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BACONS

The rising clamor about PCB's

Useful though they may be, these toxic materials will probably be phased out in the U.S., in the near future

Rarely, if ever, has a conference's keynote speaker expressed the wish that the meeting at which he spoke was unnecessary. The keynote speaker who expressed this rather surprising wish was EPA administrator Russell Train who spoke at the National Conference on Polychlorinated Biphenyls (PCB's) held in Chicago last November, and sponsored by the EPA and the Research Triangle Institute (Research Triangle Park, N.C.). Train said that if the federal government had passed a toxic substances control law in 1972, when a federal task force urged that such a measure be enacted, the PCB conference "would have been rendered unnecessary." Train called for rapid passage of a toxic substances control act.

However, no toxic substances law has been passed as this goes to press, and a PCB conference was indeed necessary, because these compounds are now fairly widespread in the environment. They are found mostly in the fresh-water hydrosphere, its bottom sediments, and its biota. PCB's bioaccumulate, particularly in fatty tissues from which any purge, where it may occur, is very slow. Humans burdened with PCB's in sufficient quantity will develop medical symptoms typified by Yusho disease, a painful, sometimes lethal ailment that first appeared in Japan in 1968, and for which 1291 patients had been registered as of last April 30.

The dilemma

PCB's, which are so environmentally and medically intolerable, are a boon to many industries. For instance, they are non-conductors, as well as good heat transferring media, and they are non-flammable. Thus, PCB's are ideal for large transformers and power capacitors, for which they are made in the U.S. by Monsanto under the trade name "Aroclor". PCB's also have applications as plasticizers, hydraulic fluids, diffusion pump oils, wax additives for investment castings, carbonless carbon paper (in the past), and electrical circuitry and components. At present, their use in the U.S. is restricted to closed systems; their manufacture is banned in Japan as of 1972.

An industry spokesman, however, told ES&T that perhaps up to 55% of "closed" transformers may not, in reality, be closed. Some weak points for transformer leaks could be gaskets in leads; others could be the oil level viewing glasses that are said to break on occasion. Old or defective capacitors might be deposited in landfills where they may be broken during the burying process; their PCB content would escape, and could eventually percolate to a stream. PCB spillage could also occur if oil is drained from a defective transformer, to be filtered and reused.

Indeed, PCB's are still finding their way to certain streams, lakes (especially the Great Lakes, which were charac-

terized as a PCB sink), stream and lake sediments, and fresh-water biota. Their environmental and economic effects have been felt, as one gathers when one reads a letter by Jean Hermes of Green Bay, Wis., speaking for her family; they are in the commercial fishing business on Lake Michigan. Last July, regulatory actions by the Food and Drug Administration (FDA) caused the closing of the Hermes' business when fish from their nets were found to contain up to 54 ppm of PCB's, and, as Hermes put it, "deprived the family of its livelihood." The FDA allows no more than 5 ppm in fish, and Canada, no more than 2 ppm.

The conflict between the industrial benefits of PCB's and their long-term toxic environmental effects was the subject of a strong speech by Nathaniel Reed, assistant secretary of the Interior for fish and wildlife and parks. Reed reminded the conference that the Department of the Interior (DOI) invested \$33 million and 17 years to control sea lampreys and other predatory fish, and restore the Great Lakes fisheries to an approximately \$350 million annual value with emphasis on building salmonid fish stocks. He wants to see this program continue, for overriding economic and biological reasons, but he warned that the DOI will not be justified in maintaining the fisheries if the fish cannot be harvested—"and we now face this stark possibility." Reed pointed out that "a significant portion" of these fish con-

Current and past PCB manufacture

Country	Manufacturer	Trade name
France	Prodéco	Phénoclor Pyralene
Germany	Bayer	Clophen
Italy	Caflaro	Decachlorodiphenyl (DK) Ienclor
Japan*	Kanegafuchi Mitsubishi	Kennechlor Santotherm
U.S.	Monsanto	Aroclor Thermal FR-1

*PCB manufacture is banned in Japan.
Source: EPA, Region V

PCB-containing askarels in the U.S.

Manufacturer	Trade name
Aerovox	Hvylol
Allis-Chalmers	Chloroxol
American Corp.	Abestol
Cornell Dubilier	Dy Kanol
General Electric	Pyranol
Kuhman Electric	Sel-T-Kuhl
McGraw Edison	Elemax
Sangamo Electric	Diactor
Wagner Electric	Notlamol
Westinghouse Electric	Inerteen

Source: EPA, Region V

tain PCB residues exceeding the 5 ppm action level established by the FDA; if that level were lowered to 1-2 ppm, "essentially the entire Great Lakes commercial food fishery would be curtailed."

Medical effects

Medical effects of PCB's were displayed dramatically in Japan after late 1968, when rice oil, contaminated with PCB's and related chemicals from the electrical components of the rice oil-making process, was ingested. Symptoms included fatigue, headaches, pain in joints, anemia, acneiform eruptions, pigmentation changes, and ocular signs.

The acne symptom is particularly painful. Many of the pustular eruptions appear on the back, and are excruciating, especially when the patient's back comes in contact with almost anything. From April 1973 to March 1974, PCB levels in the blood of the most affected Yusho disease patients was generally 7.2 ± 4.9 parts per billion, according to what Masanori Kuratsune of Kyushu University (Fukuoka, Japan) told the conference.

