquitous use, the Food and Drug Administration's monitoring program routinely finds permethrin on food. In 2001, it was the 8th most commonly detected pesticide with DDT being number 1, despite DDT being banned in 1972.

- The immune system appears to be a sensitive target for permethrin activity.
- Permethrin also affects both male and female reproductive systems.
- According to the EPA, permethrin is a possible human carcinogen. The EPA found that permethrin increased the frequency of lung tumors in female mice, and increased the frequency of liver tumors in male and female mice.

Piperonyl butoxide

Piperonyl butoxide is used in formulations of permethrin, other pyrethrins and pyrethroids as a synergist to increase the effectiveness of the insecticides. As such, it is sometimes relied upon as an indicator of the presence of permethrin and other pyrethroids. It does not, by itself have pesticidal properties. However, when added to insecticide mixtures their potency is increased considerably

- The US EPA has classified piperonyl butoxide as a possible human carcinogen.

Pentachlorophenol

In the U.S., most exposure to pentachlorophenol (PCP) comes from its past use on treated wood and soil. From 1987 to 1993, the EPA recorded releases of PCP to land and water, mostly from treated wood and military munitions factories, totaling nearly 100,000 pounds. PCP has been limited since 1984 to use by certified applicators for certain purposes. It is still used as a preservative on wooden utility poles, railroad ties and wharf pilings. It is also still used in California, mostly on almonds and structural pest control.

- The EPA has determined that pentachlorophenol is a probable human carcinogen and the International Agency for Cancer Research classifies it as possibly carcinogenic to humans.

DDT

DDT is no longer registered for use in the United States. However, it is still used in other (primarily tropical) countries for malaria control. It is classified in EPA's Toxicity Class II, moderately toxic. DDT was banned from use in the United States in 1972, and remains banned barring public health emergency (e.g., outbreak of malaria).

Of the quantity of DDT used in 1970–72, over 80 percent was applied to cotton crops.

Because of its ubiquitous past use, the Food and Drug Administration's monitoring program routinely finds DDT on food. In 2001, it was the most commonly detected pesticide. In a recent body burden study by the Centers for Disease Control and Prevention (CDC), scientists found DDT in blood of 99% of those sampled—the highest incidence of any pesticide sampled.

Of the quantity of the pesticide used in 1970–72, over 80 percent was applied to cotton crops, with the remainder being used predominantly on peanut and soybean crops. The decline in DDT usage was the result of increased insect resistance; the development of more effective alternative pesticides; and growing public concern over adverse environmental side effects. DDT is not metabolized very rapidly by animals; it is deposited and stored in the fatty tissues. The biological half-life of DDT is about eight years and is still a ubiquitous contaminant.

- DDT and its breakdown products are considered hormone disruptors.
- The Centers for Disease Control have reported a relation between DDT and the likelihood of preterm birth.

Polybrominated Diphenyl Ethers (PBDEs)

Three of the seven PBDEs that were selected for analysis—BDE 47, BDE 99, and BDE 209—were present at quantifiable concentrations in all dust samples. As shown in Figures 6 and 7, the decabrominated diphenyl ether, BDE 209, predominated in our samples and had the highest mean concentration, followed by BDE 47 and BDE 99. On average, these three PBDEs accounted for 95 percent of the total concentration of this contaminant group. A summary of occurrence and effects is given below. For a more detailed and referenced discussion see Appendix I.

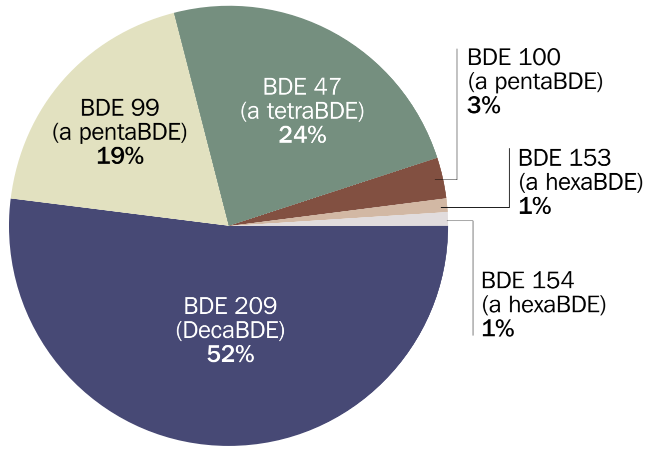
More than 70 brominated chemicals or groups of chemicals are used as flame retardants in plastics, textiles and other materials. Polybrominated diphenyl ethers (PBDEs) are one of the three groups that dominate the market for flame retardants. PBDEs are applied to or incorporated into many common household products, such as furniture, carpeting, mattresses, televisions, coffee makers and hair dryers. Decabromodiphenyl ether (Deca-BDE or BDE 209) is most commonly used in plastics and textiles, in electrical components and in styrene rubbers used in carpet backing and furniture. Sunlight and UV light can degrade BDE 209 to form less brominated BDEs, such as the pentabromodiphenyl ethers (penta-BDEs).

PBDEs have been found in air, water, fish, birds, marine mammals, and humans In many cases, their concentrations are increasing over time. Diet is regarded as the most likely route of PBDE exposure for the general population. However, air inside homes and offices can carry PBDE concentrations that are estimated to be almost ten times higher than levels in the air outside the buildings. Moreover, house dust has been identified as an important pathway of PBDE exposure for young children.

Studies of breast milk in the U.S. have found PBDE concentrations from 10 to more than 100 times higher than those in Europe. Moreover, contrary to claims by PBDE producers that BDE 209 (deca) is neither mobile nor bioavailable, recent studies have identified BDE 209 in 20 to 80 percent of breast milk samples. A recent study indicates that PBDEs in Swedish breast milk began to decrease in 1997, possibly due to a voluntary phase-out of penta-BDE. BDE 209 has also

FIGURE 6

Contributions of Individual PBDEs to Total PBDE Concentration, Across All Samples

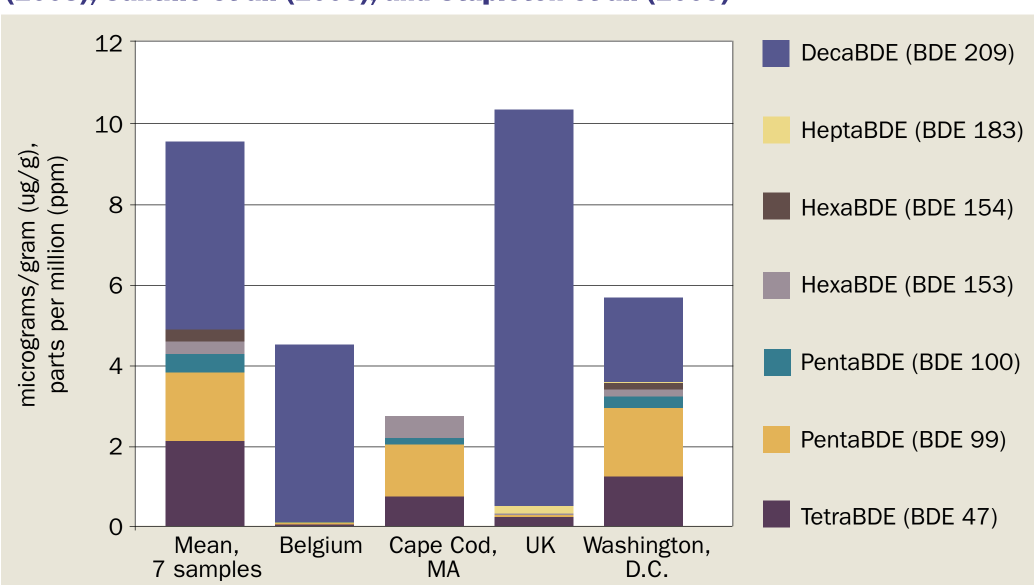


been identified as the dominant PBDE in several U.S. food groups.

