

Introduction

PCBs (polychlorinated biphenyls) are a class of chemicals consisting of 209 individual compounds known as congeners. Commercial products called Aroclors were produced from the congeners and were historically used for a variety of purposes, including heat reduction and fire prevention in electrical equipment. The EPA treats all PCBs as potentially hazardous to human health regardless of the different effects each congener may have. Due to health concerns, PCB production was banned in the US in 1979.

In New Bedford Harbor (NBH), high levels of PCBs and heavy metals measured in harbor sediment, water, and fish led to the identification of NBH as federally designated Superfund Site in 1983.

PCB Sources

- Outdoor:
 - Release of PCBs from industrial uses before the 1979 ban includes leaks and spills during manufacture and transport of chemicals, and illegal or improper waste management on land or in harbor sediments.
 - Dredging sediments in the harbor floor and transport of contaminated sediment to the CAD cell is likely to result in release of PCBs to the air.¹
- Indoor:
 - Old electrical appliances, fluorescent lighting fixtures, and building materials may contain PCBs. These release PCBs into the air, particularly when they get hot during operation.

PCBs in the environment

- PCBs can remain in the environment for decades.
- Once PCBs are discharged into the environment, they do not easily break down, but the relative amounts of the 209 congeners can change.
- PCBs that are released into the water bind to sediments on the harbor floor, but can be released back into the water over time and if sediment is disturbed.²
- Lighter PCBs can evaporate into the air from the soil, water, or exposed sediments at low tide.
- Small organisms and fish in contaminated waterways may absorb PCBs. PCB concentrations are shown to accumulate in fatty tissues of fish, and increase as it moves up the food chain.³
- Plant crops may contain low levels of PCBs if grown in contaminated soil.²

How do PCBs enter our bodies?

- People are mainly exposed to PCBs through the consumption of contaminated fish and shellfish.^{2,3}
- Exposure may also occur through inhalation of airborne PCBs or contact with skin due to equipment leaks, contaminated soils or sediment, or swimming in contaminated water.
- PCBs are absorbed into the body through the gastrointestinal tract, lungs, and skin.⁴ Once absorbed, the PCBs are carried in the bloodstream to organs, including the liver, kidney, immune system, and nervous system. PCBs can cross the placenta and some can cross the blood brain barrier. Most are stored in fatty tissue.⁴

How do PCBs affect our health?

- **Short term (acute) exposure** at very high concentrations, which one may encounter while working with PCBs, may result in irritation of the eyes and skin conditions including acne and rashes. Some studies have also shown irritation of the nose and lungs, depression, fatigue, nausea and vomiting, and liver damage.^{3,4}
- **Long term (chronic), lower dose exposures** have been shown to negatively impact the nervous, immune, and reproductive systems in adults and children. PCBs may block the action of hormones, which are important for the normal functioning of many organs.²

- **Neurological effects** – Studies of children born to women exposed to PCBs suggest effects on memory, reflexes, learning, IQ, and motor function.⁴
- **Immune system effects** – PCBs have been shown to suppress the immune system and increase susceptibility to infection in both adults, children and infants.⁴
- **Reproductive health** – Effects by PCBs on the human menstrual cycle (regularity and duration), fertility, and associations with increased miscarriage rates, as well as decreased birth weight and pre-term births have been reported.⁴
- **Cancer** – Workplace exposures have been associated with cancer of the liver and biliary tract. Animal studies have demonstrated cancer of the liver, thyroid and in some cases, immune system. While the EPA classifies PCBs as “probably carcinogenic to humans”, the International Agency for Research in Cancer classifies PCBs as “carcinogenic to humans”.^{2,4,5}

How can I be tested for PCB exposure?

- PCB levels can be measured in the blood. Results may detect past exposures and recent high-level exposures, but will not indicate the source, exact amount, or duration of exposure.²
- Quest Diagnostics labs offer PCB blood tests with the referral from a doctor’s office, for a cost of approximately \$130. However, interpretation of the results is difficult and most often inconclusive since PCBs are measured in most people, regardless of whether they live near NBH.

Are there standards for PCB levels?

Federal Standards:

- **Food:** Maximum limits of 0.2 parts per million (ppm) of total PCBs in infant and junior food, 0.3 ppm in eggs, 1.5 ppm in milk, 2.0 ppm in fish, and 3.0 ppm in poultry and red meat.⁶
- **Air:** Workplace guidelines have been set by NIOSH and OSHA for Aroclor PCB mixtures, but there are no guidelines for ambient air levels.²
- There are no standards for PCB levels in sediment.

Minimal Risk Levels: MRLs estimate daily human exposure to a hazardous substance that would not cause adverse health effects.⁷

- MRL for intermediate oral exposure: 0.03 µg/kg/day for neurological toxicity.
- MRL for chronic oral exposure: 0.02 µg/kg/day for immune system effects.

Note: PCBs are mixtures. Individual congeners are measured, but guidelines and regulations can be either for total PCBs or a subset of them. For example, the chronic oral exposure MRL above was determined by evaluating a PCB mixture called Aroclor 1254.

Where can I find more information?

- Agency for Toxic Substances and Disease Registry (ATSDR). 2000. “Toxicological profile for Polychlorinated Biphenyls (PCBs)”. <http://www.atsdr.cdc.gov/toxprofiles/tp17.pdf>
- EPA. “Polychlorinated Biphenyls (PCBs)”. 2000. www.epa.gov/osw/hazard/wastemin/minimize/factshts/pcb-fs.pdf

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3. EPA. “Polychlorinated Biphenyls (PCBs)”. 2000. www.epa.gov/osw/hazard/wastemin/minimize/factshts/pcb-fs.pdf
4. Agency for Toxic Substances and Disease Registry (ATSDR). 2000. “Toxicological profile for Polychlorinated Biphenyls (PCBs)”. <http://www.atsdr.cdc.gov/toxprofiles/tp17.pdf>
5. International Agency for Research on Cancer. 2015. “Agents Classified by the IARC Monographs, volumes 1-112”. <http://monographs.iarc.fr/ENG/Classification/ClassificationsAlphaOrder.pdf>
6. US Food and Drug Administration. 2014. “Code of Federal Regulations – Title 21: Sec. 109.30 Tolerances for polychlorinated biphenyls (PCB’s)”. <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcr/CFRSearch.cfm?fr=109.30>
7. Agency for Toxic Substances and Disease Registry (ATSDR). “Minimal Risk Levels (MRLs) List”. <http://www.atsdr.cdc.gov/mrls/mrlist.asp>