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PCB's- THE HIDDEN PERIL

by Caroline Haglund

We live in a society that is much more pollution-conscious than previous generations have been. As a result, many people have raised questions about what effects pollutants have on the human body. Among the pollutants that have caused concern are polychlorinated biphenyls (PCB's).

PCB's have been used in a wide range of products, including electrical transformers, capacitors, carbonless copy paper, and fluorescent lights. They have also been used in paint, varnish, plastics, food wrappings, adhesives, microwave ovens, television sets, air conditioners, ceiling caulk, fire-resistant fabrics, electric wire insulation, hydraulic fluids and lubricants, wood preservatives, and other items.

Polychlorinated biphenyls have been contaminating our soil, water, and air since 1930, but their greatest contamination comes from the air. When products containing these chemicals are disposed of in junkyards, landfills, or incinerators, PCB's become airborne as dry particles or vapors and settle on water and land, thus entering the food chain. Scientists also believe that PCB's can be assimilated directly from the air, passing through the lungs and into the bloodstream.

PCB's enter waterways and run-off from landfills, sewage, discharges from industry, and acciden-

tal spills. Although copy paper containing PCB's is no longer made, it turns up in paper used for recycling at paper mills, and the PCB's are discharged in the effluent.

Only in the past ten years have we begun to realize the danger of polychlorinated biphenyls in our lakes, streams, and rivers—particularly in the Hudson and Mississippi rivers and in the Great Lakes. Among foods containing residues of PCB's, fish have the highest amount (with residues also found in milk, poultry, eggs, and beef). High concentrations were found in the fat of large salmon and lake trout from Lake Michigan. In April, 1978, the State Department of Natural Resources discovered uncommonly large amounts (10,000 parts per million) in Wisconsin's Sheboygan, Onion, and Mullet rivers—the result of leakage of industrial wastes from a dump site.

The heat-resistant and long-lasting qualities that make PCB's particularly suited to industry also ensure that they will remain in the environment for a long time. They do not break down except at extremely high temperatures (higher than 1,000° C.). A bacterium has been discovered that will slowly decompose the chemicals, but it is most useful with fresh emissions at disposal plants.

Small amounts of polychlorinated biphenyls pose no threat to adults, but deposits stored in women's tissues may subtly affect unborn children and nursing infants, and may also lower disease resistance. Research with monkeys at the University of Wisconsin indicates that this low exposure causes hyperactivity and learning problems.

At the University of Wisconsin's Biotron and Regional Primate Research Center in Madison, Dr. James R. Allen and Dr. Robert E. Bowman lead research to determine effects of low-level exposure to PCB's. Rhesus monkeys are used because they metabolize PCB's much the same as do humans.

Dr. Bowman is conducting a study in which the mothers are given only .5 to 1 part per million (ppm) of PCB's three times a week in feed—approximately the amount a person might receive if he eats Lake Michigan trout or salmon once a week. Tests show that although adults are not significantly affected, infants are hyperactive and have learning difficulties.

PCB's are more toxic than they

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were first thought to be. The Federal standard for levels of this pollutant until recently has been 5 parts of PCB's per million parts of fish and poultry and 2.5 ppm for milk and dairy products. "The present data, both behavioral and pathological, indicate severe toxicity with a continuous diet at 2.5 ppm of PCB's," says Dr. Bowman. After receiving this amount daily in their food, adult monkeys develop chloracne (similar to a bad case of acne) plus hair and weight loss. There is a high rate of abortions and stillbirths. Infants are smaller, and some are born with undeveloped thymus glands. Of eight adult female monkeys in the 2.5-ppm group, eight conceived, five infants

were carried to term, and three survived past weaning at four months. Only one live birth occurred in the 5-ppm group.

The Food and Drug Administration recently reduced permissible levels of PCB's permitted in fish, milk and dairy products, poultry, and eggs sold across State lines, effective August 28, 1979. Levels for fish were lowered from 5 ppm to 2 ppm; for milk and dairy products, from 2.5 ppm to 1.5; for poultry, from 5 ppm to 3 ppm; and for eggs, from .5 ppm to .3 ppm.

The FDA asked the governors of eleven States (Connecticut, Illinois, Indiana, Massachusetts, Michigan, Minnesota, New Jersey, New York,

Ohio, Pennsylvania, and Wisconsin) to warn consumers, particularly pregnant and nursing women, to stop eating fish such as coho and chinook salmon from the Great Lakes, and freshwater trout and catfish.

