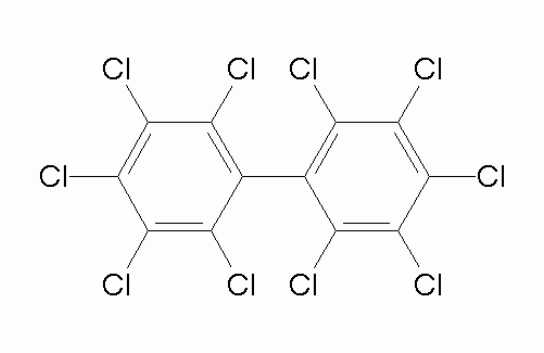
Polychlorinated Biphenyls (PCBs)

What are PCBs and where do they come from?

Polychlorinated Biphenyls (PCBs) are a class of highly toxic, human-made chemicals containing carbon, hydrogen and chlorine. Their general structure is shown in the picture to the right. There are 209 different forms of PCBs. PCBs have many physical properties that make them good for use in industry, but at the same time very problematic when they enter the natural environment. They are resistant to heat, acids and bases. They are stable and they don't evaporate easily. These properties make them stay in the environment for a long time.



PCB production began in 1929 and industry continued to use them until the 1970s and 1980s. At that point, human and environmental health concerns caused them to be banned or restricted by many countries. PCBs were used extensively in oils for electrical, heat transfer and hydraulic equipment and in consumer products like plasticizers in paints, plastics and rubber products, inks, surface coatings and adhesives.

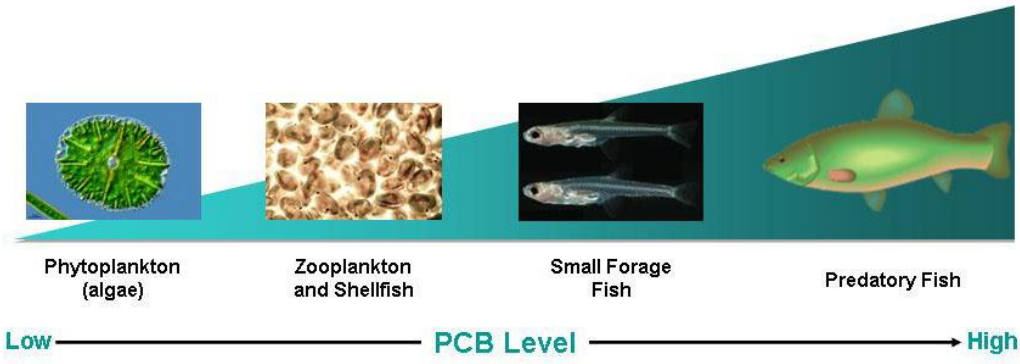
PCBs can still be found in old transformers, fluorescent light fixtures and other electrical equipment and appliances. If such equipment is not properly disposed of, PCBs can be released into the environment as old components wear out. PCBs can also be released when PCB-contaminated oil waste is burned. If you suspect that you have old equipment containing PCBs, contact the GNWT Environment and Natural Resources (http://www.enr.gov.nt.ca) to find out how to dispose of it properly. Approximately 10 % of the 2 million tonnes of PCBs ever produced are still in the environment.

In Canada's Arctic, there are several sites that have been contaminated with PCBs. One example is the Distant Early Warning (DEW) line (yellow, blue and red dots on the map) in Northern Alaska, Yukon, NWT, Nunavut, Labrador and Greenland. These sites were set up by the United States to detect potential attacks by the Soviet Union in the 1950s and 1960s. When these sites were abandoned, drums of PCB-contaminated oil rusted and released PCBs into the soil. These sites are being cleaned up by removing all the contaminated soil.

PCBs in the Environment

PCBs in the air can move to the landscape in rain and snow or attached to particles like dust and soot. In lakes and rivers, most of the PCBs are located in the bottom sediments. However, PCBs do not remain in sediments forever and they can leave by a few different ways. When it is very warm, PCBs can move from the sediments into the water. From the water, they can evaporate back into the air. Sunlight can break down PCBs in water and air. PCBs in soils and sediments can also eventually break down, but it takes many years. Contaminated soils and sediments often have to be dug up and taken away to solve a local PCB contamination problem.

Fish are exposed to PCBs in lakes and rivers. PCBs build up in fish over time through a process called *bioaccumulation*. Fish that feed on the bottom of lakes, tend to have higher levels of PCBs. Large fish that feed higher in the food chain (e.g., predators that eat other fish) have higher levels of PCBs than small fish that eat insects or plants. In this picture, the size and darkness of the green bar represents the amount of PCBs in the different organisms. The large fish on the right has the highest level of PCBs.



On land, birds will have more PCBs in their bodies than the insects they feed on. PCBs are stored in fish and bird bodies in fat, not muscle. Some types of insects, crabs, birds, fish and mammals can break down some of the different PCBs in their bodies.

In the past when PCBs were used a lot, some areas (like the Great Lakes) were contaminated badly and wild bird populations were seriously affected. Their eggs and chicks died and some birds that survived were deformed. Levels are usually not this high anymore. Now that PCBs are not used by industry, levels in the environment (including the arctic) and in the bodies of wild animals are dropping.

References/For More Information

Environment Canada – PCB Resources
http://www.ec.gc.ca/bpc-pcb/default.asp?lang=En&n=5B874257-1

GNWT Environment and Natural Resources – Hazardous Waste page
http://www.enr.gov.nt.ca/_live/pages/wpPages/Waste_Management_Program_home.aspx