Chemical Pollutants: Polychlorinated Biphenyls Still a Threat

Manufacturers and users of potentially toxic chemicals have argued that there is no need for federal regulations to control their use. They contend that voluntary controls and self-policing are adequate protection from potential hazards. This type of argument has generally been successful in preventing the passage of restrictive laws, but the recent reemergence of polychlorinated biphenyls (PCB's) as a major environmental problem suggests that voluntary controls may often be inadequate, even when the manufacturers apparently have the best of intentions.

PCB's are aromatic compounds containing from 12 to 68 percent chlorine. Their high degree of stability and their low flammability make them ideal for many industrial uses. These same properties, however, make the chemicals exceptionally persistent in the environment—far more so, for example, than the chlorinated pesticides such as DDT. Three years ago, the persistence and toxicity of PCB's in the environment had been fully recognized, and a variety of steps were taken that, it was thought, would bring the situation under control. In one of the most important voluntary actions, the Monsanto Company of St. Louis, Missouri—the only U.S. producer of PCB's—discontinued sales of the chemicals except for their use in electrical components. The Food and Drug Administration also adopted an interim safety level of 5 parts per million (ppm) for PCB's in food, and the Environmental Protection Agency (EPA) issued waste disposal restrictions that were supposed to keep PCB levels below 0.01 part per billion in rivers and streams.

But these steps apparently did not produce the desired effect. The total amount of PCB's in the environment has not only not declined since then, but has apparently increased substantially. According to Thomas E. Kopp of the EPA's Office of Toxic Substances, at least 4.5 million kilograms of PCB's are lost to the environment each year through vaporization, leaks, spills, and burial in landfills. This is an exceptional amount considering that, last year, Monsanto produced only about 18 million kilograms and another 170,000 kilograms were imported. Some 360 million kilograms have been produced in the United States since 1957.

The most serious problems have been observed in the northeastern United States and the province of Ontario. Both salmon and striped bass from the upper Hudson River and Lake Ontario, for example, have been found to contain PCB's in concentrations from 5 to 20 ppm, well above the 2-ppm limit for edible fish adopted last month and the established U.S. limit. Several investigators have reason to believe that if a limit of 1 ppm were adopted, none of the fish in the Great Lakes would be edible.

PCB concentrations nearly as high as those observed in Great Lakes fish have been found, according to Charles R. Walker of the U.S. Fish and Wildlife Service, in fish from such widely scattered areas as the Allegheny and Kanawha rivers in the East, the Tennessee and Missouri rivers in the Midwest, the Chena and Columbia rivers in Alaska and the Far West, and the Rio Grande, Alabama, and Mississippi rivers in the Gulf states. High concentrations of the chemicals have also been found in waterfowl from the major U.S. flyways and in other birds, such as starlings, throughout the country. EPA Administrator Russell E. Train also says that PCB's have been found in the water supplies of Winnebago, Illinois, and Sellersburg, Indiana, and that their presence is suspected in the water supplies of Bridgeport, Connecticut, Escondido, California, and New Bedford, Massachusetts.

Released into Rivers

The sources of this material are not completely known, but much obviously comes from manufacturing plants where PCB's are used. According to Robert Durfee of Vesar Inc. of Springfield, Virginia, about 70 percent of Monsanto's PCB production is used in electrical capacitors, while the remainder is used in transformers. The EPA has, in fact, identified ten electrical component plants where PCB's are released into rivers. In addition, one of these component producers and Monsanto itself have been identified by EPA as the sources of PCB's entering the sewage systems of Bridgeport, Connecticut, and Sauget, Illinois.

A good portion of the PCB's in the environment must also come from the imported materials, which are even more poorly controlled. Durfee says that some 80 to 90 percent of imported PCB's are used as plasticizers in waxes that in turn are used to form molds for producing high-quality metal castings. The remainder is used for what he terms "semiclosed heat transfer applications."

Other sources of environmental PCB's include the effluent from mills that recycle business forms and other paper products that were manufactured with the chemicals and smoke from the burning of such papers. Lesser amounts are also released from other products that contain small quantities of PCB's.

The health consequences of PCB's in the environment are firmly established. Many investigators have shown (*Science*, 27 October 1972, page 388) that PCB's interfere with reproduction in, for example, rodents, fish, fowl, and primates. According to Assistant Secretary of the Interior Nathaniel P. Reed, PCB's may thus hasten the extinction of endangered species despite our best efforts to preserve them. He cites as an example the $175 million effort to restock the Great Lakes with lake trout, splake, and salmon when those species had been nearly wiped out by the invasion of sea lampreys. Not only do PCB's interfere with reproduction of the restocked fish, but they also render those that survive inedible. And if the fish cannot be consumed by man, Reed argues, it will be difficult to justify the expense of further efforts to replenish them. Another species which he says is directly endangered by PCB's is the bald eagle.

In animals fed PCB's, other ailments have been observed. These include acne, loss of hair, enlarged livers, gastrointestinal lesions, and abnormalities of the lymphatic system. Furthermore, Renate D. Kimbrough of the Center for Disease Control has observed malignant liver tumors in rodents fed diets containing 100 ppm of PCB's. Her results have, however, not been corroborated by other investigators.

PCB's also produce adverse effects in man. Ailments such as those that occur in laboratory animals fed PCB's have been observed by Masanore Kuratsune of Kyushu University in 1291 Japanese persons who were affected by a 1968 incident in which PCB's contaminated a batch of cooking oil. In addition, workers using the chemicals to manufacture capacitors at two General Electric Company plants north of Albany, New York, have complained of allergic dermatitis, nausea, dizziness, eye irritation, and asthmatic bronchitis.

EPA contends that even though PCB's are hazards, it does not have the power to restrict or halt their production, to stop their importation, or to prevent manufacturing plants from releasing them into waterways, all of which may be necessary to halt the threat to the environment. Train thus argues that it is essential for Congress to pass the Toxic Substances Control Act now under consideration, which would give EPA such powers. Passage of the act will make it necessary to find adequate new substitutes for PCB's in electrical components. But even if these measures are accomplished, the PCB's that have already been produced may still threaten the environment for a very long time.

—THOMAS H. MAUGH II