



Guide To

PBDE: Toxic Flame Retardant What Women, Children and School Personnel Need to Know

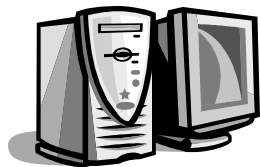
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What are Flame Retardants?

Chemical flame-retardants are used in a variety of products to prevent the spread and occurrence of fire. While fire



safety is critical, this family of chemicals, known as Polybrominated diphenyl ethers (PBDEs) are highly toxic. They are found

in carpeting, foam cushions, polyester clothing and bedding, wallpaper, toys, household dust, a variety of plastic products, meat and dairy products, computers, faxes, cell phones and other electronic devices.

PBDEs are man-made chemicals that do not break down and are bioaccumulative; they build up in our bodies over our lifetimes and accumulate in the environment. Structurally, they are similar to PCBs, which were banned in 1979 because of their high toxicity, persistence, and evidence that they can cause developmental problems in children.

According to Environmental Working Group, the U.S. is the world's largest maker and user of PBDEs, and levels found in Americans are as much as 100 times higher than in Europe, where PBDEs were banned in 2001. There are three types of polybrominated diphenyl ethers—penta, octa and deca— which work differently for various applications.

Toxic Flame Retardants in American Schools

PBDEs, especially deca-BDE, are in products commonly found in schools. They are in furniture upholstery, drapes, seating, office equipment, televisions, computers and other educational technology. In fall 2001, an estimated 99 percent of U.S. public schools had access to the Internet. Today, there is about one instructional computer for every three students in the United States, according to the U.S. Department of Education. Scientists have found PBDE chemicals in dust samples swiped from computers and interactive technology, which can easily be inhaled or ingested and can rapidly accumulate in children's bodies. In tiny doses these fire retardants impair attention, learning, memory and behavior in laboratory animals.



Rising Levels in the U.S.

- Levels of PBDEs in U.S. women's breast milk are 10-100 times higher than levels in European women.
- PBDE levels in U.S. fish, sediments, and wastewater are increasing.
- Total PBDE levels in breast milk, blood and tissues have increased by a factor of 100 during the past 30 years, doubling about every five years.
- PBDE levels in the Great Lakes trout doubled every 3-4 years between 1980 and 2000.

The Dangers of Deca-BDE:

- The three most common formulations of poly-brominated diphenyl ethers—penta, octa and deca—contain different numbers of atoms of bromine in molecules. Penta has an average of five bromines, octa has eight, and deca has mostly 10 bromines per PBDE molecule.
- Penta and octa-PBDE have been voluntarily phased out by Chemtura (previously called Great Lakes Chemical Corp), the only U.S. manufacturer of these two chemicals. However, deca is still of great concern.
- Deca-BDE is the highest volume commercial flame retardant mixture, and can easily break down to more toxic forms, including penta and octa that have been phased out.
- Deca is widely found in the environment, and builds up in fish and the human body, including umbilical cord blood and breast milk. High concentrations are also in dust found indoors.
- Deca is a neurological toxin and children are most highly exposed.



The European Union has already restricted the use of deca in electronic devices and two U.S. states have passed legislation calling for a phaseout of deca in residential products.

The widest use of deca (up to 80 percent) is in plastic polymers commonly used to make computer and audio/video equipment, cell phones, fax machines, appliances and televisions. Deca is also used in textile and wire and cable applications.

Deca can degrade into more toxic forms (similar to penta) in the environment in soil, sediment, dust found indoors and fish tissue. Many studies are now finding deca in humans.

- Deca has been identified in the umbilical cord blood of newborn babies.
- In several studies, deca has been found in the breast milk of women.

Health Effects of PBDEs

In studies, PBDE flame retardants have been shown to impair learning, memory, attention and behavior, disrupt thyroid functioning, depress immune systems, cause reproductive and neurological problems and may also cause cancers. **According to scientists, human blood and tissue levels of these chemicals have been doubling every two to five years in the U.S.**

PBDEs easily off-gas from products that incorporate them, are readily absorbed by the body, slowly eliminated; accumulating in our fatty tissue, and pollute the environment. Scientists have found that low doses of PBDEs can disrupt thyroid hormone levels and interfere with neurodevelopment. In the womb, thyroid impairment causes permanent harm to brain and sensory organ function. PBDE levels can be especially high in children because they take in more food, air and water than adults. Babies and children are exposed to PBDEs by drinking breast milk, ingesting dust found indoors, consuming meat and dairy products, and coming into contact with products such as electronics, foam, and polyester materials. According to an Environmental Working Group report, “The average level of bromine-based fire retardants in the milk of 20 first time mothers was 75 times the average found in recent European studies.” Moreover, flame retardants in pregnant women have access to the developing fetus, which is most vulnerable to toxic chemicals.

