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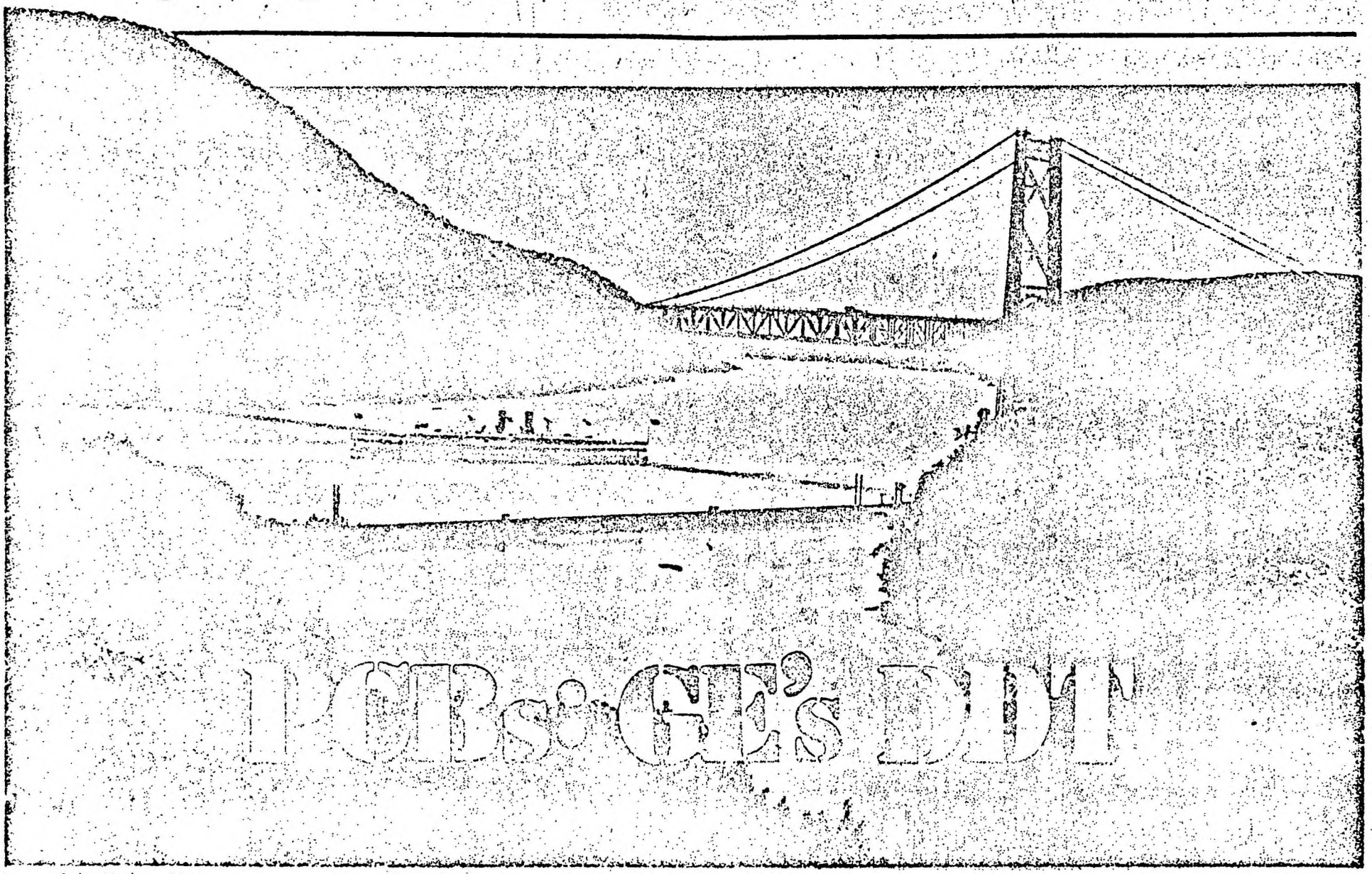

View of the Hudson River.

By PETER HELLMAN

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Quality of Life

CHALLENGES

LUKE HART, manager of the two General Electric capacitor factories at Hudson Falls and Fort Edward, N.Y., holds 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 toxic, a group of virtually indestructible compounds with the tongue-twisting name polychlorinated byphenyls, and Hart doesn't need to explain "the fuss." It has involved, in dizzying succession, pollution of the Hudson River so severe that most commercial fishing had to be banned, a precedent-setting $4,000,000 settlement by the polluter and — now that GE has agreed to stop pouring PCBs into the river — a staggering new problem: What to do about 500,000 pounds of the stuff that still reside menacingly on the river bottom?

In his big, drab office at the Hudson Falls plant, Hart demonstrates for his visitor and a watchful GE corporate lawyer the positive side of PCBs.

