

POLYBROMINATED DIPHENYL ETHERS (PBDES)

Overview

PBDEs, a subgroup of brominated flame retardants, are persistent and bioaccumulative industrial chemicals that cause numerous problems including Cancer, thyroid problems, and neurodevelopmental effects (#Schmidt, 2003) (#Eriksson et al, 2006). They have been widely used since the 1970s as flame retardants in electronics, textiles, and polyurethane foam, among others (#Stiffler, 2007 and #Birnbaum, 2004). They are mixed into the products in order to raise the temperature at which they burn, making the products more flame resistant. PBDEs are released from products when TVs or computers heat up, while sleeping on mattresses, or when the products degrade (#Stiffler, 2007). The group - made up of penta, deca, and octa formulations - was voluntarily banned in the EU, and octa and penta mixtures have been banned nationally in the US with certain states banning the deca formulation (#Birnbaum, 2004). In general, lower brominated compounds are more toxic than higher brominated compounds (#Birnbaum, 2004).

Chemical Description

Structurally, PBDEs are very similar to PCBs. There are over 209 different PBDE compounds, and the three most common commercial formulations are deca, octa, and penta depending on the number of bromine atoms. PBDEs are considered more degradable than other persistent chemicals due to their weak carbon-bromine bond (#Schmidt, 2003).

Because they are merely additives mixed into products, they have the ability to leave the products during degradation (A#TSDSR, PBBs and PBDEs).

They accumulate in fatty tissues of organisms and are passed up the food chain to larger organisms in a process known as Biomagnification. A 25-year Swedish study indicated that PBDE levels in people double approximately every five years (#Stiffler, 2007, #Schmidt, 2003).

Deca

Deca accounts for 80 percent of the PBDEs currently produced and is composed of around 97 percent pure brominated diphenyl ether. It is used primarily as an additive in electronics, electronic equipment, and textiles, and it is commonly found in mattresses and TVs (#Birnbaum, 2004). It is practically nontoxic in laboratory conditions, but in sunlight it breaks down into penta and tetra forms of PBDEs, which accumulate within organisms and biomagnify(Schmidt). The U.S. produces deca, the most controversial and widely used formula, at a rate close to 50 million pounds a year, most of which is used in television

casings. Deca demand is expected to grow because it is now approved for use to meet new federal fire safety standards for residential furniture and mattresses.

Octa

Manufacturers discontinued production of Octa in 2004 ([#Stiffler, 2007](#)).

Penta

Penta is a viscous liquid used primarily as an additive in textiles and polyurethane foams and is composed of 24-38 percent tetraDPE, 50-60 percent penta, and 4-6% HxBDE ([#Birnbaum, 2004](#)).

Manufacturing of this form was halted in 2004 ([#Stiffler, 2007](#)).

Exposure

PBDEs enter the air, water, and soil when they are put into products or when they exit products as a result of degradation ([#ATSDR, PBBs and PBDEs](#)). They **biomagnify** up the food chain and are stored in fats. They are now ubiquitous in the environment - found from the Arctic to the Antarctic - and are present in nearly all human bodies ([#Stiffler, 2007](#)).

Health Effects

Very serious health effects are associated with exposure to PBDEs, but toxicity depends on the compound and the amount that one is exposed to. PBDEs are chemically similar to **PCBs** and, not surprisingly, they show similar health effects as well ([#Sightline](#)). They are **biomagnified** toxic compounds, meaning they accumulate within food chains. Laboratory studies on mice have shown them to be **neurotoxic** chemicals, neurobehavioral and **developmental toxicants**, and **Carcinogens**. They have noticeable effects on the thyroid and liver ([#Schmidt, 2003](#), [#Birnbaum, 2004](#), and [#ATSDR, PBBs and PBDEs](#)) and they impair learning, memory, sexual development, and behavior ([#Sightline](#)). Additionally, PBDEs and **PCBs** - still present in the environment - can "interact and enhance neurobehavioral defects when the exposure occurs during a critical stage of neonatal brain development" ([#Eriksson et al, 2006](#)). Exposure to PBDEs is nearly impossible to avoid due to their ubiquity in the air, water, food, human fat, and breast milk ([#ATSDR, PBBs and PBDEs](#)). The fetus is exposed to the toxins in utero as well as from breast milk, which where the toxins are transferred from the mother to the baby. A 25-year Swedish study found that the concentration of PBDEs in breast milk doubled every five years during the 25-year period ([#Eriksson et al, 2006](#)).