Deca: More Toxic than Previously Thought

- ◆ PBDEs, like PCBs, are toxic to the brain, reproductive system and liver and disrupt thyroid function.
- ◆ Deca has the ability to cause the same effects on developing brains as penta, which has already been banned in eight states and Europe.
- ◆ An estimated 15 million women living in the U.S. have levels of PBDEs in their body greater than levels that have been shown to cause reproductive problems in laboratory animals.
- ◆ The U.S. EPA considers deca a possible human carcinogen.
- ◆ Children are receiving up to 300 times greater exposure than adults, primarily from breast milk, and dust ingestion and inhalation.

Avoiding Toxic PBDEs

Alternatives to the use of PBDE flame retardants are available and cost effective. Some alternatives are:



- ◆ product redesign to eliminate the need for these chemicals;
- ◆ use of natural flame retardant materials like wool and leather or plastics containing sulfur;
- ◆ use of less toxic chemicals, like red phosphorus, ammonium polyphosphate and aluminum trihydroxide.
- ◆ Self-extinguishing plastics that do not need added flame retardants e.g. polysulfone, polyaryletherketone, and polyethersulfone.



Many electronic firms are taking the lead in using safer alternatives or designing products without the need for chemical flame retardants, including Apple, Dell, Xerox, Ericsson, IBM, Intel, Motorola, Sony, Panasonic, Phillips, and many others. Motorola now uses a PBDE-free laminate that is cost effective, while meeting fire safety standards.

Advice for Parents and Schools:

Demonstrate your purchasing power!

Individual consumers, schools, colleges and universities can use their purchasing power to drive the demand for higher environmental, health and safety standards in the electronics industry by demonstrating responsible electronics purchasing.

In July, 2006, the U.S. EPA initiated “EPEAT,” the Electronic Product Environmental Assessment tool. This system is designed to help purchasers like schools, healthcare facilities and state, local and federal governments to compare and select laptops, desktop computers and monitors based on a list of preferred environmental attributes. Electronic Product Assessment Tool: www.epeat.net

Note: As part of the Toxic Substances Control Act, the EPA has identified chemicals, including PBDEs, for risk assessment, to take place in 2013 and 2014. Learn more at <http://www.epa.gov/oppt/existingchemicals/pubs/workplans.html#2013>

Prevent Electronic Waste!

According to the Silicon Valley Toxics Coalition, up to 80% of U.S. electronic waste is exported to developing countries where toxic components are burned, dumped or smashed apart by low wage workers or children or sent to U.S. prisons where inmates work without federal health, safety or labor protection. Only 10% of unwanted or obsolete computers are recycled responsibly.

Send your old equipment back to the electronic company! Computer manufacturers now offer computer recycling programs that you can use, often for free. Dell, HP and Apple all have computer “take back” policies that allow you to send back your old equipment when buying a new product. Dell will take back any Dell product for free, and will recycle any company’s old computers even if you’re not buying a new one.

How to Find Preferred Products:

Check out these websites for safer alternatives to toxic PBDE flame retardants on the market.

- ◆ **The Silicon Valley Toxic Coalition**, www.svtc.org
- ◆ **Computer TakeBack Campaign**, www.electronicstakeback.com/
- ◆ **Clean Production Action**, www.cleanproduction.org
- ◆ **Safer Products Project**, www.saferproducts.gov
- ◆ **Pollution in People**, www.pollutioninpeople.org

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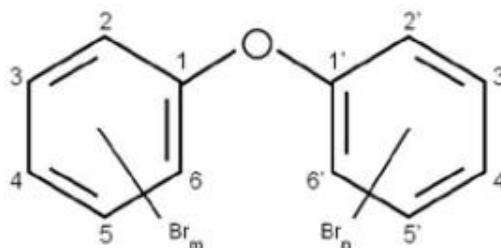
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Molecular Structure of PBDE
(where $m + n = 1$ to 10 bromine atoms)



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