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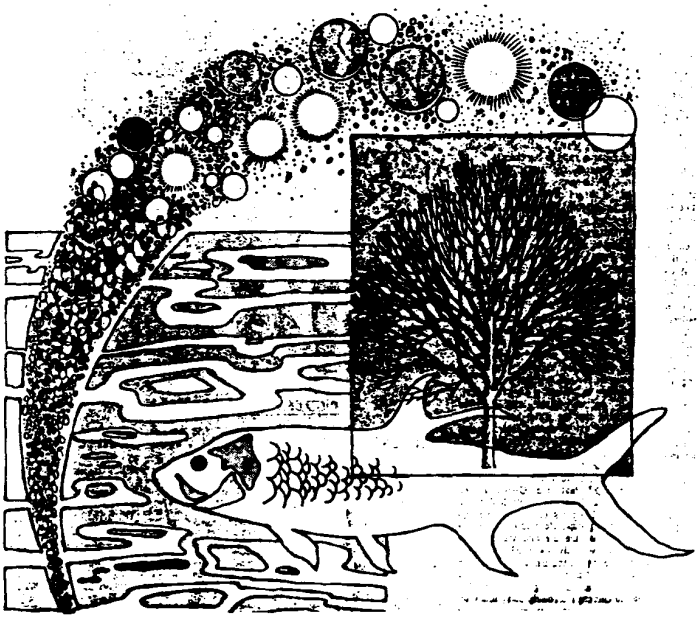
PCBs ... Environment's Subtle Pollutants



PCBs have been around for some 45 years. They don't smell, fix in slicks atop water or turn fish belly up in a river or lake. But they can cause a variety of illnesses in humans and cause animals to cease reproduction. Now researchers are trying to find out why—and how to get rid of PCBs in rivers like New York's Hudson. Peter Hellman is a free-lance writer who has often fished the Hudson River.

By PETER HELLMAN
N.Y. Times News Service

Luke Hart, manager of the two General Electric capacitor factories at Hudson Falls and Fort Edward, N.Y., held up a small vial filled with a brilliant, clear, slightly viscous liquid.

"This is the stuff that's caused all the fuss," he says. "This is PCBs."

PCBs are oils, a group of virtually indestructible compounds with high heat-resisting, water repellent and lubricating qualities that doesn't need to explain "the fuss."

It has involved, a dizzying succession, pollution of the Hudson River so severe that most commercial fishing had to be banned, a precedent-setting $4 million settlement by the polluter and — now that G.E. has agreed to stop pouring PCBs into the river — a disturbing new problem. What to do about some 100,000 pounds of the stuff that still resides ominously on the river bottom?

In his big, desk office at the Hudson Falls plant, Hart demonstrates for his visitor such a vaunted G.E. corporate harvest the positive side of PCBs.

He plugs in an electric heater with an ammeter in its line. He pushes one button and the needle jumps to 40 amps. He pushes another button and the needle drops back to 20 amps.

"Unfortunately, your May 7th memo did not arrive until May 10th, and I had already taken more samples and done more exploration into the PCB problem ..."

What the state would not do for itself was finally done, in August, 1974, by Royal Hudson and Robert Davis of the local office of the EPA. Disturbed, along with a few others in the agency, by reports of high PCB levels showing up around the country, they decided to check out the Hudson River, with special attention to the section below Fort Edward and Hudson Falls. Nadeau and Davis found extraordinarily high levels of PCBs in the water, river mud and living creatures in the vicinity of the G.E. plants.

'World's Record'

Just below Fort Edward, they found what was until then, a "world's record" for PCB-infected fish — a rock bass measuring in at 355 PPM. They could hardly believe it was still alive.

For a full year, the report of the two scientists floated around. It finally reached Dr. Glenn Paulson, a chemist at the EPA's National Water Quality Laboratory in Duluth, Minn. Dr. Veith had first come up against PCBs as a graduate student working on the mink problem in the 1960s. Now he was watchdogging PCBs nationwide. "I was convinced after reading the report," he says, "that the Hudson River situation was the worst I'd seen in the country by at least a factor of 10."

Veith wrote a review of that report, emphasizing its seriousness, and sent it off to the director of the EPA regional office in New York. It was forwarded, on July of last year, to Gordon Reed, who had been commissioner of the DEC for just six months.