- In studies with laboratory animals, mice and rats exposed to one or more PBDEs have shown a wide variety of effects including evidence of hormone disruption, reproductive/developmental toxicity including neurotoxicity, and cancer.
- Common metabolites of the PBDEs are reported to compete strongly with the thyroid hormone, thyroxin, raising the

FIGURE 7

Polybrominated Diphenyl Ethers — Mean Concentrations of Target PBDEs in House Dust in this study and those reported by Al Bitar (2004), Rudel et al. (2003), Santillo et al. (2003), and Stapleton et al. (2005)



potential for a broad range of effects on growth and development, including permanent neurobehavioral impacts, comparable to the thyroid disrupting effects of PCBs.

- Laboratory animals exposed to PBDEs during the period immediately before or after birth exhibited behavioral changes when they reached adulthood. These changes included marked hyperactivity and learning and memory deficits
- During exposure in newborn mice PBDEs, including BDE 209, have been shown to distribute throughout the body and concentrate in the brain. They induce developmental neurotoxic effects in adult mice that worsen with age and lead to abnormal behaviour.

> ***“At pharmacologic levels, butyltins might contribute to the onset of developmental disorders of the male reproductive system.”***
>
> *Doering at al. (2002)*

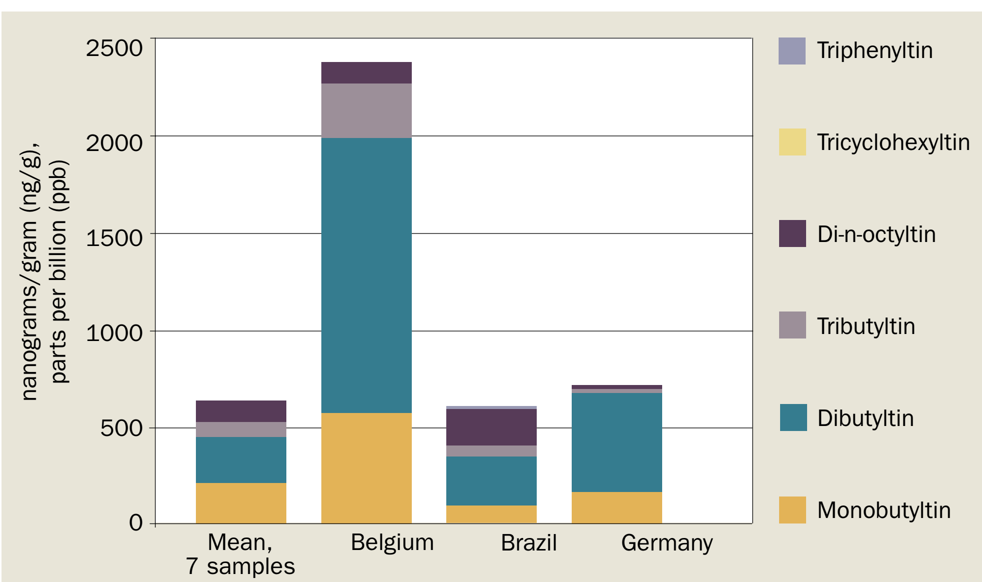
Organotins

Of the seven organotins analyzed, four were quantified in all samples: monobutyltin, dibutyltin, tributyltin, and di-n-octyltin. To our knowledge this is the first study to analyze for organotins in household dust in the US. A summary of occurrence and effects is given below. For a more detailed and referenced discussion see Appendix I.

Major use of organotins began some 40 years ago in parallel with mass production of PVC plastic (vinyl). Between 1955 and 1992, organotin production increased by a factor of ten and reached about 40,000 metric tons per year in 1996. Mono- and dialkyltins account for 81 percent of total organotin use: 76 percent used as heat and light stabilizers for PVC and 5 percent as catalysts for polyurethane and silicone elastomers. The remaining organotin uses consist mainly of tributyl-, triphenyl- and tricyclohexyltin, about 10 percent of which is

FIGURE 8

Organotins — Mean Concentrations of Target Organotins in House Dust Samples from this study and those reported by Al Bitar (2004), Costner et al. (2004), and Fromme et al. (2005)



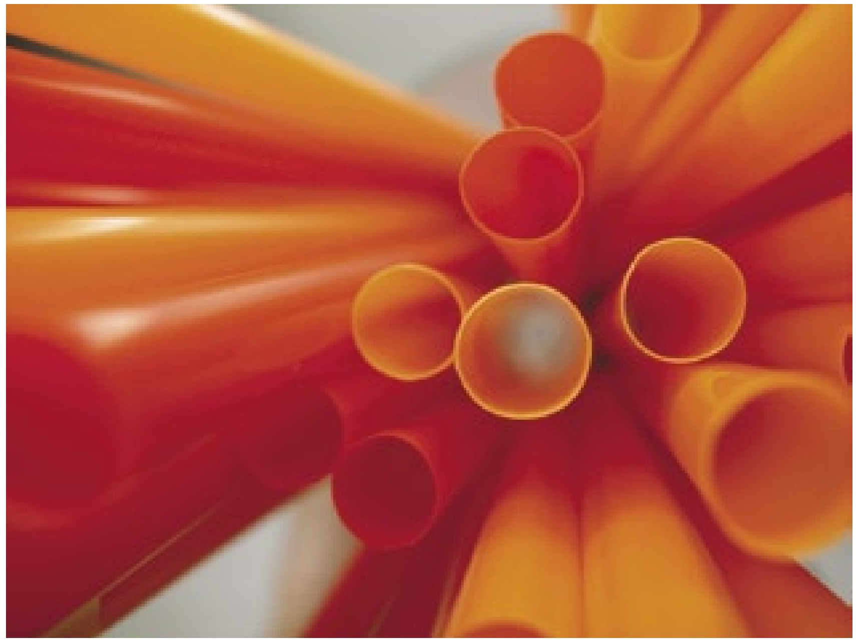
used as antifouling biocides, and 8 percent as pesticides.

Organotins are found in PVC water pipes, PVC food packing materials, glass coatings and polyurethane foams. Other uses, mainly of butyltin, include rigid PVC profiles and sidings, venetian blinds, rain gutters, window profiles and, in particular in the U.S., building sidings. Organotins also occur in textile products that contain polymer parts, such as t-shirts with prints, sanitary napkins, bandaids and diapers. They are used as fungicides on textiles that are exposed to extreme conditions such as canvas.

Organotins were found in 50 percent of ordinary plastic products purchased in a Japanese supermarket—diaper covers, sanitary napkins, polyurethane gloves, cellophane wrap, dishwashing sponges and baking parchments. Organotins were also found in the cookies baked on the parchment. Another study in Japan found organotins in children's PVC toys—face masks, balls, soft toys and food toys. Organotins have also been detected in drinking water transported through PVC pipes. Elevated levels of organotins, particularly tributyltin, have also been found in PVC flooring and, at somewhat lower concentrations, in carpets.

Organotins are found widely in the environment. They have been detected in air and precipitation, freshwater resources, ocean water, soils and sediments. Organotins, particularly tributyltin (TBT), have been identified in many species including mollusks, fish, marine and freshwater birds, marine mammals,as well as various terrestrial mammals.