PCB's found in mothers' milk of monkeys

Because PCB's accumulate in fat, they build up in mothers' milk. Infant monkeys that nursed, at first gained constantly for two months, then lost weight and showed signs of PCB poisoning. At four months the remaining three infants were placed on a synthetic-milk supplement. By eight months of age their eyelashes

were thicker, swelling of the eyelids declined, and facial acne disappeared. These monkeys are more than two years old now, but remain hyperactive. Younger siblings also exhibit definite toxic signs, even though the mothers were off the PCB diet for one year before breeding again and appear healthy.

Although the number in these studies is relatively small, Dr. Allen feels it is adequate because of strict environmental conditions maintained at the Biotron. Many other monkeys have been used in experiments with varying PCB dosages. In all cases (excepting .5 to 1 ppm), similar signs and symptoms developed. A total of 50 low-level PCB monkeys will be tested by the end of the current three-year project.

Common reactions of monkeys to PCB's are loss of eyelashes, dry, crusty skin, and excessive skin coloration. Short exposure at 2.5 and 5 ppm produces skin changes. Adult female monkeys are affected more than males because the females have a higher percentage of fat in which PCB's can collect. Menstrual cycles are altered, with irregularity and abnormal and prolonged bleeding occurring.

Metabolic studies on experimental animals show that PCB's may produce cancerous changes and promote existing tumors. Monkeys absorb more than 90 percent of an oral PCB dosage, with the chemicals concentrating in the skin, adrenal glands, ovaries, liver, and brain. They cause severe stomach ulcers and cell abnormalities. Symptoms of nausea and loss of appetite in humans accidentally exposed to large amounts of PCB's suggest similar effects. Any cancerous complications may not be apparent for 20 to 30 years after exposure.

The impact of PCB's on human health was magnified in 1968 on the island of Kyushu. More than 1,000 Japanese used rice oil contaminated with PCB's. Symptoms of poisoning ranged from nausea and abdominal pains to memory loss, bone and joint deformities, chronic bronchitis, asthma, and pneumonia. Abortions, stillbirths, and small infants oc-

curred. Nine of thirteen infants were born with dark-brown skin.

Industry has long recognized the dangers of polychlorinated biphenyls to workers. Inhalation causes lung irritation and severe headaches, plus chloracne. PCB's were known to be toxic to the liver as early as 1937. For the past seven years, Monsanto Industrial Chemical Company, sole United States producer of PCB's, has limited production of these chemicals. A 1976 Federal law prevents manufacture as of January 1, 1979. Foreign companies have exported PCB's without restrictions, but distribution and processing in the United States was scheduled to end by July 1, 1979. Products previously made with these chemicals are in wide use, however, and manufacturers with products (such as capacitors) in which PCB's are completely enclosed may distribute those they have on hand.

A 1975 Environmental Protection Agency (EPA) survey of nursing women throughout the country found detectable levels of PCB's in breast milk. Levels ranged up to 12 ppm, with an average of 1.8. Milk of mothers living in New York, Michigan, Wisconsin, Kansas, and Texas contained the highest levels. No injurious effects have been reported, but a supplementary study is underway to determine whether these breast-fed infants suffer symptoms of PCB toxicity.

Benefits of nursing outweigh dangers

Should women nurse their babies? Should they first have their milk tested? A test for more than a dozen chemicals, including PCB's, is now available at Raltech Scientific Services, Inc., in Madison, Wisconsin, for \$60. Refrigerated or frozen samples of a mother's milk may be submitted in specified containers by her physician or by herself.

"Pediatricians feel it is premature to suggest a discontinuation of nursing because of the presence of PCB's in milk," says Dr. Allen. "The benefits obtained were felt to outweigh by far the potential deleterious effects." But Dr. Allen emphasizes that pregnant women and

nursing mothers should not eat fish, particularly from the Great Lakes. Most levels of PCB's in fish exceed 5 ppm. As more information is obtained, this recommendation may be modified.

Dr. Bowman believes it is too early to say whether PCB's contribute to hyperactivity in children. While some cases may result from exposure to PCB's, many other causes exist. All research to date has been with small amounts of commercial PCB's. Monkeys have not been tested with PCB residues in fish or other contaminated foods that may be either more or less toxic than commercial mixtures. A study is underway using residues from Great Lakes' fish, but there are not yet any monkey offspring from mothers fed this diet.

While actual data are incomplete, enough is known to put a high priority on PCB research. The possibility that human infants are receiving exposure at levels producing symptoms in monkeys makes it all the more urgent that research continue and that human exposure to PCB's be minimized.

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