Polychlorinated biphenyls (PCBs)

What are the effects of PCB exposure on wildlife and human health?

PCBs cause problems because they are stored in the fatty tissue or organs of animals, where they can have toxic effects. For example, in animals they can disrupt the endocrine system, cause cancer or genetic defects, weaken the immune system and have harmful effects on fertility.

In the human body, PCBs can remain in fatty tissues and in the liver and may be transferred from mother to child through the placenta or breast milk.

Health effects may include:
- Suppression of the immune system, leading to increased infection rates, and thereby increasing the risk of acquiring several human diseases including changes in the skin such as chloracne and pigmentation disturbances;
- Increased risk of certain cancers of the digestive tract, liver and skin;
- Alteration of thyroid and reproductive functions in both males and females, such as reduced growth rates, retarded development and increased risk of developing cardiovascular and liver disease and diabetes;
- Disruption of hormones and developmental functions during fetal and early life, which may result in irreversible neurological complications, alterations on how the brain develops, reduced IQ and altered behaviour.

How can one prevent exposure to PCBs?

Children should not be allowed to play with old appliances, electrical equipment, or transformers that might contain PCBs. Discourage children from playing in the dirt near hazardous waste sites, eating dirt and putting dirty hands, toys and other objects in their mouths. Shower before leaving the workplace and keep work clothes and tools separate from clean items.
What are PCBs?
The PCBs are synthetic organochlorine chemicals that were useful industrial products in the past, but their production was halted because they persist in both the environment and living organisms. They are mixtures of up to 209 different chlorinated components (congeners).

Characteristics of PCBs:
• Non-flammable
• Fire-resistant
• Highly stable
• Have a high boiling point
• Exhibit electrical insulating properties
• Non-degradable to a large extent
• Transported over long distances
• Accumulate
• Persistent in the environment

What are PCBs used for?
PCBs are resistant to acids, bases and heat. They have been used in hundreds of industrial and commercial applications including:
• Lubricants and insulation fluid in cooling systems and electrical equipment such as transformers and capacitors;
• Heat transfer and hydraulic equipment;
• Stabilising additives in flexible PVC coatings of electrical wiring and electronic components;
• Products including old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators made before 1977;
• Insecticides;
• Reactive flame retardants;
• Plasticisers in paints and cements;
• Plastics;
• Rubber products;
• Adhesives and sealants;
• In pigments, dyes, surface coatings and carbonless copy paper ink; and
• As de-dusting agents, waterproofing compounds, casting agents, vacuum pump fluids, fixatives in microscopy and surgical implants.

How do PCBs get into the environment?
PCBs enter the air, water, and soil during their manufacture, use, and disposal. They also enter the environment from spills and leaks during their transport, and from leaks or fires in products containing PCBs and also from PCBs released from hazardous waste sites, illegal or improper disposal of industrial waste, and leaks from old appliances and equipment.

What happens once PCBs enter the environment?
Once in the environment, most PCBs are not readily biodegradable. PCBs can travel long distances in the air and via suspended solids in water and be deposited in areas far from where they were originally released. In water, a small amount of PCBs may be dissolved, but most stick to organic particles and soil/sediment. That is because soil and sediment consist not only of mineral particles, but also organic carbon, and therefore, PCBs are present in large quantities in river sediment and floodplain soil.

What are the sources of PCB pollution in the environment?
PCBs are generated and released into the environment as waste byproducts of chemical manufacturing and incineration. The incineration of municipal waste may lead to PCB pollution and produce dangerous by-products, such as hydrogen chloride (HCl) and dioxins (PCDDs and PCDFs). PCBs can also evaporate from contaminated water bodies. Furthermore, landfills containing transformers, capacitors, and other PCB waste can release PCBs into the air, and environmental contamination may continue to occur due to the disposal of old electrical equipment containing PCBs.

How do PCBs accumulate in human health and wildlife?
PCBs tend to build up in living organisms both by uptake from the environment over time (bioaccumulation) and along the food chain (biomagnification). PCBs remain stored in fatty tissues much more than in muscles or other body parts. PCBs generally biomagnify along the food-chain, which leads to greater PCB concentrations in organisms that are higher up in the food chain.

• In the aquatic environment, concentrations are greater in shellfish than in the plankton on which they feed, and even greater in animals at the top of the food chain such as large predatory fish or mammals (seals, dolphins, and whales).

• On land, the biomagnification occurs, for instance, through the accumulation of PCBs from soil or plant leaves to worms or insects and finally to birds and mammals. PCBs can also be found in the eggs of contaminated birds.

• Humans can also accumulate PCBs from food, mostly from eating fish, although meat and dairy also are sources. On average, in humans, the concentration of PCBs in fatty tissues are over a hundred times greater than in the food they eat. The PCBs are fat-soluble substances, humans mainly ingest PCBs from breast-feeding, contaminated food such as fish, meat and dairy products and drinking water. But also from the air (mainly by breathing in dust particles or air near hazardous waste sites) and through the skin (through direct contact with the chemicals or digging or playing in