- Organotins are toxic at relatively low levels of exposure and findings suggest that chronic, low-level exposure to dibutyltins (DBT) in human populations may have toxic impacts on both the immune and nervous systems. At lower doses, triphenyltins (TPT) exposure during pregnancy resulted in behavioral changes in the offspring.
- Tributyltins (TBT) and triphenyltins (TPT) are all listed as poisons and described as respiratory toxins, fetotoxins, reproductive toxins, immunotoxins, possible carcinogens, skin and respiratory irritants, and allergens.
- Organotins are known to damage the immune system in mammals. They are transported through the placenta, as demonstrated by their adverse developmental effects
- In a 1999 study, organotins were tested in the blood of people living in Michigan: monobutyltin (MBT) was present in 53 percent of the samples; dibutyltin (DBT), 81 percent; and tributyltin (TBT), 70 percent.
- DBT is neurotoxic to mammalian brain cells and has been shown to cause toxic effects on the immune system at concentrations comparable to those reported in human blood. DBT had neurotoxic effects at levels that were lower than those reported in human blood and some forty times lower than the lowest toxic concentration of trimeth-yltin, a known neurotoxicant.



Organotins are found in PVC water pipes, PVC food packing materials, glass coatings and polyurethane foams.

> ***PFOA is detectable in the blood of most humans and animals worldwide, which is problematic because it is only slowly eliminated in mammals, is potentially toxic, has no known metabolic or environmental degradation pathway, and is potentially carcinogenic.***
>
> *Ellis et al. 2005*

Perfluorinated Chemicals (PFOS and PFOA)

All dust samples contained quantifiable concentrations of the two target perfluorinated chemicals—perfluorooctanoic acid (PFOA) and perfluorooctanyl sulfonate (PFOS). PFOS concentrations were highest in all samples, with a mean of 424 ppm and a range of 76.4 to 1,170 ppm, while the mean concentration of PFOA was 78.7 ppm with a range of 18.5 to 205 ppm. To our knowledge this is the first study to detect PFOA and PFOS in household dust in the US. A summary of occurrence and effects is given below. For a more detailed and referenced discussion see Appendix I.

The two perfluorinated chemicals (PFCs) that were selected for analysis in our study are only two of the already quite large and still growing number of perfluorinated chemicals (PFCs) that are manufactured and/or found in the environment. PFOA is the best-known of the PFCs because it is used to make Teflon, Goretex, and other oil-, water- and stain-resistant materials that are used in many common items, including nonstick frying pans, utensils, stove hoods, stain-proofed carpets, furniture, and clothes. PFOA and PFOS may also be formed as products of the degradation of other PFCs.

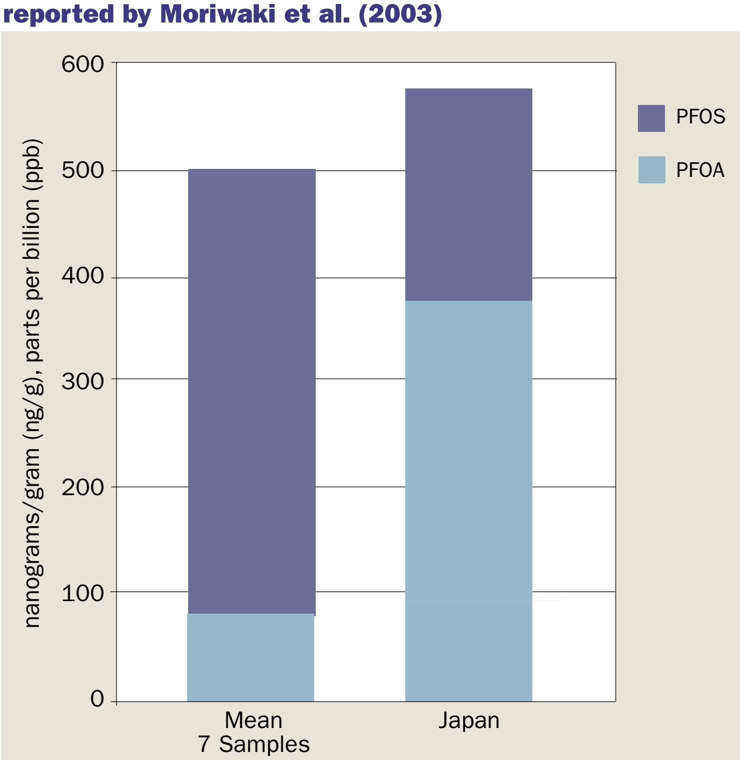
Polytetrafluoroethylene (PTFE) also known as *polyvinyl fluoride*, is commonly marketed as Teflon. This use accounted for 60–65 percent of all fluoropolymer consumption in the US., Western Europe and Japan in 2001.

These chemicals are used in soil, stain, grease, and water-resistant coatings for textiles, carpet, cookware and automobiles. PFOA is also used widely in fire-fighting foams. PFOS has been used in refrigerants, surfactants, polymers, pharmaceuticals, flame retardants, lubricants, adhesives, cosmetics, paper coatings, and insecticides. The U.S. manufacturer, 3M, discontinued PFOS production in 2000.

PFCs are pervasive contaminants in the global environment. PFOS and other PFCs are found in freshwater and marine mammals, fish, birds, shellfish, and domestic

FIGURE 9

Perfluorinated Chemicals — Mean concentrations of Perfluorooctanyl Sulfonate (PFOS) and Perfluoroctanoic Acid (PFOA) in House Dust in this study and those reported by Moriwaki et al. (2003)



cattle. Although contamination is global, including remote locations in the Arctic and North Pacific Oceans, concentrations of PFCs are relatively greater in or near the more populated and industrial regions.

- A number of studies have found PFCs to be pervasive contaminants in the blood of the general population of the U.S.
- It was known as early as 1975 that fumes from hot pans coated with Teflon (polytetrafluoroethylene (PTFE) can kill pet birds. Broiler chicks have died after exposure to polytetrafluoroethylene-coated light bulbs.
- Exposed to PFOS, female rats showed loss of appetite, interrupted estrus cycles, and elevated stress hormone levels. PFOS was found to accumulate in brain tissue, particularly the hypothalamus, suggesting that PFOS crosses the blood-brain barrier and may interfere with reproductive hormones.
- One recent review noted that studies in monkeys, rats, fish and humans have found that subchronic exposure to PFOS led to significant weight loss, reduced serum cholesterol, and reduced thyroid hormones.
- In rats, rabbits and mice, developmental effects of exposure to PFCs include reduced fetal weight, cleft palate, delayed ossification of bones and cardiac abnormalities.
- Recent laboratory studies with PFOA involving rats have shown low birth weight, small pituitary gland, altered maternal care behavior, high pup mortality, and significant changes in the brain, liver, spleen, thymus, adrenal gland, kidney, prostate, and testes.

Breastfeeding Is Still Best for Baby

> ***Breastmilk is one of the most important contributors to infant health.***
> *—US Surgeon General*

While many of the chemicals we found in house dust have also been detected in human breast milk, this should not discourage mothers from breastfeeding.

Breast milk is a good indicator of the chemicals the fetus is exposed to during pregnancy. Because of the high fat content of breast milk, some chemicals can be more easily detected in breast milk than in blood. PBDEs, for example are fat-loving chemicals that would require a much larger quantity of blood than breast milk to obtain an accurate measurement.

Most doctors agree that the benefits of breastfeeding are crucial to the developing infant. Breast milk is the best nutrition for infants. It also provides important hormones, protective immune factors, and promoters for the development of the brain and nervous system. Breastfeeding also reduces the incidence of anemia and some gynecologic cancers in women, including premenopausal breast cancer.

Formula feeding does not eliminate children's exposure to toxic chemicals. Children are exposed to significant levels of chemicals, regardless of whether they are breastfed, through food, the household environment, and from contaminants that cross the placenta while a fetus is still developing.

Exposures to chemicals during pregnancy generate more concerns than have exposures through breastfeeding. Chemical exposures before birth have been shown to have adverse health effects, but common exposures through breastfeeding have not been shown to cause harm.

