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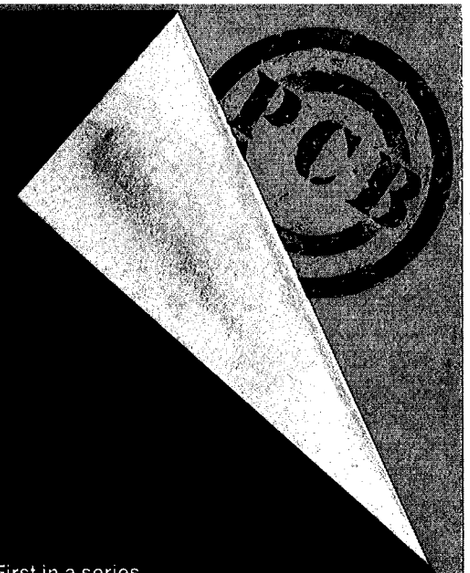

First in a series

CONTROLLING PCBs
The Nature of the Problem

Canadian Council of Resource and Environment Ministers

The Nature of the Problem

What are PCBs?

Polychlorinated biphenyls (PCBs) are synthetic chemical compounds consisting of chlorine, carbon and hydrogen. PCBs were first produced in 1881 and first manufactured for a variety of industrial and commercial uses in 1929. PCBs are also known by various brand names which include Aroclor, Hyvol, Pyranol and Inerteen.

Although PCB mixtures are usually light coloured liquids that feel like thick, oily molasses, some PCB compounds form sticky, yellow liquids or a brittle gum ranging in colour from amber to black. PCBs are almost insoluble in water and denser than water, so they sink to the bottom when added to it.

PCBs are fire-resistant, do not conduct electricity and are very stable, meaning that they are highly resistant to chemical attack or degradation by natural processes in the environment. Although most PCBs are not volatile at temperatures below 40°C, overheating of electrical equipment containing PCBs can produce emissions of acrid, irritating vapours.

How Have PCBs Been Used?

PCB mixtures have had a variety of uses over the years. The major use of the chemical has been as a dielectric fluid coolant and insulator for electrical capacitors and transformers. PCBs have also been used as hydraulic and heat transfer fluids. Until the early 1970s, PCBs were also used in some electrical appliances; as surface coating for carbonless copy paper, washable wall coverings, upholstery fabrics; as plasticizers in sealants, caulkings, synthetic resins, rubbers, paint pigments, waxes and asphalts; and as flame retardants in lubricating oils.

PCBs may be present in electrical transformers designed to use PCBs as a dielectric fluid, at levels of 40 to 70 percent (i.e. 400,000 to 700,000 parts per million) and at levels of only a few parts per million in some mineral oil transformer units contaminated with PCBs. The higher concentrations of PCBs that exist in some equipment represent the greater risk to the environment and this is where federal and provincial governments are focussing their greatest concern and effort.

Approximately 635 million kilograms of PCBs were produced in North America before their manufacture was banned in 1977. Canada imported approximately

40 million kilograms of PCBs. Widespread contamination of the environment with PCBs was recognized in the last half of the 1960s by scientists searching for traces of another chlorinated hydrocarbon, DDT. By 1972, researchers and scientists had established that there was sufficient evidence to clearly indicate that the release of PCBs into the environment posed a potential hazard to the environment and human health.

Environmental and Health Effects

PCBs are an excellent example of chemicals that, subsequent to their introduction and commercial use, have been found to exhibit undesirable characteristics affecting the environment or human health. These undesirable characteristics have necessitated after-the-fact measures to manage and control their use and dispersal in the environment. It is somewhat ironic that some of the properties that made PCBs desirable industrial chemicals were also the cause of their undesirable environmental effects; the resistance to decomposition of PCBs has contributed to their widespread presence in the environment. Once in the environment, PCBs can be accumulated by various life forms and the contamination passes up the food chain through freshwater and marine plants, birds, fish and other animals and eventually to man.

Before PCBs were recognized as a problem, they probably entered the environment largely from the disposal of products such as carbonless copy paper, sealants, paints and waste oils. At the present time, PCBs enter the environment from incomplete incineration, from landfill leachate, from leaks in transformers and hydraulic and heat transfer systems and from accidental causes such as transformer fires and transportation spills. Once PCBs are released into the environment, they can be spread by airborne transport. PCBs have been found in the oceans of the world, in Arctic bears, in rainfall, as well as in human beings throughout the world.

The health effects of PCBs have been studied in animal species and, to a limited extent, observed in human beings. In several animal species, reproductive processes and enzyme and immunity systems were affected. Cancers of the liver were also observed in rats fed diets containing large amounts of PCBs. The known toxic effects in humans from ingestion, inhalation or absorption of PCBs include chloracne, eye discharges, headaches, vomiting, fever and visual disturbances. But no conclusive, direct relationship between cancer and human exposure has ever been made.

People who might be exposed to PCBs include workers servicing and maintaining some types of electrical equipment, workers cleaning up spills or leaks of PCB fluids, employees of scrap metal or salvage companies and waste collection workers. Information manuals have been produced by governments to assist those people who might be exposed to PCBs. These manuals deal specifically with the various types of PCB wastes, where they might be found and how they should be handled.

The evidence concerning the release of PCBs into the environment and their presence in the food chain led to the major decision of 1973 by the Organization for Economic Cooperation and Development (OECD) that all member countries should limit the use of PCBs to enclosed uses and should develop control mechanisms to eliminate the release of PCBs into the environment.