At last, things began to happen. Startled by the alert all the way from Duluth, Reed poked around his own department to see if anyone knew about the PCB problem. He was then bargained to discover that plenty was

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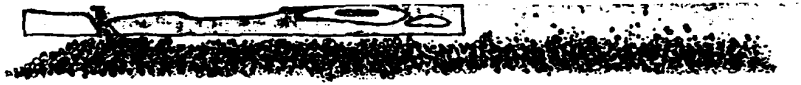
But the motor continues to turn at full power, even though it is drawing half as much current.

The difference, Hart explains, is that the second button has cut-in capacitors — devices that store and smooth out electric current so that it is more efficient. Capacitors are used in everything from toasters to huge generators, helping save untold millions of dollars on everyone's electric bills.

Yet, in its basic form, the capacitor consists of nothing more than layers of a metal like aluminum foil, which is a conductor of current, separated by paper, which is not a conductor. Such a nonconductor is called a dielectric, and the best capacitor of all is one in which the paper dielectric is impregnated with PCBs.

At its two plants on the Hudson River, G.E. puts anywhere from a few drops to three gallons of PCBs into the tens of thousands of capacitors it makes each day. G.E. engineers, says Hart, have not found any compound equal to PCBs for high dielectric performance coupled with almost complete resistance to fire or explosion. Because PCBs are a



that it believes will be effective in its capacitors and safe in the river.

Even so, the company is spending several million dollars to prevent residual PCBs in pipes and the soil around the plants from leaking into the Hudson. All domestic production of PCBs, according to the new Toxic Substances Control Act recently approved by Congress, shall cease by July 1, 1979.

Last August, after months of negotiations, G.E. agreed to pay the State Department of Environmental Conservation $3 million to help restore the river and another $1 million for research. The state will chip in $3 million of its own for restoration. This is an agreement with many implications. By paying up, G.E. has tacitly admitted responsibility for the environmental consequences that stem from its activities.

Then, in 1964, a Swedish scientist named Soren Jensen was puzzled by the results of a sophisticated analysis he was conducting on the soil and animals of his country. He was looking for traces of DDT and related insecticides, but he found instead traces of something that did not conform to known DDT patterns.

After two years of trial-and-error comparisons, Dr. Jensen finally identified the unknown substance as PCBs. At that point, of course, they were merely a novel presence, not in the same worrisome and well-publicized class with DDT. If anything seemed ominous about the discovery, it was that Dr. Jensen found PCBs in plankton and in large eagles — the bottom and top of a wildlife food chain.

That, and the fact PCBs were being found in a country that did not manufacture them. The nearest exposure to PCBs have suffered no more than occasional skin rashes. But Dr. Irving Selikoff of the Mount Sinai Medical Center, who now is studying workers at the two plants on the Hudson, warns that to assume the problems are limited to skin rashes "would be in error."

Minks Unproductive

Meanwhile, as Monsanto, sole U.S. producer of PCBs, supplied an ever-growing demand for the product all through the 1960s, mink ranchers in the Great Lakes region were having mysterious problems getting their female minks to reproduce. "These ranchers were getting wiped out," says Robert Ringer, a physiologist at Michigan State University, "and they didn't know why."

Dr. Ringer suspected the trouble was the DDT in the Great Lakes fish that

keep down dust. But even "closed systems" don't stay closed forever: Old capacitors and transformers continue to be discarded in dumps where they eventually break open and leak PCBs into the soil. Though Monsanto acted voluntarily, it surely would have been forced into such a ban by a federal task force then studying PCBs. In Japan, that same year, all PCB production was ordered stopped.

But G.E. continued to be Monsanto's biggest PCB customer; in 1970, it had purchased a record 4,000 tons, and the bulk of it went to the two capacitor plants on the Hudson River. Despite clear evidence of big problems with PCBs, no red flag had yet gone up there. As late as Dec. 31, 1974, in fact, G.E. would be granted a federal permit, with the full blessings of the DEC, to discharge up to 30 pounds per day into the Hudson — not an ounce less than G.E.'s estimate of its own discharge over the previous

known, but nothing had been done. Nobody had even bothered to tell him about PCBs. Reid found that he had to develop new communication lines to insure he would get PCB memos — including those of Ward Stone.