Babies born to mothers who ingested PCB-contaminated "Yusho oil" showed some unusual features, particularly dark brown pigmentation of the mucous membranes, some fatal growth inhibition, eruption of teeth at birth, and gum problems, for example. Some of these symptoms continued in new-born babies even after the mother's intake of "Yusho oil" had been discontinued for a few years. However, the children's PCB blood levels, while "significantly higher" than that of ordinary children, was lower than that of their mothers.

Frederick Kutz of the EPA described findings of PCB's in fatty tissues in people in the U.S. over fiscal years 1973 and 1974. For fiscal 1973, of 1277 people, 5.5% had more than 3 ppm of PCB's; 29.6% had 1-3 ppm; 40.2% had less than 1 ppm; and the remainder showed no detectable level. For fiscal 1974, of 1047 people, 4.9% had more than 3 ppm; 35.4% had 1-3 ppm; 50.6% had less than 1 ppm; and the balance had no detectable level. What PCB's were detected by combined gas chromatography were mostly penta-, hexa-, and heptachlorobiphenyls. Kutz noted that tetrachlorobiphenyl and less chlorinated isomers were not normally found in human tissue.

What if animals, including birds and fish, are PCB-contaminated? Reproduction can suffer markedly, especially by the third or fourth generation; malformation might also occur. In rats, it was noticed that suspicious liver neoplasms developed. Data gathered so far indicate that the carcinogenic potential of PCB's can definitely not be ruled out, even though final conclusions on this subject are yet to be drawn.



EPA administrator Train
Regretted need for PCB conference

PCB's in food

Charles Jelinek of the FDA told the conference that fish received their PCB contamination mainly through the environment, whereas milk and dairy products, eggs, poultry, animal feeds, infant foods, and paper food packaging received PCB's principally from agricultural and industrial applications. However, use of PCB's at food, animal feed, and food packaging manufacturing plants is now prohibited. Through the enforcement of this regulation and of regulatory levels established for PCB's in appropriate products, the level and frequency of occurrence of PCB's in non-fish food products declined drastically from fiscal year 1973 through fiscal year 1975.

Even in the case of fish, no PCB's were found during 1973-1975 in FDA examinations in 62% of fish sold in interstate commerce. However, about 3% of the fish were over tolerance (5 ppm of PCB's). All of the samples found to be violative were from the Great Lakes area, and included such species as chub, carp, and Coho salmon. PCB's are found almost exclusively in freshwater fish in the U.S., and, as secretary Reed pointed out, much of these are found in salmonid fish caught for sport, over which the FDA presently has no control. To cut PCB contamination in fish, Jelinek called for halting the entry of PCB's into the aquatic environment.

Secretary Reed
"Great Lakes fishery could suffer"



In December, EPA administrator Train announced that his agency will seek an eventual halt to all PCB production and use in the U.S.

Are there alternatives?

PCB's seen to be enough of a threat so that alternatives with the same excellent industrial attributes plus a lack of environmental detriments would be desired. A. Karim Ahmed of the Natural Resources Defense Council (NRDC, New York, N.Y.) told the conference of his organization's campaign to stop U.S. manufacturer's use, and discharge of PCB's, and gave as one reason PCB content in edible fish in various parts of the country ranging 0.57-157.27 ppm. This is considerably higher than what the FDA found in commercial fish.

Most of these PCB's may have come from askarels (transformer oils), such as Arcolor 1248, 1260, and 1254, some of which are no longer made. In certain Hudson River sediments near Fort Edward, N.Y., just south of a General Electric (GE) plant, 540-2980 ppm of PCB's were found. GE has been ordered to stop discharging PCB's by September 30, by Ogden Reid, New York's commissioner of environmental conservation.

One possible alternative to PCB's may be dilononyl phthalate (ENJ-2065), developed by Exxon Chemical Co., U.S.A. ENJ-2065 is now being used in some commercial capacitors. Others may consist of Dow Corning substitutes found in gas-cooled or air-cooled dry-type transformers, or silicone oils now in volume use in Japan. Dow Chemical Co., and McGraw Edison said that butylated monochlorodiphenyl oxide is effective, and far less bioconcentratable and more biodegradable than PCB's. Prodlec (Courbevoie, France), which makes PCB oils under the names "Phenoclor" and "Pysilene", is looking at a mixture of pure dichlorobiphenyls and chlorisilene, an alkylated derivative in 20:80 proportion, which B. Ray Coquale, a Prodlec engineer, told the conference has a low toxicity and is biodegradable. Incidentally, a French law, passed last July 8, requires recovery of all PCB's.

Since PCB's are deemed a long-term environmental hazard, and there is much pressure from groups like the National Fisheries Institute (Washington, D.C.), as well as environmental organizations, to ban them, more substitutes will eventually be developed and used, even if transformer and capacitor costs must increase somewhat. Indeed, restrictions on PCB's seem to be becoming tighter with the passage of time, and it would not be surprising to see the U.S. and Organization for Economic Cooperation and Development (OECD) countries eventually go the way of Japan, and institute what effectively amounts to a ban. JJ