

PBBs (Polybrominated Biphenyls) in Michigan

Frequently Asked Questions – 2011 update

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What are PBBs (polybrominated biphenyls)?

Polybrominated biphenyls (PBBs) are man-made chemicals that were used as fire retardants in plastics that were used in a variety of consumer products. PBB is a relatively stable substance that is insoluble in water but highly soluble in fat. Manufacture of PBBs was discontinued in the United States in 1976.

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What happened in Michigan in 1973?

In early 1973, both PBB (sold under the trade name FireMaster) and magnesium oxide (a cattle feed supplement sold under the trade name NutriMaster) were produced at the same St. Louis, Michigan plant by the Michigan Chemical Company. A shortage of preprinted paper bag containers led to 10 to 20 fifty-pound bags of PBB accidentally being sent to Michigan Farm Bureau Services in place of NutriMaster. This accident was not recognized until long after the bags had been shipped to feed mills and used in the production of feed for dairy cattle. By the time the mix-up was discovered in April 1974, PBB had entered the food chain through milk and other dairy products, beef products, and contaminated swine, sheep, chickens and eggs.

As a result of this incident, over 500 contaminated Michigan farms were quarantined, and approximately 30,000 cattle, 4,500 swine, 1,500 sheep, and 1.5 million chickens were destroyed, along with over 800 tons of animal feed, 18,000 pounds of cheese, 2,500 pounds of butter, 5 million eggs, and 34,000 pounds of dried milk products.

For a more detailed account of the Michigan PBB incident, see G.F. Fries' 1985 journal article.⁴

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⁴ Fries GF. The PBB episode in Michigan: an overall appraisal. Crit Rev Toxicol. 1985;16(2):105-56. Review.

What did the Michigan Department of Community Health (MDCH) do about the PBB incident?

Despite the destruction of very large quantities of contaminated animals, dairy, and meat products, people throughout Michigan were potentially exposed through consumption of these food products.

Measurements eventually showed that the overwhelming majority of Michigan residents who were exposed to PBB received very low levels. Initial screenings from a sample of people from quarantined farms confirmed that they had higher levels of PBB in their blood but could not determine that PBB had caused any immediate health effects. In order to track and study any possible long-term health effects, the **Michigan Long-Term PBB Study** began in 1976, coordinated by the then-named Michigan Department of Public Health. MDCH worked with federal and academic health researchers to enroll and follow a cohort of approximately 4,000 people, mainly families and neighbors on farms who consumed the most contaminated products, and their offspring. These individuals completed health and exposure questionnaires and had their blood tested for levels of PBB and other chemicals in the environment. Information on cases of cancer and deaths were also recorded.

The registry of Michigan citizens exposed to PBBs was the basis of many years of scientific research on potential health effects. In 2011, MDCH discontinued any further activity to maintain this registry. Dr. Michele Marcus of Emory University continues her research on PBB health effects with interested cohort members. For information on current PBB research activities or to find out about participating in the research, [contact Dr. Marcus](#) or phone 1-888-892-0074.

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Do PBBs cause cancer?

It is not known whether PBBs can cause cancer in humans, but we know that they can cause liver cancer in rats and mice. The U.S. Department of Health and Human Services (HHS) determined that PBBs may reasonably be anticipated to be carcinogens.

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How does PBB exposure affect humans?

Some PBB-exposed Michigan residents complained of nausea, abdominal pain, loss of appetite, joint pain, fatigue and weakness. However, it could not clearly be established that PBBs were the cause of these health problems. There is stronger evidence that PBBs may have caused skin problems, such as acne, in some people who ate contaminated food. Some workers exposed to PBBs by breathing and skin contact for days to months also developed acne.

More recent studies have suggested that PBB and other related chemicals, such as PCBs and PBDEs⁵, may interact with the endocrine system⁶ and disrupt its natural balance (see the next section).