That August, Reid warned the citizenry not to eat striped bass from the Hudson or salmon from Lake Ontario, a warning he would convert into a ban in the Hudson by February. He also ordered an administrative hearing, chaired by a Columbia University law professor, Abraham Sofaer, to determine if G. E. had violated state water-quality standards and if so, what sort of restitution the company should reasonably make.

At those hearings, held last November, a parade of state's witnesses testified that PCBs are toxic to a wide range of living creatures, including man. It also was made strikingly clear, not only how high PCB counts were downstream from the two G.E. plants (70,000 PPM at the Hudson Falls outflow), but how low they were just a few hundred yards upstream (practically negligible).

PCBs entered the river primarily via

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superior insecticide agent as well, they also are produced for use in transformers to carry heat away from the coils, where fire is always a threat. Sealed up in electrical systems, PCBs do their job and never misbehave.

Only in the last decade has it become obvious that PCBs are a subtle but pervasive pollutant of air, earth and water. Other such pollutants have been detected in the environment recently — notably lapone and Mirex. But none has turned up with such alarming frequency as PCBs in all kinds of living organisms from tiny crustaceans to human beings.

In Mother's Milk

Just last summer, the U.S. Environmental Protection Agency found the chemical in the milk of mothers in 10 different states. The effect of PCBs is, at worst, fatal, and at best, unknown. And, thanks to G.E., nowhere is there a greater concentration of PCBs at least in the environment than in the Hudson River below the capacitor plants at Hudson Falls and Fort Edward.

Due to high levels of PCBs in resident and migratory fish all the way down to its mouth, over 100 miles away, the Hudson has been closed since last February to most commercial fishing for the first time in its history — a time, ironically, when the river is relatively free of traditional pollutants.

It has been a year since G.E. has discharged any significant quantities of PCBs into the river. The current daily discharge is less than one pound. By next summer, G.E. will stop using PCBs altogether and substitute another substance — as yet not announced — manufacturer was in Germany, across the Baltic Sea. Dr. Jensen speculated — correctly — that PCBs, rising unburned from incinerators because of their low flammability, could travel long distances by attaching themselves to airborne dust particles, raindrops and snowflakes.

Moreover, the company has done so even though it has never been specifically prohibited from dumping PCBs into the river. In fact, until recently, it had a permit — issued by the EPA and endorsed by the state — that specifically authorized it to discharge up to 30 pounds of PCBs into the river daily. By contributing $3 million of its own toward restoration as part of the agreement, the DEC has tacitly acknowledged its own failure as a watchdog.

The August agreement was accomplished by negotiation after a rigorous but comparatively swift expolitical hearing sponsored by the DEC and chaired by a law professor from Columbia University. The whole process took less than a year.

And, while the parties never saw the inside of a courtroom, the agreement nonetheless puts American companies on notice that they may be held responsible for what they do to the environment — even when they have not been specifically prohibited from doing it.

Around Long Time

The truth is that PCBs have been around for some 45 years without producing the kind of dramatically obvious effects that might have caused G.E., or any other user to think twice about dumping them in a river. They don't smell, lie in slicks atop the water or turn fish belly up; they simply sink to the bottom. At the same time, they are extraordinarily useful to industry. Besides their use in capacitors and transformers, PCBs have proved invaluable in products as diverse as hydraulic fluid, adhesives and carbonless carbon paper.

Four years after Jensen's discovery and on the other side of the world — at a rice-oil factory in the Fukuoka prefecture of western Japan — a machine containing PCBs sprang a leak, contaminating the rice oil. Thousands of people who used that oil for cooking became ill. The effects of what came to be known as the yusho — rice-oil syndrome — included skin eruptions and darkening of the pigmentation, swollen eyelids, eye discharges, swelling and painful joints, numbness of the limbs, coughing and sputum, and general fatigue. Some victims suffered from enlarged livers and embalanced enzyme and blood levels.

Perhaps most disturbing, mothers who had been exposed only fleetingly to PCBs — and who did not necessarily show any symptoms themselves — gave birth to babies with dark pigmentation, delayed tooth development, and lower-than-average weight. Even today, almost nine years after eating they quantities of PCBs — and long after all traces have passed from their bodies — the symptoms of many yusho victims persist.

