



“The story of polychlorinated biphenyls (PCBs) is a modern version of Pandora's Box. The box was opened and we cannot put all of the 'evils of the world' back

and close the lid. We can now, however, try to minimize the damage caused by the release of PCBs into our world and learn from this mistake.

In the mid 1900s, PCBs were the wonder of industry. Non-flammable, chemically stable and with a high boiling point, they were ideal as insulators, lubricants, and plasticizers in electrical equipment and in other industrial applications. The problem is that being chemically stable resulted in PCBs persisting in the environment when released into nature during manufacturing, use and disposal. By the 1970s, high levels of PCBs noted in the environment resulted in a 1976 federal law requiring phasing out PCBs. But the damage had been done. High levels were and continue to be found in the bodies of wildlife and humans. Details about this process and the consequences of this accumulation — including developmental and reproductive effects — are elaborated in this article.

We cannot turn back the clock and eliminate PCBs from our environment. However, we can reduce our children's exposures. This column describes how to protect your child and family from the harmful effects of PCBs still found in older appliances and fixtures, landfills and soil.”

- Larry B. Silver, MD

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What are PCBs?

Polychlorinated biphenyls, commonly known as PCBs, are mixtures of up to 209 individual chlorinated compounds. They can be oily liquids, vapor in air or solids that are colorless to light yellow. PCBs are all manmade — there are no PCBs that occur naturally in the environment. They have no odor or taste.^{1,2}

Before they were phased out by a 1976 U.S. federal law, PCBs were used as coolants and lubricants because they don't burn easily and are good insulators. They were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics and rubber products; in pigments, dyes and carbonless copy paper and many other applications.

More than 1.5 billion pounds of PCBs were manufactured in the United States before 1977.²

PCBs were used so widely partly because of their chemical stability. Unfortunately, this stability is also what makes them persist in the environment — PCBs don't break down.¹ PCBs have entered air, water and soil during their manufacture, use and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.¹

Even several decades after stopping the manufacture of PCBs, we're still being exposed to and suffering the health effects of these chemicals. They're out there, and we can't take them back.

How do PCBs affect children's health?

PCBs have been shown to affect or harm humans in several ways. Babies born to women who ate PCB-contaminated fish have shown abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and

a decrease in short-term memory, can last for several years.¹

Other studies have suggested that the immune system is affected in children born to and nursed by mothers exposed to increased levels of PCBs.¹ Compromised immune

Health effects (continued)

systems from PCBs have led to greater numbers of respiratory and ear infections.³ PCBs can also lead to thyroid toxicity as well as changes in thyroid hormone levels in both children and adults³ (for more information on the importance of thyroid hormones on children's development, please see related Practice Prevention columns).

Yet other effects have been found in workers exposed to PCBs. Chloracne (a severe and sometimes persistent form of acne resulting from

exposure to chlorine compounds) is a well known indicator of exposure to PCBs. Other skin and eye problems, menstrual disturbances and lowered male fertility have resulted from exposure. Workers exposed to PCBs have also shown increased rates of cancer at several sites, particularly the liver, biliary (gallbladder) tract, intestines, and skin.³ The Department of Health and Human Services, the Environmental Protection Agency and the International Agency for Research on Cancer have all determined that PCBs probably cause cancer in humans.¹

How are children exposed to PCBs?

PCBs remain in many products and can still be released to the environment from hazardous waste sites, illegal or improper disposal of industrial wastes and consumer products, leaks from old electrical transformers containing PCBs and burning of some wastes in incinerators. Once in the air, PCBs can travel long distances before settling on land and water.

PCBs bind strongly to soil. In water, PCBs tend to stick to organic particles and bottom sediments and are taken up by small organisms and fish in water. They then accumulate in animals that eat these small aquatic organisms and fish, reaching levels that may be many thousands of times higher than in water.¹

Children can absorb PCBs by inhaling them, ingesting them with food or drink or through direct contact with skin.³ Contaminated food, water, soil and other surfaces are therefore routes of exposure.¹

- **Food:** The main food sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat and dairy products. PCBs accumulate in animal fats and fatty tissues.⁴
- **Air and soil:** Children can inhale or contact PCBs when playing or spending time near hazardous waste sites or in an area where there was a transformer fire.
- **Water:** Drinking contaminated well water can expose children to PCBs.
- **Old appliances and equipment:** Discarded older appliances, electrical equipment or transformers may contain PCBs. Children who play in or with these items can be exposed. Refrigerators, television sets and fluorescent light fixtures from the late 1970s or earlier that are still in use may leak small amounts of PCBs when they get hot during operation. Children who touch the leaking PCBs can absorb them through their skin.