For more information, see *Why breastfeeding is best for babies?* by Physicians for Social Responsibility *http://psr.igc.org/BFeasyeng2pg.10.18.pdf.*

WHY OUR REGULATORY SYSTEM IS FAILING US

> ***"...it seems to me that if you wait until all the frogs and toads have croaked their last to take some action, you've missed the point..."***
>
> *One Frog Can Make a Difference—Kermit's Guide to Life in the 90's*
> *R.P. Riger, Jim Henson Productions Inc. 1993*

The previous sections have documented the inherent hazards of six widely used chemical classes. Most of these chemicals are still used in products today. Even those that have been restricted, such as DDT, will remain in the environment for decades to come due to their persistence and bioaccumulation. But what about the known hazardous chemicals that are legally allowed to be used in everyday products and that end up in our air, water, food, household dust, and bodies?

Why are manufacturers putting toxic chemicals in and on the products they sell for household and personal use when, sooner or later, those chemicals can become household contaminants that threaten the health of their customers? And why do hazardous chemicals continue to be used in products when safer, feasible alternatives exist?

Surveys show that most people believe that chemicals contained in the products they buy every day have been tested and shown to be safe or government would not allow them to be sold.[40] Unfortunately, the reality is far from this perception.

The problem rests in our current chemical regulatory system—the high burdens it places on government agencies to take action to protect health as well as the lack of incentives to develop safer chemicals and products.

How did this situation arise and why is our government doing nothing to rectify this worrying state of affairs? The growth of the chemical industry after World War II saw the proliferation of a wide range of synthetic chemicals, which were, for the most part, unregulated.

It was only in the late 1970s that the federal government enacted the Toxics Substance Control Act (TSCA) to regulate industrial chemicals used in commerce. The law provided authority to the U.S. EPA to require health and use data on chemicals in commerce, to review applications for new chemicals coming on to the market, and to control chemicals that may be dangerous to health or the environment. Unfortunately, those chemicals that were on the market prior to 1979—amounting to more than 99% by volume of the chemicals on the market today—were considered automatically "registered" and reviewed—in other words, safe until proven dangerous. For the EPA to restrict one of these chemicals (all of the industrial chemicals reviewed in this report were on the market prior to 1979), the EPA must demonstrate that there is a significant risk to health, that the benefits of regulation (for health) outweigh the costs to industry, and that they are chosing the least burdensome form of regulation to meet a goal.

When the EPA tried to severly restrict the sale of asbestos in 1990, after ten years of research, the 5th Circuit Court of Appeals struck down EPA's regulation stating that they had not reached the threshold for

Surveys show that most people believe that chemicals contained in the products they buy every day have been tested and shown to be safe or government would not allow them to be sold. Unfortunately, the reality is far from this perception.

requiring a phase-out of this known toxic material. Because of these burdens, it is nearly impossible for the EPA to restrict chemicals on the market. As such, the EPA has restricted fewer than 10 chemicals in 25 years.

Even data collection activities for existing chemicals have been limited. In 1998, the U.S. EPA published a report demonstrating

that over 93% of high production volume chemicals (those produced over one million pounds per year) lacked some basic screening level health data. As a result of this report and another by the Environmental Defense Fund, the chemical industry entered into a voluntary initiative, called the High Production Volume Chemical Challenge. This effort will provide substantial basic toxicological data for a large percentage of the 2800 chemicals produced over one million pounds per year. Nonetheless, the data being collected by industry does not address many health effects of concern. The voluntary program does not cover the more than 6,000 chemicals currently used annually in quantities between 10,000 and 1 million pounds.

The lack of power to regulate existing chemicals provides a strong disincentive for manufacturers to develop safer chemicals.

Further, it does not include exposure data and information on how chemicals are used throughout supply chains, which is critical for prevention efforts. Industry analyses in Europe have shown a severe lack of information on chemical use and toxicity throughout product supply chains, such that chemical manufacturers may not even know how their chemicals are being used.

For new chemicals coming on the market since 1979, companies must complete a "pre-manufacture notification" including information on the chemical and any toxicological, use, or exposure information that may be available. The EPA has an opportunity to review this information at the pre-manufacture stage (before any marketing has occurred). This pre-manufacture review allows the EPA to raise concerns about chemicals before they are produced and funds spent on marketing and manufacturing. However, because no actual testing is required for new chemicals, the EPA is often required to review these chemicals on the basis of computer models. And because no additional testing is required of new chemicals as their production is initiated and increased, once those new chemicals reach the market, EPA's power to regulate them is greatly diminished.

A similar situation exists in pesticide regulation. American and international agencies have established maximum exposure levels, above which they recognize significant cause for concern about increased risk of both cancer and non-cancer effects. While there are some differences in the thresholds established by different health and environmental agencies, the levels of exposure triggering concern are generally extremely low.

These "acceptable" levels are not necessarily safe because they are determined in toxicity tests that consider only single chemicals. In the real world, we are exposed to a multitude of chemicals simultaneously. In fact, most pesticides are sold as mixtures. Thus, toxicity studies of the effects of individual chemicals on laboratory animals can never be truly representative of actual exposures. In addition, many studies do not take into account special periods of vulnerability such as childhood or pregnancy, where a single, very low dose of a chemical at a certain time could cause permanent damage to the fetus or developing child.[41]

TABLE 5

States Move to Protect Public Health and the Environment in the Absence of Federal Governance Leadership

Alaska
The Anchorage School District bans the use of pesticides linked to health or environmental damage

California
Penta-BDE and Octa-BDE to be banned. PROP 65 demands labeling of CMRs for consumer products. Banned pharmaceutical uses of lindane. At least five school districts in CA ban the use of pesticides linked to health or environmental damage.

Colorado
The Boulder Valley School District bans the use of pesticides linked to health or environmental damage.

Hawaii
Legislation banning PBDEs

Illinois
Pending legislation to ban pharmaceutical uses of lindane

Maine
Penta-BDE and Octa-BDE banned as of 2006. Deca-BDE banned as of 2008. Mercury is banned.

Massachusetts
Pending legislation to find safer alternatives for ten hazardous chemicals, including PBDEs, DEHP, and some pesticides. Pending legislation to mandate the use of safer cleaning products in many public buildings. Legislation to require comprehensive toxics use reduction for large user segments. Boston passed a dioxin free purchasing resolution to avoid PVC use. MA state law bans the use in schools or daycares of pesticides that are considered known, likely, or probable carcinogens, inert ingredients with toxicological concerns, or any products used for purely aesthetic reasons. The law also limits use of pesticides indoors.

Michigan
Legislation banning Penta-BDE and Octa-BDE by 2006. Stakeholder Task Force on all Deca-BDE. PBDEs and mercury guidelines in state purchasing contracts.

Minnesota
Pending legislation to ban the herbicide atrazine

New York
Penta-BDE and Octa-BDE to be banned by 2006. Deca-BDE phase out for review. Pending legislation to ban pharmaceutical uses of the pesticide, lindane. PVC flooring is excluded as an eligible material for the state green building tax due to its release of harmful chemicals throughout its life cycle. NY's second largest city, Buffalo, passed a PBT-free purchasing resolution. At least five school districts, including NYC, have adopted policies that limit the use of pesticides for aesthetic purposes or ban some highly toxic pesticide categories.

Oregon
Pending legislation in the 2005 Oregon Legislature to phase out the sale of products containing brominated flame retardants. Oregon's most populous county, Multnomah County, adopted the precautionary principle in 2004 to help reduce the use of toxic substances. Executive Order to achieve zero discharge of persistent chemicals by 2020. The Portland schools do not allow the use of known or likely carcinogens.

Washington
Executive order to phase out PBTs prioritizing 25 high priority chemicals. Legislation pending to ban all PBDEs as part of the PBT Executive Order. Seattle passed a PBT-free purchasing resolution. Passed mercury reduction legislation. Six school districts and four cities in WA ban the use of pesticides linked to health or environmental impacts.

Note: CMRs refer to carcinogens, mutagens and reproductive toxics. PBTs refer to persistent, bioacummulative and toxic substances.