Recently, a Japanese researcher told a cancer conference at Cold Spring Harbor that the incidence of liver cancer among yusho patients now appears to be as high as 15 times the normal rate.

In New York, G.E. always has asserted test workers with long-term the total sum. But even worse by far than fish poisoning unusually high levels of DDT, the laboratory mink went right on reproducing. In 1968, Dr. Ringer finally determined that the problem was not DDT but PCBs. A tiny amount — just 0.101 part per million (PPM) — stopped mink reproduction. A larger amount — 1.57 PPM — killed all the adult minks. Even this last figure is well under the maximums of 5 PPM that the U.S. Food and Drug Administration currently allows in food for human consumption.

Other experimental evidence was piling up. One American researcher fed PCBs to rats and produced tumors. Another, James Allen, a pathologist at the University of Wisconsin, fed PCBs to monkeys and produced the symptoms of the yusho syndrome, including reproductive problems.

In female monkeys that were fed PCBs at the FDA's permissible level for humans, 5 PPM, only one in eight gave birth to normal offspring. And once the infant monkeys began nursing, they were subject to further hazards. Since PCBs move rapidly into fatty parts of the body, the substance becomes concentrated in the mother's milk, hence, the level of PCBs present in the infants at birth subsequently increased 100 times.

As the danger flags went up, Monsanto began limiting sales in 1971 to manufacturers who used PCBs in "closed systems" that is, in transformers and capacitors, where the substance is sealed in and not exposed.

"Open systems," by contrast, put PCBs in direct contact with the environment — paint, for example, or worse, sprays used on dirt roads to several years.

G.E. could scarcely have hid its massive PCB discharges and it never tried. The company had stated baldly that it had been dumping PCBs into the Hudson for a long time at the rate of at least 30 pounds a day, and that it planned to go on doing it. The DEC, in approving G.E.'s various permits over the next few years, limited the dumping of certain chemicals — Kveidahl nitrocen, for example — but it never mentioned PCBs.

Even if the DEC was somehow unaware of the alarms sounded by the experimental research on PCBs, it couldn't have missed the conspicuous presence in its own department of Ward Stone, a wildlife pathologist and militant opponent of PCBs. Stone had begun copywriting his superiors with memos in 1963. On Jan. 30, 1972, he proposed that the state monitor everything from ducks to seals for PCBs. The cost of such an initial analysis, he figured, would be no more than $2,000.

Stone began to hop around the state to dig up soil samples where utility poles had fallen and spilled PCBs from broken transformers. These forays apparently made Stone's superiors nervous. At times, they seemed to view him as an errant mouse scooting around the kitchen. After sending out a long memo detailing his findings of up to 10,000 PPM of PCBs in soil around fallen poles, Stone got back a memo from his supervisor, Herbert Doig, thanking him for his efforts and telling him that others were now at work on the problem — "It will, therefore, be unnecessary for you to devote additional time to the issue."

Four days later, Stone wrote Doig: waste vacuum used to vacuum out the coolings of capacitors that had been submerged in a PCB bath. This water could easily be contained and the PCBs destroyed by ultra-high-temperature incineration.

G.E.'s PCB discharges are all but ended; a monumental problem remains: The estimated 500,000 pounds of PCBs on the river bottom downstream from the plants. The state has roughly $6.4 million with which to attack the problem — about $5.6 million of it from the settlement with G.E. (The rest of the G.E. money will be spent on studies of other chemicals in the Hudson, including one G. E. plans to use in place of PCBs.)

On an ageless schedule each spring, in the meanwhile, unknown to most people who live along the Hudson shores, fragile alewives and bluebeck herring will turn the corner from the sea in March and head up the river — past the Battery, past the West Side Highway, up the ever-widening flow to the Tappan Zee, Haverstraw Bay and even up into the narrowing of the Highlands.

They will swim up to spawn by the billions. Several weeks later, they will be followed by their larger cousins, the fighting shad. Then come the result striped bass and the modest, hundred-long sturgeons. As all these fish move upstream, they will unavoidably accumulate PCBs.

And, despite the landmark agreement between the company and the state, nobody knows when those fish will be free of PCBs, or free enough at least to allow the river to be reopened to commercial fishing.

Just as nobody knows precisely what the eventual effects of this subtle pollutant will be. ☐

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