Practice Prevention

PBDEs

from the Learning and Developmental Disabilities Initiative, July 2006

"You want to keep your family safe from fire. But, to do this, must you put your family at risk for non-Hodgkin lymphoma or breast cancer or put your children at risk for possible developmental brain disorders? Fortunately, the answer is no.

PBDEs are good flame retardants and are used in many products to limit the expansion of small flames into larger flames. However, there are alternatives.

What can you do? PBDEs are being phased out of many consumer goods. Avoid purchasing items that still have PBDEs added to them. Instead, use products that are naturally flame-retardant; wool is a good example. Ventilate and clean your house to minimize the level of PBDEs in the home. Limit the amount of fat and other PBDE-laden foods your child eats. If pregnant or nursing, these suggestions are even more critical.

Watch out for your family's safety. Help other families by being proactive with your government officials, urging them to reduce the levels of PBDEs in your community."

- Larry B. Silver, MD

What are PBDEs?

Polybrominated diphenyl ethers, better known as PBDEs, are man-made chemicals that are added to some fabrics and plastics during the manufacturing process. PBDEs act as flame retardants, greatly reducing the risk of a small flame turning into a large fire.[1] PBDEs are used to meet federal, state and local flammability standards for mattresses and other items in the U.S., and they save hundreds of lives each year.

There are different kinds of PBDEs. PentaBDEs are added to mattresses and foam cushioning in upholstery, while octaBDEs are used in business equipment, automobile trim, telephones, and kitchen appliance casings. DecaBDEs are used in electronic enclosures, such as wire insulation, televisions and computers.[1] DecaBDEs are also used as a fabric treatment and coating on carpets and draperies.

What is the effect of PBDEs on children's health and development?

Human clinical studies have suggested links to non-Hodgkin lymphoma and breast cancer after PBDE exposures.[2] Although we don't have clear evidence about the health effects of PBDEs on human brain development, a number of harmful effects have been shown in animals such as mice and rats:

- PBDE exposure before and after birth caused problems with brain development in mice. Studies have observed problems with learning, memory and behavior.[3]
- Exposure to PBDEs during development can decrease thyroid hormone levels in mice.[2] Appropriate levels of thyroid hormone is essential for healthy brain development. Decreases in thyroid hormone may contribute to problems with brain and nervous system development.[4]
- Mice pups demonstrate difficulties in excreting PBDEs compared to adult mice, leading to higher concentrations during key developmental windows.[5]

In addition, PBDEs are very similar in molecular structure to polychlorinated biphenyls (PCBs), which were commonly used as lubricants in electrical transformers for decades. When scientists discovered that PCBs affected healthy neurological development in humans, they were banned in the 1970s. PBDEs also harm reproductive systems and immune system performance and are associated with liver tumors in mice and rats.[2,6,7]

PentaBDEs have shown harm at the lowest exposures compared to decaBDEs[8], meaning that the pentaBDEs are more toxic.

How are children exposed to PBDEs?

Children can be exposed to PBDEs in most places that they spend time: at home, at school, and in cars and buses. For many years, PBDEs have been added to these products:

- mattresses, futons and other cushions
- pillows, mattress pads and other bedding
- casings for appliances, televisions and computers
- cars, airplanes and buses
- textiles such as carpeting, draperies and upholstery fabric (Fabrics for clothing are treated with other flame retardants, not PBDEs.)

PBDEs are released from these products[9] into the air and combine with dust that then settles onto household surfaces. Children can be exposed if they play in dusty areas or put contaminated items into their mouths.

PBDEs are also found increasingly in food[10], especially oils and fats, fish and shellfish, meat and meat products, and eggs. The lowest levels of PBDEs have been found in fruits, vegetables, and tubers such as potatoes. Higher levels are found in farmed salmon than wild salmon.

PBDEs have been found in the breast milk of 100 percent of nursing mothers tested in Oregon, Washington, British Columbia and Montana. Levels of PBDEs in breast milk are shown to be 20 to 40 times higher than those in the breast milk of European women. In addition, the levels have increased rapidly in the last 20 years.[11] It is important to emphasize, however, that breastfeeding is still the best thing you can do for your infant for many good, healthy reasons.