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

Sport fish. Many areas post fish advisories if the levels of PCBs or other contaminants in local waters are known to be high. Before catching and eating fish, find out if there are any existing advisories in the lakes and streams you may be fishing. Advisories may be posted on warning signs near the water, although sometimes signs are missing. To be safe in the absence of a sign, call your local or state health or environmental protection department to learn about any advisories on the types and sizes of fish that may be eaten. Generally, fish that feed on insects, such as bluegill, perch, stream trout, and smelt, tend to be lower in PCBs. Lake trout and fish that feed on the bottoms of lakes and streams may contain higher levels of PCBs. Younger, smaller fish of these bottom feeders usually contain fewer PCBs than older, larger fish.

When cleaning fish, remove the head, organs, skin, and fat. Grilling, baking, or broiling fish can cook off more fat where PCBs accumulate, whereas frying fish can seal in the harmful pollutants.⁴ Fish can also be poached if the broth is discarded.⁵

Other meats. Before cooking, remove all visible fat on meat, including the skin on chicken. Grill meats or use other cooking methods that allow potentially contaminated fat to drip away from the meat.⁴

Fruits and vegetables. Washing and peeling fruits and vegetables will remove potentially contaminated soil and residues from them.^{4,5}

Old appliances and electrical equipment.

Whenever possible, remove old (pre-1979) appliances, fluorescent light fixtures, and transformers from your home and property. Don't let children play near old equipment or garbage incinerators.⁴

Soil. Children should wash their hands after playing in soil and should not be allowed to put dirty hands, toys or other items in their mouths.⁶

Adult work exposures. Parents or others who are exposed to PCBs at work can bring them home on clothes, tools or other equipment. These adults should shower and change clothes if possible before coming home. Potentially contaminated tools and equipment should not be brought into the home or places where children will come in contact with them.⁶

Water. Wells in which a submersible pump has failed can be contaminated with PCBs. Contact your local Department of Health to find out how to clean the well.⁵

Breast milk. Sadly, human breast milk may be contaminated with PCBs from the mother's exposure at any time during her life. In most cases, the benefits of breastfeeding outweigh any risks from exposure to PCBs in mother's milk.¹ Pregnant and nursing women should take extra care to avoid additional exposures to PCBs.

For more information or for other Practice Prevention columns, visit the Institute for Children's Environmental Health (ICEH) online at www.iceh.org/resources.html or call 360-331-7904.



ICEH serves as the national coordinator for the Collaborative on Health and the Environment's Learning and Developmental Disabilities Initiative.



Footnoted resources

1. Agency for Toxic Substances and Disease Registry, PCB Fact Sheet. www.atsdr.cdc.gov/tfacts17.html, viewed September 14, 2006.
2. U.S. Environmental Protection Agency. Polychlorinated Biphenyls (PCBs). www.epa.gov/opptintr/pcb/, viewed September 14, 2006.
3. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Polychlorinated Biphenyls (PCBs). November 2000. www.atsdr.cdc.gov/toxprofiles/tp17.html, viewed September 14, 2006.
4. University of Minnesota. PCBs in the Environment and Their Extensive Effects on Fetuses and Children. enhs.umn.edu/5100/pcbs/reduce.html, viewed September 14, 2006.
5. Illinois Department of Public Health. Polychlorinated Biphenyls (PCBs). www.idph.state.il.us/cancer/factsheets/polychlorinatedbiphenyls.htm, viewed September 14, 2006.
6. Indiana University Northwest. Human Health. [/www.iun.edu/~environw/health1.html#Reduce%20your%20risk%20of%20PCB%20exposure](http://www.iun.edu/~environw/health1.html#Reduce%20your%20risk%20of%20PCB%20exposure), viewed September 14, 2006.