⁵ **PCBs** Polychlorinated biphenyls are a mixture of compounds very similar to PBBs. The difference between the two is the substitution of chlorine for bromine in PBBs. Polybrominated diphenyl ethers (**PBDEs**) are brominated flame retardants similar to PBBs. PCBs and PBDEs are man-made chemicals. Manufacture of PCBs was banned in the U.S. in 1977, but they persist as environmental contaminants; while PBDEs remain in use today as a additive to plastics and foam.

⁶ **Endocrine system** The group of organs and glands that work together to secrete hormones into circulation. The endocrine system plays an important role in growth and development of infants and children and the reproductive capacity of adults.

What are the results of the long-term study?

There is no one definitive result of the study: the Michigan Long-Term PBB Study has been very valuable in that researchers have been able to amass a wealth of data by following the same group of people over the course of more than 30 years following their exposure. Much of what scientists know about the human health effects of PBB contamination has been learned from the Michigan study, and numerous scientific articles stemming from the Michigan cohort data have been published over the years. Some of the recent (as of 2010) research is summarized below:

There is some evidence linking high PBB exposure to an increased risk of cancers of the breast and the digestive system and for lymphoma, but the numbers of cases are yet too few to draw firm conclusions. Increased rates of neurologic, immunologic, dermatologic, and musculoskeletal effects have been noted in the cohort; however, these effects do not show a consistent relationship with serum PBB levels.

Study results failed to show an association for PBB exposure with benign breast disease and duration of lactation, infertility, endometriosis, fibroids, thyroid dysfunction or hip fractures. However, spontaneous abortion rates were elevated among second-generation women born after the Michigan PBB incident. In addition, a high initial PBB serum level in conjunction with a recent weight loss (suggesting the potential release of stored PBBs) showed associations with a shorter menstrual cycle and with a longer bleed time during menstruation.

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How do I know that I've been exposed to PBB?

There are tests that can detect PBBs in blood, body fat, and breast milk. These tests can tell whether you have been exposed to high levels of the chemicals, but cannot tell the exact amount or type of PBB you were exposed to, nor whether harmful effects will occur. These tests are not routinely available at the doctor's office, but samples can be sent to laboratories that have the appropriate equipment. The MDCH Bureau of Laboratories no longer provides serum PBB testing; however, Emory University may do so for Long-Term PBB Study members (see contact info below).

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Do PBBs leave the body after exposure?

Yes, gradually. However, there is no medical treatment that will lower PBB levels in the human body.

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How long does it take for PBBs to leave the body?

Daniel Rosen from the Centers for Disease Control and Prevention (CDC) published a 1995 article citing 10.8 years as the calculated half-life of PBBs within the human body among those enrolled in the Long-Term PBB Study. This rate is not an absolute, but the average amount of time for half of the PBBs stored in the body to be excreted by natural processes. Currently, 30 years after the exposure period, this article suggests that the amount of PBBs in circulation in a typical human has likely halved approximately 3 times. For example, a person with a relatively high level of serum PBBs in 1973, like 10 ppb (parts per billion), in 2004 would likely measure less than 2 ppb in his blood. Furthermore, in another 10 years (2014) we could expect the serum PBB levels to be lower than the smallest detectable level of 1ppb⁷.

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⁷Rosen, D H, et al. Half-life of polybrominated biphenyl in human sera. Environ Health Perspect. 1995 Mar; 103(3): 272–274.

Where can I get more information?

Download [Tox FAQ, Frequently Asked Questions about PBBs](#) or [Toxicological Profile: PBBs and PBDEs](#) (the Tox. Profile is a comprehensive review of all the PBB research); or contact the Agency for Toxic Substances and Disease Registry (ATSDR) by phone **1-888-422-8737** or email cdcinfo@cdc.gov.

For information on current PBB research activities at Emory University, to find out about participating in the research, or to get more information on PBB serum testing, please [contact Dr. Michele Marcus](#) or phone 1-888-892-0074.

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