He plugs in an electric motor with an ammeter on its face. He pushes one button and the needle jumps to 400 amps. He pushes another button and the needle drops back to 200 amps. But the motor continues to hum 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, GE puts anywhere from a few drops to three gallons of PCBs into the tens of thousands of capacitors it makes each day. GE 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 superior heat-transfer agent as well, they are also preferred 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.

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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 PPBs, kepone 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.

Just last summer, the United States Environmental Protection Agency found the chemical in the milk of mothers in 10 states. The effect of PCBs is, at worst, fatal, and at best, unknown. And, thanks to GE, nowhere is there a greater concentration of PCBs at loose in the environment than in the Hudson River below the capacitor plants at Hudson Falls and Fort Edward. Because of high levels in summer, in resident and migratory fish all the way down to its mouth, over 200 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 GE has discharged any significant quantities of PCBs into the river. The current daily discharge is less than one pound. By next summer, GE will stop using PCBs altogether and substitute another substance — as yet not announced — 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, must cease by July 1, 1979.

Last August, after months of negotiations, GE agreed to pay the State Department of Environmental Conservation $3,000,000 to help restore the river and another $1,000,000 for research. The state will chip in $3,000,000 of its own for restoration. This is an agreement with many implications. By paying up, GE has tacitly admitted responsibility for the environmental consequences that stem from its activities.

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 $3,000,000 of its own toward restoration as part of the agreement, the state environmental agencies had tacitly acknowledged its own failure as a watchdog.

The August agreement was accomplished by negotiation after a rigorous but comparatively swift ex-judicial hearing sponsored by the state agency and headed by a law professor from Columbia University. The whole process took less than a year. And although 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.

The truth is that PCBs have been around for about 45 years without producing the kind of dramatically obvious effects that might have caused GE 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.

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, 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 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 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.

PCBs . . . found in a country that did not manufacture them.

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 imbalanced enzyme and blood-lipid 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 tiny 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, GE has always asserted that workers with long-term exposure to PCBs have suffered no more than occasional skin rashes. But Dr. Irving Selikoff of the Mt. Sinai Medical Center, who is now studying workers at the two plants on the Hudson, warns that to assume the problems are limited to skin rashes "would be in error."

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 the mink ate. But even when he fed them fish containing unusually high levels of DDT, his laboratory mink went right on reproducing. In 1968, Dr. Ringer finally determined that the problem was not DDT but PCBs. A tiny amount — just 0.164 part per million (PPM) — stopped mink reproduction. A larger amount — 3.57 PPM — killed all the adult minks. Even this last figure is well under the maximum 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 became 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 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 GE continued to be Monsanto's biggest PCB customer; in 1970, it had purchased a record 4800 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 here. As late as Dec. 31, 1974, in fact, GE 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 GE's estimate of its own discharge over the previous several years.

GE 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 state environmental agency DEC, in approving GE's various permits over the next few years, limited the dumping of certain chemicals — Kjeldahl nitrogen, for example — but it never mentioned PCBs.

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Even if the agency 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 peppering his superiors with memos in 1969. On Jan. 26, 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 $2400.

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 18,000 PPM of PCBs in soil around fallen poles, Stone got back a memo from his superior, 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: "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 Nadeau and Robert Davis of the local office of the federal environmental agency.

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 GE plants. Just below Fort Edward, they found what was, until then, a "world's record" for PCB-infested fish — a rock bass measuring in at 355 PPM.

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PCBs

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They could hardly believe it was still alive.

For a full year, the report of the two scientists floated around. It finally reached Gilman Veith, a chemist at the federal agency's National Water Quality Laboratory in Duluth, Minn. Veith had first come up against PCBs as a graduate student working on the mink problem in the 1960s. Now he was checking PCBs nationwide. "I was convinced after reading this 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, in July of last year, to Ogden Reid, who had been commissioner of the state agency for just six months.

At last, things began to happen. Startled by this alert all the way from Duluth, Reid poked around his own department to see if anyone knew about the PCB problem. He was flabbergasted to discover that plenty was 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 GE 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 was also made strikingly clear, not only how high PCB counts were downstream from the two GE plants (78,000 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 waste waters used to wash off the casings of capacitors that had been submerged in a PCB bath. This water could easily be contained and the PCBs destoyed by ultra-high-temperature incinceration.

GE's PCB discharges are all but ended; a momentous problem remains: the estimated 500,000 pounds of PCBs on the river bottom downstream from the plants. The state has roughly $6,400,000 with which to attack the problem — about $3,400,000 of it from the settlement with GE (The rest of the GE money will be spent on studies of other chemicals in the Hudson, including the one GE plans to use in place of PCBs.)

On an ageless schedule each spring, in the meanwhile, unbeknown to most people who live along the Hudson shores, fragile alewives and blueback 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 swift striped bass and the ancient, lumbering sturgeon. 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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