The lack of power to regulate existing chemicals provides a strong disincentive for manufacturers to develop safer chemicals. While the EPA has developed some innovative initiatives in Green Chemistry, Design for Environment, and pollution prevention, these are generally small, underfunded, and marginal to the EPA's toxics program. In agriculture, a similar situation exists. Last year, the US Department of Agriculture awarded $4.5 million in research grants for the Integrated Organic Program but investment on organic R&D and promotion equals 0.1 percent of total federal agriculture grants.[42] In essence, our regulations fail to promote sustainability and innovation.

Currently, the Senate is examining the Green Chemistry Research and Development Act which would increase federal research and development into this science.

Currently, the Senate is examining the Green Chemistry Research and Development Act which would increase federal research and development into this science. This Act was proposed by Rep. Phil Gingrey (R-GA) and is supported by the American Chemical Society. Such initiatives are indeed welcome but they must be part of a comprehensive overhaul of the current Toxic Substance Control Act to make the goal of safe chemicals production the core mission of chemical management.

For chemicals regulation to be effective, the EPA needs the authority to collect and act on accumulating information , including an ability to require safer substitutes for chemicals that are of high concern. As the regulations currently exist this is virtually impossible to do because the burden of proof is put on the regulators to prove harm rather than for the chemical industry to demonstrate that they have adequately examined a full range of potential risks and shown the chemical can be used safely.

Our chemical management in the U.S. needs a modern and effective overhaul to urgently fill the data gaps, act on early warnings to substitute chemicals and chemical classes of high concern, and promote innovation in green chemistry and safe chemical use by companies.

In the absence of a federal overhaul of chemical policy, and faced with a lack of chemical industry accountability and weak federal regulatory powers, some state governments are taking action. These actions include procurement guidelines for products free of persistent, bioaccumulative or toxic chemicals; hazardous chemical phaseout programs; toxic use reduction planning requirements; and labeling requirements such as California's Proposition 65. The U.S. Federal Government must respect the right of states to enact strong laws to protect their citizens from dangerous chemicals.

These approaches are building momentum for national reform. It is essential that states continue to develop policies that target inherently hazardous chemicals for substitution along with an aggressive program to work with downstream chemical users to find and implement safer substitute materials. This applies not only to industrial chemical use but to agricultural uses as well.

EUROPE'S NEW CHEMICAL POLICY: REACH

> ***"At the very least, we recommend that where synthetic chemicals are found in elevated concentrations in biological fluids such as breast milk and tissues of humans, marine mammals or top predators, regulatory steps be taken to remove them from the market immediately."***
>
> *Royal Commission on Environmental Pollution, UK—Chemicals in Products, 2003*

At the World Summit for Sustainable Development, the global community including the United States adopted the "Generational Goal" to guide chemical policy development and protect public health. This is an evolution of European policy which in 1995 stated the goal of preventing pollution to the North Sea "… by continuously reducing discharges, emissions, and losses of hazardous substances thereby moving towards the target of their cessation within one generation (25 years) with the ultimate aim of concentrations in the environment near background values for naturally occurring substances and close to zero concentrations of man-made synthetic substances."

Increasing recognition that hazardous chemicals were migrating out of products, that waste was becoming increasingly toxic, that large data gaps existed for the bulk of chemicals in commerce, and that regulatory powers to substitute chemicals were limited forced the European Union to examine its chemical regulatory system. Europe, home to the largest chemical market in the world, faced a situation whereby 70% of the chemicals that have been evaluated under the new chemicals program since 1981 have one or more dangerous properties.[43]

Even though the Europe Union had restricted a variety of hazardous chemicals from production and use, the community and experts realized that a chemical by chemical approach took too long and could never adequately address the thousands of chemicals that needed to be investigated. This provided added incentive to re-think its chemical management program and focus it to create better safe guards for public health.

Chemicals Currently Restricted or Banned in the European Union Market

- Known and probable carcinogens, mutagens and reproductive toxicants and preparations containing them.
- Mercury in electronics
- Lead in electronics
- **Phthalate Esters** in small toys
- Cadmium
- Hexavalent Chromium in electronics
- Nickel in jewelry
- **Polybrominated diphenyl ethers**
- Polybrominated biphenyls in textiles and electronics
- Copper chromate arsenic
- **Tributyl tin**
- Azo dyes in textiles
- **Pentachlorophenol**
- Creosote
- Organostannic compounds
- Trichloroethane
- Hexachloroethane
- Tetrachloroethane
- Short chain chlorinated parrafin

Source: Integrated Chemicals Policy, Lowell Center for Sustainable Production, University of Massachusetts, Lowell

Note: text in **bold** denotes chemicals analyzed for and found in dust

Europe's new draft chemicals management program, entitled REACH, is set for enactment in 2006 or 2007. This far-reaching policy would require the Registration, Evaluation and Authorization of Chemicals (REACH) to close the large loophole in information and regulate chemicals of high concern.

In effect, REACH would require that industry publicly provide basic health, safety and environmental impact data for over 30,000 high volume chemicals—many of which are widely used in everyday consumer products. Those chemicals which are demonstrated to be of high concern would need to get authorization (like regulation for drugs) in order to be produced and used. Authorization would only occur if strict controls, and proof of socio-economic need could be demonstrated. Many believe the rigorous procedure of getting a chemical authorized would, in fact, lead to the search for safer substitutes. Others, such as the Nordic countries and some companies,

TABLE 6

A Comparison of the US versus Proposed New European Chemicals Regulation

Toxic Substances Control Act	Proposed Regulations in REACH
TSCA is based on proving harm before acting—the burden of proof rests on the government to demonstrate that a chemical "will present an unreasonable risk" before the EPA can limit the use of particular chemical.	REACH is based on a precautionary approach—industry has the burden of testing and assuring safety of all the chemicals they use. Governments can severely restrict substances based on their inherent dangers and adequate evidence of harm.
The EPA only regulates chemicals put on the market since 1981—this amounts to less than 1% by volume of chemicals on the market.	REACH does not differentiate between new and existing chemicals—all chemicals produced in amounts greater than one ton will be regulated (estimated 30,000 chemicals). This levels the playing field between old and new chemicals.
TSCA only requires that manufacturers submit available toxicity data and registration for new chemicals and even then can only require testing when the agency believes the chemical might be problematic.	REACH requires basic human and environmental toxicity information for all new and existing chemicals. In effect, it forces the chemical industry to be accountable for all their product lines manufactured prior to the 1980s and still in commerce today.
Under TSCA it is very difficult for the EPA to restrict the use of existing chemicals that are highly toxic and found to be linked to cancer, reproductive problems and/or persisting and accumulating in the environment and human bodies (the EPA has restricted less than 10 chemicals in the past 25 years).	REACH will require authorization for the use of inherently harmful materials, which include chemicals that are known or probable carcinogens, reproductive toxins, mutagens as well as chemicals that persist and accumulative in the environment and our bodies and endocrine disrupting chemicals. The use of these materials will be restricted and the list will be publicly available.
TSCA allows large quantities of chemicals to be used in everyday products without any health or ecological data.	REACH does not allow chemicals* to be put on the market unless data is provided (no data, no market).
TSCA is fully paid for by taxpayer dollars.	Industry will partly pay for REACH through registration fees.

*Carcinogenic (cancer causing), Mutagenic (causes mutations in cells), Reproductive Toxin (linked to birth defects), Persistent (resists breakdown), Bioaccumulative (magnifies up the food chain), Teratogenic (linked to birth defects), Endocrine Disruptor (disrupts the hormonal system)

are lobbying hard to have any authorized chemical the focus of immediate substitution with safer chemicals.[44]

The American Chemistry Council and the Bush Administration Lobby Against Reform

Through international efforts, such as the global Stockholm Convention on Persistent Organic Pollutants (POPs) and Europe's REACH legislation, many governments are adopting integrated approaches to replace high risk chemicals with safer alternatives. Unfortunately, the United States is playing an active role in undermining this process. At home, the Administration has tried to use ratification of the Stockholm Convention as an excuse for restricting the ability of the EPA and state governments to regulate future POPs.

