Polychlorinated Biphenyls: Still Prevalent, but Less of a Problem

The presence and danger of polychlorinated biphenyls (PCB's) in the environment is not yet a dead issue, but it is one that appears to be dying quite rapidly. Despite mounting evidence of both the omnipresence and toxicity of this widely used chemical, governmental and industrial curbs on its use have largely halted its influx to the environment, and the potential for ecological damage appears to have been averted.

PCB's have been detected in fish, wildfowl, foods, and highly polluted waterways (*Science*, 14 January, p. 155). New evidence presented at the 164th national meeting of the American Chemical Society, however, suggests that PCB's have pervaded the environment to a much greater extent than was previously suspected.

Gerald W. Bowes of the Canadian Wildlife Service, Ottawa, Ontario, for example, has found PCB's in tissues of polar bears and seals captured throughout northern Canada, including locations well within the Arctic Circle. In these nonmigratory bears, he notes, the concentration of PCB's was greater than the combined concentrations of the organochlorine pesticides DDT and DDE. In the United States, the U.S. Geological Survey has found PCB's in water and sediment samples from 17 of 39 states examined. Hans J. Crump-Wiesner of the USGS says that concentrations of PCB's in water samples ranged from 0.1 to 4.0 parts per billion (ppb), and that such residues were detected even in newly developed real estate lakes and at two USGS field stations far removed from industrial sources. Bottom sediment samples contained PCB concentrations as great as 3.2 ppm.

The Food and Drug Administration has detected PCB's in nearly 20 percent of some 3500 samples of fish, milk, eggs, and cheese examined during the past 18 months, according to Albert C. Kolbye, Jr., deputy director of FDA's Bureau of Foods. More than 54 percent of fish samples contained detectable amounts of PCB's, as did 29 percent of egg samples. Only 6 percent of cheese samples and 7 percent of milk samples contained detectable amounts, however. The average PCB concentration in a normal U.S. diet, Kolbye adds, is only about 10 percent of FDA's interim safety level of 5 ppm.

More important, Anne R. Yobs of the Environmental Protection Agency's Office of Pesticides Programs, Chamblee, Georgia, reported that PCB residues were found in 54.3 percent of 2189 human adipose (fatty) tissue samples collected in 18 states and the District of Columbia. More than two-thirds of the positive samples contained at least 1 part per million (ppm). PCB levels greater than 1 ppm, she says, were found in approximately twice as many males as females, and in three times as many whites as nonwhites but statistical evaluation of the results has not been performed because the study is still in its preliminary stages.

Toxic Effects in Other Species

There is no evidence to suggest that these amounts of PCB's have any toxic effects in humans, but the toxic effects of amounts found in other species have been amply demonstrated. Mink, for example, are highly susceptible to PCB's. Robert K. Ringer of Michigan State University, East Lansing, has shown that PCB levels of 5 ppm in the food of minks completely halts their reproduction. This concentration is comparable to that in many Great Lakes fish—particularly coho salmon—that are used as food by the large mink industry in the area. Mink ranchers have thus been forced to more expensive ocean fish, poultry, and meat by-products, Ringer says, and the infant Great Lakes coho industry has been devastated.

Chickens are also affected by PCB contamination. Helene C. Cecil of the U.S. Department of Agriculture's Agricultural Research Service, Beltsville, Maryland, has found that the hatchability of chicken eggs declines drastically when hens are fed a diet containing PCB's at 20 ppm. After one group of hens had been fed such a diet for 5 weeks, for instance, only 8 percent of their fertile eggs hatched. More than a third of the embryos in the unhatched eggs, she adds, exhibited teratogenic abnormalities such as crossed beaks, rotated ankles, or edema. This poor hatchability was observed only with PCB's containing 32 to 54 percent chlorine, however; little or no effect was observed with those containing either 21 or 68 percent chlorine. Hatchability was restored when PCB's were removed from the hens' diet.

Many estuarine organisms are killed by low concentrations of PCB's, according to DelWayne R. Nimmo of the EPA laboratory in Gulf Breeze, Florida. Populations of the ciliate *Tetrahymena pyriformis*, one of the first links in the fish food chain, are significantly reduced within 96 hours by exposure to 1 ppb of PCB in water. Nimmo also finds that at least three species of fish and one species of shrimp die in water containing 5 ppb, and that the growth of one species of oyster is reduced. Foster L. Mayer, Jr., of the U.S. Department of Interior Fish-Pesticide Laboratory in Columbia, Missouri, has found similar results for invertebrates that are part of the food chain for freshwater fish.

Despite the ubiquity and toxicity of PCB's, the problem of their presence in the environment is "fairly well in hand," contends EPA deputy research director John Buckley. All of the answers about PCB's are not yet known, he concedes, but current regulatory actions seem adequate to deal with the problem, and the amount of PCB's in the environment should soon start declining.

Earlier this year, for example, EPA issued waste disposal restrictions designed to keep PCB levels below 0.01 ppb in rivers and streams. Shortly thereafter, the FDA prohibited the use of PCB's in materials used for food containers and for any application in food processing plants.

Most important, perhaps, the Monsanto Company of St. Louis, Missouri —the only U.S. producer of PCB's— has voluntarily discontinued sales of PCB's for uses that might allow the chemicals to enter the environment. Virtually the only remaining use of PCB's in this country will be as insulators in electrical transformers and capacitors, an application for which no acceptable substitutes are available. And even in these applications, Buckley says, the principal components will be the less highly chlorinated PCB's, which are certainly the least persistent and now appear to be the least toxic.

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