Environmental Effects

The health concerns listed above also apply to wildlife and all animals.

PBDE Benefits

PBDEs are low-cost chemicals that can halt or slow the spread and duration of fires ([#Stiffler, 2007](#)). However, manufacturers have abandoned production of penta and octa formulations, and some have found suitable alternatives to deca ([#Stiffler, 2007](#)).

Precautions

Consumer Precautions

Consumers do have the ability to limit exposure to PBDEs. Below is a list of tips from the [Green Guide](#):

- ♣ Eat a heart-healthy diet. Reducing your consumption of animal fats will also lower amounts of [PCBs](#), [PBDEs](#), [dioxins](#) and other POPs in your diet. "Eating less amounts of animal fats will result in lower PBDE levels (in our bodies) in the long run," says Dr. Birnbaum. She recommends a heart-healthy diet, which will reduce your exposure to [biomagnifying chemicals](#) such as [PBDEs](#), [PCBs](#) and [dioxins](#), as well as reduce your risk of cardiovascular disease.
- ♣ Eat farmed fish less frequently (some researchers recommend no more than once per month), especially European and Atlantic salmon, which have been shown to have high [PBDE](#), [PCB](#) and [Dioxin](#) levels. Choose wild salmon - fresh, frozen or canned - instead.
- ♣ Clean floors with a HEPA filter vacuum cleaner that traps fine particles of dust, soot, and pollen, and wet mop regularly. Keep your home well-ventilated. This will also help reduce concentrations of other forms of indoor air pollution, according to Dr. McDonald.
- ♣ Cover and seal rips in upholstery with exposed polyurethane foam, especially if the foam is loose and crumbling. Exposed foam may release PBDEs directly into house dust and air.
- ♣ Contact your mattress manufacturer to see whether your mattress is made with polyurethane foam that contains PBDEs. If it does, but you aren't ready to replace your mattress, consider purchasing a tightly woven allergen-barrier mattress casing to block dust that may be laden with PBDEs. As soon as the mattress shows wear, replace it with a PBDE-free option.

See the [Green Guide](#) and the [Pollution in People](#) website for more tips on how to avoid PBDEs.

Manufacturing Precautions

From the Toxic Free Legacy Coalition:

Manufacturers can avoid using PBDEs by designing products using inherently flame resistant materials, such as metal, glass, pre-ceramic polymers, Kevlar, leather, and natural fibers including jute, hemp, and wool. Safer flame-retardant chemicals are another option as well.

Many manufacturers of electronics, mattresses, and furniture have already stopped using PBDEs and are still meeting the highest fire safety standards.

Washington's PBDE bill will not prescribe what non-PBDE materials manufacturers should use, but instead allows flexibility on how to comply with the ban. The legislation's ban on the deca form of PBDE will be enacted in January 2010 only if the Washington Departments of Ecology and Health find a safer alternative to deca that is available at a reasonable cost AND approved by a fire safety committee made up of five fire association representatives.

Electronic manufacturers can meet the highest fire safety standards without using PBDEs. Many large computer companies have already voluntarily stopped using PBDEs and switched to inherently more fire-resistant materials, or the use of other chemical retardants. Because the bromine industry has voluntarily stopped manufacturing the highly toxic penta and octa forms of PBDEs, the focus of alternatives assessment is on safer, effective alternatives to the use of deca.

Companies that have stopped using PBDEs include Dell, Canon, Hewlett-Packard, Ericsson, Mitsubishi, and Sony. Many other companies are phasing out the use of PBDEs in their product lines.

Source : <http://www.toxipedia.org/pages/viewpage.action?pageId=296>