

Polychlorinated Biphenyls (PCBs): Health effects

PCBs were used from the 1930s to the 1970s in a range of industrial products. They were phased out due to impacts on the environment including bioaccumulation in fish and mammals.

The effects on human health depend on the concentration of PCBs and the type and extent of exposure.

What are PCBs and what were they used for?

Polychlorinated biphenyls (PCBs) are organochlorine compounds which are mixtures of up to 209 individual chlorinated compounds referred to as congeners. These congener mixtures of chlorobiphenyl (the base chemical) are referred to by different identification systems.

In the Arochlor system a four digit numbering system is used where the latter two numbers represent the degree of chlorination, e.g. Arochlor 1260 means biphenyl with a 60% degree of chlorination.

PCBs were used from the 1930s to the 1970s in a range of industrial products including sealing and caulking compounds, inks and paint additives. They were also used to make coolants and lubricants for certain kinds of electrical equipment, including transformers and capacitors. They were phased out due to impacts on the environment including bioaccumulation in fish and mammals.

What happens to them in the environment?

PCBs may enter the air, water and soil from manufacturing, accidental spills and improper disposal. They do not break down readily and can persist in the environment for very long periods of time. They can be transported as particles in water and air and some

PCBs can be measured as vapour in the air. Only a small amount of PCBs can dissolve in water with most adhering to organic particles (such as compost) and sediments. They therefore bind strongly to soil.

PCBs can be taken up by organisms and (bio)accumulate in fish and mammals. The distribution of PCBs in the environment is therefore extensive and the general public may be exposed to PCBs from soil/dust, air, water, or as residues in foods.

How can exposure to PCBs occur?

Old appliances such as refrigerators and toaster ovens (more than 30 years old) may leak PCBs, and vapours accumulating in confined environments can be inhaled or make contact with the skin. Liquid PCBs may also be absorbed through skin contact from such appliances.

PCBs may be ingested if consuming contaminated food or may be inhaled from contaminated hazardous waste sites.

Exposure may also occur in workplace environments involved in repair and maintenance of PCB transformers, through accidents and spills, and disposal of PCBs and PCB-contaminated equipment.

Intake of PCBs from contaminated soil may occur via ingestion, inhalation or dermal (skin) exposure to



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contaminated soil/dust, and from inhalation of PCB vapours. In open air environments the potential for vapour inhalation is considered limited. Tilling of dry soil can result in ingestion of small but measurable amounts of soil.

PCBs may be stored in a mother's body and released during pregnancy, cross the placenta and enter the unborn baby. PCBs are excreted in breast milk and this can be a source of PCBs for babies.

How can potential exposure be determined?

Potential exposures to chemicals may be assessed by testing contaminated soil, food, air or water for the chemicals of interest (environmental monitoring) and estimating the intake of each of these into the human body. This assists the process of "health risk assessment" which determines the possible risk to health for community members.

Can the level of PCBs in the body be tested (biological monitoring)?

Several methods have been developed to assess internal exposure (the amount absorbed by the body and distributed to various organs and tissues) to PCBs.

There are tests to determine whether there are PCBs in blood, body fat and breast milk. These are not routine clinical tests but they show whether an individual has been exposed to PCBs.

Although tests results may indicate exposure less or greater than the general population they will not indicate whether harmful health effects will develop.

Results of tests in the USA indicate that levels of PCBs in the general population have been declining over time.

What are the possible health effects of being exposed to PCBs?

The effects on human health will depend on the extent of exposure (length of time, etc), the amount one is exposed to (dose or concentration), the toxicity of the particular PCB one is exposed to and whether exposure occurs through the lungs (inhalation), mouth (ingestion) or from skin contact. A variety of other factors can also affect health impacts from such exposure, including pre-existing illness and the age of the person.

The most common health effects in people with large exposures to PCBs are skin conditions including acne and rashes.

In workers exposed to high levels of PCBs, tests have indicated liver damage. Some studies in workers suggest PCB exposure may cause nose and lung irritation, gastro-intestinal discomfort, depression and fatigue.

In studies with animals fed PCBs in food, health effects have included anaemia, acne-like skin conditions and damage to the liver, stomach and the thyroid gland.

Other reported health effects in animals have included immune system changes, behavioural alterations and impaired reproduction. PCBs are not known to cause birth defects.

Rats fed high levels of PCBs for two years developed liver cancer. Studies of people working with high levels of PCBs have shown some association with certain types of cancers, such as liver and biliary tract cancer.

Both the US Environmental Protection Agency and the WHO International Agency for Research on Cancer consider PCBs to be probably carcinogenic to humans.

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What are the effects of PCB exposure to children?

The effects of short-term exposure to children are the same as for adults. However children, who have lower bodyweights than adults, do not require as great an exposure to experience the same health effects as adults.

Young children also have behaviours that increase their potential for exposure, e.g. crawling on bare dirt surfaces, eating soil, and more hand-to-mouth activities. In addition, PCBs are excreted in breast milk and nursing mothers may subsequently pass PCBs to infants.

Some studies suggest young children exposed to PCBs have exhibited effects on the immune system and abnormal responses to tests of infant behaviour such as problems with motor skills and decreases in short-term memory.

What is the safe level of PCB intake?

A Provisional Tolerable Daily Intake (TDI) has been determined as 0.0001 mg/kg bodyweight/day. Based on this a Health-based Investigation Level (HIL) for PCBs has been set at 10mg/kg and which applies to adults and children resident on a site where contamination has been identified.

What precautions should I take to reduce potential exposure if the soil has PCBs?

Potential exposure may be reduced by various common sense precautions. Young children and pets should be excluded from bare earth areas in the garden if the soil contains PCBs. Cessation of gardening activities will diminish most soil exposure.

If gardening is continued, precautions to avoid contact with soil should be used, e.g. gloves, dust masks and

washing of gardening equipment and footwear. Contaminated soil should not be allowed to enter the indoor environment.

Some PCBs may evaporate from contaminated soil and result in the detection of odours. Should odours arising from ground sources be detected, avoid the inhalation of these odours and contact SA Health's Scientific Services on 8226 7100 for advice.

What is the safe distance from a contaminated area?

The safe distance from a site will be dictated by onsite activities that may result in release of contaminated dust or vapours. Appropriate management of a contaminated site includes ensuring that off-site releases are minimised and do not result in significant exposure to surrounding residents.

Should I continue to use groundwater from my bore?

It is possible for soil contaminants to migrate from areas of soil contamination to the groundwater. If there is a concern regarding contamination arising from a site where contaminants have been reported further investigation is necessary to assess groundwater quality. This can be achieved by suitable groundwater sampling and testing to ensure the groundwater meets the appropriate guidelines for its intended use.

Advice for parents

In young children, particularly those aged under 5 years, ingestion of and skin contact with soil would be the major exposures of concern.

Children's hands should be washed prior to eating and after playing in the yard. Young children's toys that are

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taken outside should be maintained in a clean state to reduce the risk of transferring soil to the mouth.

Soil should be kept out of homes in which very young children live. Dirty boots that have been worn whilst gardening in bare earth areas should be cleaned of soil prior to entering the house.

Who can I contact for more information?

If you have any health queries, please call Scientific Services in the Department of Health on 8226 7100.

Translation service

For information in languages other than English, call the Interpreting and Translating Centre and ask them to call the Department of Health.

This service is available at no cost to you, contact 8226 1990.

Contact

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