Abroad, the US government, largely led by the State Department and Department of Commerce have aggressively lobbied against REACH threatening trade violations and citing poorly researched economic impact analysis created by the American Chemistry Council (ACC). ACC's predictions of billions of dollars of lost sales is countered by the European Commission's assessment that the cost to the chemical industry of pro-viding data on their chemicals is estimated to cost around 2.3 to 5.2 billion Euros over 11 years of implementation. This is equal to 0.15 percent of annual profits from chemical sales, or about 50 cents per European each year.[45]

Not once have US government officials recognized the economic and public health benefits of REACH. The European Commission has calculated that REACH will save an estimated 50 billion Euros in health benefits over the next 30 years and the prevention of 4300 cases of cancer.

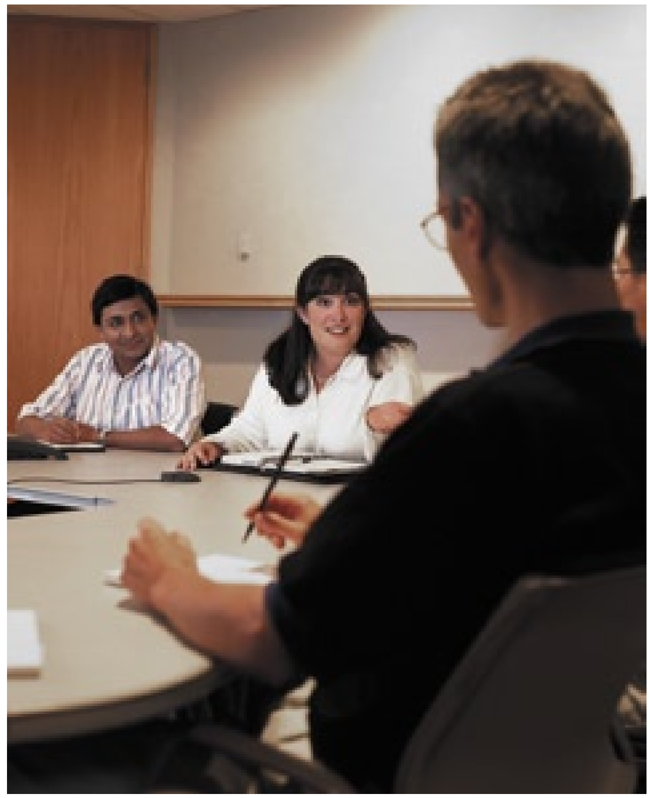
The Environmental Protection Agency has restricted less than 10 chemicals in the past 25 years.

PRODUCT MANUFACTURERS AND RETAILERS RESPOND TO CHEMICAL RISKS

Using hazardous chemicals in products is ultimately bad business practice and future thinking companies have been making the transition to safer chemical use. However consumer information about the type of chemicals in household products is very limited. People have no way of knowing if contaminants are in the products they buy and bring home, much less if these "stealth" contaminants will end up in the air and dust in their homes. We have no product labeling or product registers to consult.

In the absence of such information, advocacy and consumer groups have been testing and researching company chemical policies.

While collecting and analyzing the dust from households across the country, Clean Production Action sent questionnaires[46] to a sample of leading manufacturers and retailers asking them if they use the chemicals targetted in this study. We were also inter-



Human Health Criteria	Ecological Health Criteria
Carcinogenicity	Algae toxicity
Teratogenicity	Bioaccumulation
Reproductive toxicity	Climatic relevance
Mutagenicity	Content of halogenated organic compounds
Endocrine disruption	Daphnia toxicity
Acute toxicity	Fish toxcity
Chronic toxicity	Heavy metal content
Irritation of skin/mucous membranes	Persistence/biodedgradation
Sensitization	Other (water danger list, toxicity to soil organisms, etc.)
Other relevant data (e.g., skin penetration potential, flammability, etc.)	

Human and Ecological Health Criteria Included in McDonough-Braungart's Design Consultancy Materials Assessment Protocol

Herman Miller

ested to better understand the challenges companies might face in transitioning out of these chemicals.

We developed a color coding system based on previous surveys[47] to help consumers understand companies chemical policies. We based the color coding on company answers to the questionnaire, on information available on their website, or through public announcements the company or retailer might have made.

The results of our company ranking are contained in Appendix II.

Industry Leaders

Products do not need to contain hazardous chemicals. Innovation in healthy materials is a profitable reality. We showcase four companies who searched for and found safer chemicals for their product lines. There are many more like them who believe safe materials are possible and profitable.

These companies

- Identify known or suspected hazardous chemicals for immediate substitution with safer alternatives.
- Work with employees and suppliers to experiment and search for new materials and designs; and
- Engage with public stakeholders and disclose information to consumers.

Herman Miller (*www.hermanmiller.com*)

Based in Western Michigan, Herman Miller, a residential and commercial furniture manufacturer has been quietly integrating sustainability into their business practices. Their commitment to redesigning their new products is providing consumers with materials that are safer and cleaner throughout their life cycle. Their design strategies are driven by an aggressive sustainability agenda to be met by 2020.

Dubbed "Perfect Vision," the effort establishes significant, measurable corporate sustainability targets to be achieved by the year 2020, including:

- Zero landfill
- Zero hazardous waste generation
- Zero air and water emissions from manufacturing
- Company buildings constructed to a minimum LEED Silver certification
- And the use of 100 percent green energy to meet its power needs.

"Emerging technologies are enabling us to actively pursue our sustainability goals, and I'm convinced we'll meet them," says Environmental Affairs Manager Paul Murray, noting that in a number of areas Herman Miller already is closing in on these objectives.[48]

One key component to Herman Miller's strategy is the McDonough Braungart's Cradle to Cradle Design Protocol to assess the potential hazards of materials and chemicals proposed for new products.[49] For more information visit *www.mbdc.com* and *www.greenblue.org*.

These criteria are used to screen materials and chemicals for the safest choices in product design.

Herman Miller's Mirra chair is an example of a new product designed to use materials that rank well in the assessment protocol. Polyvinyl chloride (PVC) plastic (vinyl), brominated flame retardants and other materials of concern were replaced with safer alternatives. If current suppliers where unable to meet the new environmental standards necessary for the product, they searched for new suppliers who could. This has important ramification across supply chains by rewarding those suppliers working to produce and deliver safer materials and chemicals. In addition to hazard assessments, Herman Miller also designs for reuse and recycling to achieve their zero landfill goal.

Shaw Inc. (*www.shawfloors.com*)

Back in December of 2003, Shaw Inc, the world's largest carpet manufacturer in the world, based in Dalton, Georgia, launched a new environmental policy to change the way in which they design products. This meant finding a new set of materials that could be safely reused and recycled continuously into new products. It also meant moving out of PVC (vinyl) and other materials and chemicals that pose a risk to human health. Their vision below signifies their commitment to change.

Shaw Industries, Inc. recognizes that merely preserving and conserving the natural bounty of the earth will not make us a sustainable corporation. A truly sustainable carpet industry must mimic nature's organic cycle of life, death, and rebirth. The answer does not lie in limiting growth, but in encouraging the kind of growth that is cradle-to-cradle, returning carpet to carpet endlessly.

