

PCB FAQ

A Short Q & A on PCBs

What are PCBs?

At room temperature PCBs (polychlorinated biphenyls) are oily liquids with their level of viscosity increasing with the degree of chlorination. Chemically, they are a mixture of different chlorine substituted biphenyl molecules. For more detailed information on the physical and chemical properties of PCBs, see this article by Heidelore Fiedler.

Why were PCBs used in Building Materials?

Up until about 40 years ago, PCBs were considered a valuable ingredient in a variety of products, including certain building materials. PCBs contributed to the usefulness and lifespan of building materials by imparting a quality known as “plasticity”, that is, the ability of a material to remain pliable without breaking. PCBs were superior plasticizers because they were chemically nonreactive or inert. Because of their inertness, PCBs degrade very slowly over time. PCBs were used in paints, floor finishes, caulking and other building products where durability and plasticity were desirable.

Where else were PCBs Used?

While PCBs were useful in building materials, by far their largest use was as a dielectric fluid in electrical equipment. PCBs, being chemically stable and electrically nonconductive, made an excellent dielectric fluid for transformers and capacitors. Most PCBs ended up in large transformers at generating plants and at electrical substations, but they were also used in capacitors of different sizes, including the relatively small ones in fluorescent light ballasts. Much of this PCB containing electrical equipment is still in service today.

What Went Wrong with PCBs?

Public health concerns about PCBs exploded with the 1968 “Yusho” rice oil incident in Japan. This was a mass poisoning caused by PCB-containing, heat exchange fluid leaking from industrial equipment into edible rice oil that was then consumed by thousands of people. Many hundreds were seriously sickened and the public image of PCBs quickly went from that of a miracle product, to that of a public health nightmare. A second similar mass poisoning in Taiwan, the 1978 “Yu Shang” incident, reinforced the public image of PCBs being extremely dangerous. Laboratory studies showed that rats exposed to PCBs contracted liver cancer.

In 1976, the US government adopted the Toxic Substances Control Act (TSCA). TSCA included provisions ordering the USEPA to develop regulations requiring the end of PCB manufacturing, distribution in commerce and use except for those uses considered to be “totally enclosed”.

Just How Dangerous are PCBs?

PCBs met with a strong regulatory reaction as governments sought to protect the public from future exposures. Meanwhile, Japanese scientists were meticulously untangling the precise cause of the Yusho rice oil poisoning. They learned that the poisonings were actually not caused by PCBs; instead they were caused by trace amounts of an extremely toxic group of chemicals known as polychlorinated dibenzofurans (PCDFs). They discovered that under certain conditions, when PCBs are exposed to high temperatures, they can form small amounts of the PCDFs. That’s what happened inside the heat exchangers that leaked into the Yusho rice oil. Researchers from other countries have confirmed that the Yusho poisoning was caused by PCDFs and not PCBs.

PCDFs are not known to form inside of transformers, capacitors or PCB containing building materials unless these materials are burned under very specific conditions. PCBs that do not contain PCDFs are not known to have caused illness, except in cases of occupational exposures to high concentrations over long periods of time. In these occupational cases the symptoms reverse themselves after the exposures are discontinued.

There are no documented cases of human cancer or other chronic diseases being caused by PCBs that were not tainted with other chemicals.

Are PCBs more or less Dangerous than Lead, Asbestos and Radon?

Lead, asbestos and radon are all materials routinely encountered inside of buildings and they are all much more dangerous than PCBs. The national Center for Disease Control estimates that between 10,000 and 20,000 people die each year from asbestos-related disease. The USEPA estimates that between 10,000 and 40,000 lung cancer deaths are caused each year by exposures to radon inside of buildings. The US Center for Disease Control reports that lead toxicity impairs the learning of more than 250,000 children in the US.

In comparison there are no known incidents of cancer, learning disability or other chronic disease that have been scientifically linked to human PCB exposures.

See also:

PCB Assessment and Management