What can you do to reduce your child's risk?

There are several steps that parents can take to reduce children's exposure to PBDEs:

Many PBDEs are being phased out of consumer goods such as mattresses and electronics. Some companies such as Ikea, Panasonic and Sony have already eliminated the use of PBDEs in their products. However, older items still contain high levels. Avoid purchasing items that have PBDEs added to them, especially the more toxic pentaBDEs. Older mattresses are especially high in pentaBDEs.

Purchase mattresses and bedding made with materials, such as wool, that are naturally flame-retardant and meet flammability standards without added chemicals.

Ventilate and clean your house to avoid the build-up of PBDEs in the air and dust. When you dust and mop, use a damp rag and mop to avoid stirring up the dust and spreading PBDEs into the air.

Limit how much fat and other high-PBDE foods your child eats. Offer smaller portions of meats, fish, and eggs, and add more fruits and vegetables to your family's diet.

Pregnant women and nursing mothers can also reduce their exposure to PBDEs to avoid passing them to their children. All the steps mentioned above will help reduce a woman's intake of PBDEs.

Ask your government officials and policymakers to reduce levels of PBDEs in your community by supporting the manufacture and use of safer flame retardant chemicals such as aluminum trihydroxide, ammonium polyphosphate and red phosphorus in furniture and electronic equipment.[12]

Footnoted resources

1. Agency for Toxic Substances and Disease Registry, Public Health Statement for Polybrominated Diphenyl Ethers (PBDEs), www.atsdr.cdc.gov/toxprofiles/phs68-pbde.html, viewed 1 March 2005.

2. Siddiqi MA, Laessig RH, Reed KD. Polybrominated diphenyl ethers (PBDEs): new pollutants-old diseases. *Clinical Medical Research.* 2003 Oct;1(4):281-90.

3. Gill U, Chu I, Ryan JJ, Feeley M. Polybrominated diphenyl ethers: human tissue levels and toxicology. *Review of Environmental Contaminants and Toxicology*. 2004;183:55-97.

4. Mazdai A, Dodder NG, Abernathy MP, Hites RA, Bigsby RM. Polybrominated diphenyl ethers in maternal and fetal blood samples. *Environmental Health Perspectives*. 2003 Jul;111(9):1249-52.

5. Staskal D, Diliberto J, Birnbaum L. Disposition of BDE 47 in Developing Mice. *Toxicological Science*. 11 Jan 2006 [Epub ahead of print], www.ncbi.nlm.nih.gov/entrez/ Viewed 1 March 2006.

6. Kuriyama SN, Talsness CE, Grote K, Chahoud I. Developmental Exposure to Low Dose PBDE 99: 1--Effects on Male Fertility and Neurobehavior in Rat Offspring. *Environmental Health Perspectives*. 2005 Feb;113(2):149-54.

7. Agency for Toxic Substances and Disease Registry, ToxFAQs: Polybrominated Diphenyl Ethers (PBDEs), www.atsdr.cdc.gov/tfacts68-pbde.pdf, (viewed 16 May 2006).

8.Darnerud PO. Toxic effects of brominated flame retardants in man and in wildlife. *Environment International*. 2003 Sep;29(6):841-53.

9. Watanabe I, Sakai S. Environmental release and behavior of brominated flame retardants. *Environment International*. 2003 Sep;29(6):665-82.

10. Kiviranta H, Ovaskainen ML, Vartiainen T. Market basket study on dietary intake of PCDD/Fs, PCBs, and PBDEs in Finland. *Environment International*. 2004 Sep;30(7):923-32.

11. Smith C. “Study shows toxin in breast milk.” *Seattle Post-Intelligencer.* 29 September 2004, seattlepi.nwsource.com/local/ 192899_toxins29.html, viewed 2 February 2005.

12. Federal Environmental Agency (Germany). Environmentally hazardous and health-damaging flame retardants: Reduce use and replace. http://www.umweltbundesamt.de/uba-info-presse-e/presse-informationen-e/p5601-e.htm, viewed 14 March 2005.

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