Toward that end, Shaw has adopted these productive policies and practices.[50]

- Environmental sustainability is our destination and cradle-to-cradle is our path. Our entire corporation and all stakeholders will value and share this vision.
- Through eco-effective technology we will continuously redesign our products, our processes, and our corporation.
- We will take responsibility for all that we do and strive to return our products to technical nutrient cycles that virtually eliminate the concept of waste.
- We will plan for generations, while accepting the urgency of the present. We are committed to the communities where we live and work. Our resources, health, and diversity will not be compromised.
- We look forward to a solar-powered future utilizing the current solar income of the earth, anticipating declining solar costs and rising fossil fuel costs as technology and resource depletion accelerate.
- We will lead our industry in developing and delivering profitable cradle-to-cradle solutions to our free-market economy. Economy, equity, and ecology will be continually optimized.


Shaw Inc.

- Honesty, integrity, and hard work remain our core values. We will continue to deliver unsurpassed safety, quality, beauty, performance, and value to our customers.

Using McDonough Braungart's Cradle to Cradle Design Protocol, the company not only designs for recyclability, but also prioritizes the use of materials and chemicals that are safer for human health and the environment. To affirm their commitment to their new environmental policy, Shaw launched EcoWorx® Backing—the industry's first 100% non-PVC backing for carpets (see attributes below). At comparable cost, using the best available technologies and materials for performance and human health, Shaw established a new precedent that will lead others to change.

EcoWorx® Backing[51]

- Recyclable into more EcoWorx® backing
- Thermoplastic compound containing no chlorine to off-gas in a fire and no phthalate plasticizers to migrate into the environment
- Equal to or better than PVC backing in all performance categories
- 40% lighter weight than PVC, lowering transport costs and carbon monoxide emissions
- Extremely low in VOCs (exceeds protocols for Green Label Certification under CRI's Indoor Air Quality Program), available with a low-VOC releasable adhesive
- Class I fire rated, rating for smoke generation far superior to PVC
- Available on any modular tile or six-foot style with no upcharge, no minimum, and no overage
- Offered with a high-performance Lifetime No-Failure Warranty
  100% recyclable into more EcoWorx® backing through granulation and return to the extrusion process

In addition to EcoWorx®, Shaw also used MBDC's Cradle to Cradle protocol to design Eco Solution Q® fiber—a safer carpet fiber. Combining the two products creates a 100% recyclable carpet that Shaw will pick up free of charge at the end of life and reuse and recycle back into new carpets. As with Herman Miller, one product at a time, they are establishing new design paradigms that not only negate the need for harmful chemicals, but also reduce the need for landfills, and other waste sites.

IKEA (*www.ikea.com*)

For more than 60 years IKEA has been perfecting ways of creating low prices—manufacturing as inexpensively as possible building our own stores, flat-packing furniture for customers to put together themselves. But IKEA's responsibilities do not stop there. We also want the products to be free of hazardous substances. And we don't want the wood in bookcases, tables or other products in the store to come from areas where forests are being devastated.[52]

IKEA, headquartered in Sweden, is increasing its presence in the United States giving consumers access to products that are affordable yet made with the intention of being hazard free. This has meant establishing a comprehensive restricted substances list for all of their suppliers, banning materials like PVC (vinyl), and chemical classes like brominated flame retardants. Every IKEA product is designed with the goal of being hazard free throughout its life cycle. In areas where a safer material or chemical does not exist, IKEA establishes an aggressive research and development program to find a safer alternative. In 1999, the company phased out brominated flame retardants but found it had to use a chlorinated organohalogen as a replacement in one of its product lines. Since then it has been researching non-halogenated substitutes to continue the transition to safer materials that function well and meet international fire standards.

What makes IKEA unusual is that they have been doing this long before environmental issues were on the map as a corporate priority and necessity to maintaining competitiveness. IKEA has not been afraid to work collaboratively with NGOs such as Greenpeace, Friends of the Earth and World Wildlife Fund. In 2002, they signed the Friends of the Earth UK's Risky Chemical Pledge committing to:

- Using official lists, identify which man-made chemicals are suspected of building up in peoples bodies *(bioaccumulation)*, or interfering with the hormone, immune or nervous systems.
- Produce a strategy to identify which of its own brand and branded products contain these chemicals.
- Produce a timeline to phase out these chemicals from its own-brand products, with the aim of eliminating them in 5 years, starting with those chemicals, which pose the greatest threat.
- Put pressure on manufacturers of branded products to do the same.
- Report publicly on progress on an annual basis.

IKEA is a world leader in sustainability. They are the only retailer in the United States offering consumers affordable products ranging from beds, to shelves, to couches and rugs that can be safely brought into the home with the assurance that chemical exposure is prevented to the greatest extent possible for technologies available today.

Dell (*www.dell.com*)

"Achieve an Environmentally Focused Culture[53]"

Dell, the largest computer manufacturer in the world, based in Austin, Texas, has responded to the needs and demands of their increasingly young, socially and environmentally aware consumer base. Electronic manufacturers have developed restricted substances lists, largely due to emerging European restrictions on certain hazardous substances. However, a few such

Dell

as Dell, go beyond government regulations by listing halogenated plastics, and PVC plastic—materials long believed to release high risk chemicals throughout their life cycle for phase out.

"Dell's vision is to create a company culture where environmental excellence is second nature. Our mission is to fully integrate environmental stewardship into the business of providing quality products, best-in-class services, and the best customer experience at the best value. The following environmental policy objectives have been established to achieve our vision and mission."

Design Products With the Environment in Mind

- Design products with a focus on: safe operation throughout the entire product life cycle, extending product life span, reducing energy consumption, avoiding environmentally sensitive materials, promoting dematerialization, and using parts that are capable of being recycled at the highest level
- Set expectations of environmental excellence throughout Dell's supply chain.

Their position on brominated flame retardants also exceeds European Union mandated industry standards. While most companies work to comply with the European Restriction on Hazardous Substances, which bans only PBDEs by 2006, Dell's products are already PBDE free and plans to phase out the entire class of brominated flame retardants… "our publicly-stated goal is to eliminate (all other) brominated flame retardants in desktop, notebook, and server chassis plastic parts by year-end 2004."[54]

Dell's Restricted Materials Specification/ Supplier Programs

In order to meet global environmental product requirements, Dell developed a restricted materials specification to encompass all raw materials, parts, components or products that are ultimately incorporated into the product that Dell markets. For outsourced manufacturers, this includes products produced by the manufacturer on behalf of Dell. The following list of materials represent examples of substances that Dell has reduced or eliminated in certain applications:

- Asbestos and its compounds
- Cadmium and its compounds
- Chlorofluorocarbons (CFCs)
- Chloroparaffins, short-chained (10–13 carbon chain)
- Chromium VI and its compounds
- Halogenated plastics
- Hydrochlorofluorocarbons (HCFCs)
- Lead and its compounds
- Mercury and its compounds
- Nickel and its compounds
- Polybrominated biphenyls (PBBs) and their ethers/oxides (PBDEs, PBBEs)
- Polychlorinated biphenyls (PCBs) and terphenyls (PCTs)
- Polyvinyl chloride (PVC)

Dell has also committed to taking their products back at the end of life "to reuse, recycle and dispose of safely."

WE CAN DO BETTER: The Way Forward to Safe Chemicals

To prevent hazardous chemical exposures from everyday products found in our own homes, we need major changes in government policy, industry practice and individual consumer behavior.

For too long we have been exposed to chemicals in common household products with little or no information. This situation can not continue. The national regulatory system has failed to protect consumers, citizens and children from the unintended consequences of exposure to small doses of harmful chemicals from multiple sources. The federal Toxic Substance Control Act needs to be replaced with a new chemicals policy that will:

- **Require Safer Substitutes and Solutions**—seek to eliminate hazardous chemical use and emissions by altering production processes, substituting safer chemicals, redesigning products and systems, and rewarding innovation. Safer substitution includes an obligation on the part of the public and private sectors to invest in research and development for sustainable chemicals, products, materials, and processes.
- **Phase-out Persistent, Bioaccumulative, or Highly Toxic Chemicals**—prioritize for elimination chemicals that are slow to degrade, build up in the bodies of humans and wildlife, or are highly hazardous to humans or the environment.
- **Give the Public and Workers the Full Right-To-Know**—label products that contain hazardous chemicals, list quantities of hazardous chemicals used in agricul-

“It will be obvious when chemists have fulfilled their singular historic obligation to promote sustainability.… Every newly graduated chemist will have a thorough understanding of the fundamentals of sustainability ethics, toxicity and ecotoxicity and will know how to avoid pollution when designing chemicals and chemical processes. Chemists will have developed non-polluting affordable technologies suitable for mass distribution that can convert solar to electrical and chemical energy with high efficiency. Through the properly informed design of chemicals and chemical processes, an economically vibrant, safe technology base will have been invented that is attractive to industry while being neither toxic nor ecotoxic.”

Terry Collins, Director, Institute for Green Chemistry, Carnegie Mellon University, USA.
Quoted in Green Chemistry, *August 2003*

ture and in manufacturing facilities, and provide public access to safety data on chemicals.

- **Act on Early Warnings**—act to prevent harm when credible evidence exists that harm is occurring or is likely to occur, even when some uncertainty remains regarding the exact nature and magnitude of the harm.

- **Require Comprehensive Safety Data for All Chemicals**—assume that a chemical is highly hazardous unless comprehensive safety data are available for the chemical and require manufacturers to provide this data by 2015 for a chemical to remain on the market—this is the principle of “No Data, No Market.”
- **Take Immediate Action to Protect Communities and Workers**—When communities and workers are exposed to levels of chemicals that pose an immediate health hazard, immediate action is necessary to eliminate these exposures.

Our chemical industry could be designing a whole new set of chemicals that are safer and ultimately beneficial for human health and the environment with expertise that already resides in our universities and institutes.

The Transition to Safe Chemicals

Step One

Safer Chemistry—Companies can assemble a list of high risk chemicals and substance by substance phase them out of their products.

Step Two

Green Chemistry—The chemical industry can learn the guiding principles of what consitutes toxicity and potential hazards by reviewing the large body of resarch and studies in toxicology and pharmacology. Then they can use these principles to design chemicals less likely to be hazardous.

Step Three

Ecological Chemistry—The chemical industry and university researchers can identify those chemicals commonly employed by natural systems to support life and study the processes by which organisms make these safe materials. These principles then become the basis on which to design safe chemicals and materials.

Source: Adapted from *Making Safer Chemicals*, Ken Geiser, Lowell Center for Sustainbale Production, Aujgust 2004.

Ten Things You Can Do for a Toxic-Free Future

The public, consumers, industry and elected officials can hasten the move to safe chemicals use in society and we suggest ten steps below:

1 **Get Involved**—contact your local or state environmental group working to advance safe chemical production and ask them how you can help their efforts (for the seven states partnering on this project, please see contact info below. For other states, please visit *www.besafenet.org*). These and other national groups will be promoting the passage of the Green Chemistry Bill and working to reform federal chemical regulations.

California
Center for Environmental Health
www.cehca.org
Silicon Valley Toxics Coalition
www.svtc.org

Maine
Environmental Health Strategy Center
www.preventharm.org

Massachusetts
The Alliance for a Healthy Tomorrow
www.healthytomorrow.org

Michigan
Ecology Center
www.ecologycenter.org

New York
Citizens Environmental Coalition
www.cectoxic.org

Oregon
Oregon Environmental Council
www.oeconline.org

Washington
Washington Toxics Coalition
www.watoxics.org

2 **Don't buy products made of polyvinyl chloride plastic (PVC), or 'vinyl'**—this includes vinyl floors, vinyl shower curtains and imitation leather goods such as vinyl bags and toys. PVC requires a cocktail of chemicals such as phthalates and organotins tested for in this study. Vinyl plastic uses the number 3 to distinguish it from other plastics (or you can call the company to find out what kind of plastic it is). Visit the Healthy Building Network to find PVC-free building materials *(www.healthybuilding.net)* and Greenpeace International data base of PVC alternatives *(www.greenpeace.org. au/pvc/)*.

3 **Use natural forms of pest control in your home and gardens.** For information visit the Pesticide Action Network's website at *www.panna.org/resources/advisor. dv.html.* Also visit *www.beyondpesticides.org.*

4 Buy curtains, carpets or furniture that are free of brominated flame retardants or perfluorinated chemicals. Contact companies directly to ask if they use these chemicals in their products. See *www.safer-products.org* for more information. In addition, you can replace carpets with wood floors, cork tiles, linoleum and area rugs. For more information visit *www.healthybuilding.net* and *www.greenpeace.org.au/pvc/*.

5 Next time you buy cosmetics, choose products that are free of suspect chemicals. Visit the Safe Cosmetics Campaign to find brand name companies that are phasing out harmful chemicals *(www.safecosmetics.org)*.

6 Purchase your electronic products from companies that avoid brominated flame retardants (BFR). You can find a list of companies which are leading the field at *www.computertakeback.org* and *www.cleanproduction.org* or visit our website at *www.safer-products.org*. Also ask companies when they intend to phase out the use of PVC cables.

7 Initiate a safer chemicals program in government procurement of all products and services at the local or state level for bulk purchases of computer and electronic goods, and other product sectors outlined in our report. Initiate pesticide-free bylaws for all public spaces, and a phase out of vinyl use in all public buildings and furnishings.

8 The same can be done in the private and institutional sector. If your employer buys in bulk from suppliers, find out about their chemicals policy. At a minimum your company should have a strict phase out date for all Chemicals for Priority Action and a timeline for transitioning to safer materials. It is imperative that buyers source non-PVC plastic (vinyl) for building materials and consumer products. Big buyers can influence the market in a way that individual consumers can not.

9 If you are a retailer ask your buyers to implement a safer chemicals agreement with their suppliers and make your policy public. Responsible retailers such as IKEA have implemented a strict chemicals policy which they enforce through frequent spot checks on their products. Other retailers have joined retailer consortiums to exert more pressure on their chemical suppliers. Post your chemicals policy on the web, through product labelling or through other forms of direct communication with your consumers.

10 Prioritize local and organic food in school cafeterias, hospitals and other institutional settings. Initiate pesticide-free bylaws in your local community.

More Resources

Clean Production Action *(www.cleanproducti on.org)*, working with state partners, launched the Safer Products Project to generate public support for safe chemicals. We intend to give updates to people who wish to stay informed via our website at *www.safer-products.org*.

The following websites provide a wealth of information and an invitation to join in the movement to promote safe chemicals production and use.

Vinyl, also called PVC, uses a wide variety of toxic ingredients. When burned in fires, incinerators or accidentally, as in house fires, PVC will form dioxin as a byproduct—the most toxic compound ever synthesized. For information and further links to information on PVC visit:

- *www.healthybuilding.net*
- Greenpeace International data base of PVC alternatives *www.greenpeace.org.au/pvc/*
- *www.myhouseisyourhouse.org*
- *www.besafenet.com*
- *www.grrn.org*

Pesticides. Find safer alternatives at:

- *www.panna.org/resources/advisor.dv.html*
- *www.beyondpesticides.org*

Cosmetics. Find who is using safer chemicals at:

- *www.safecosmetics.org*

Cleaning Products. Find out which products contain hazardous chemicals at:

- *www.net.org/health/cabcon_results.vtml*

Electronics. The Computer Take-Back Campaign can tell you who is 'taking it back and making it clean" at *www.computertakeback.org*. Also visit the Silicon Valley Toxics Coalition for information about materials in electronics at *www.svtc.org*

Clean Production. For information on how manufacturing plants and product designers are moving to safer chemicals visit:

- *www.cleanproduction.org*
- *www.bluegreen.org*
- *www.mbdc.com*
- *www.sustainableproduction.org*
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