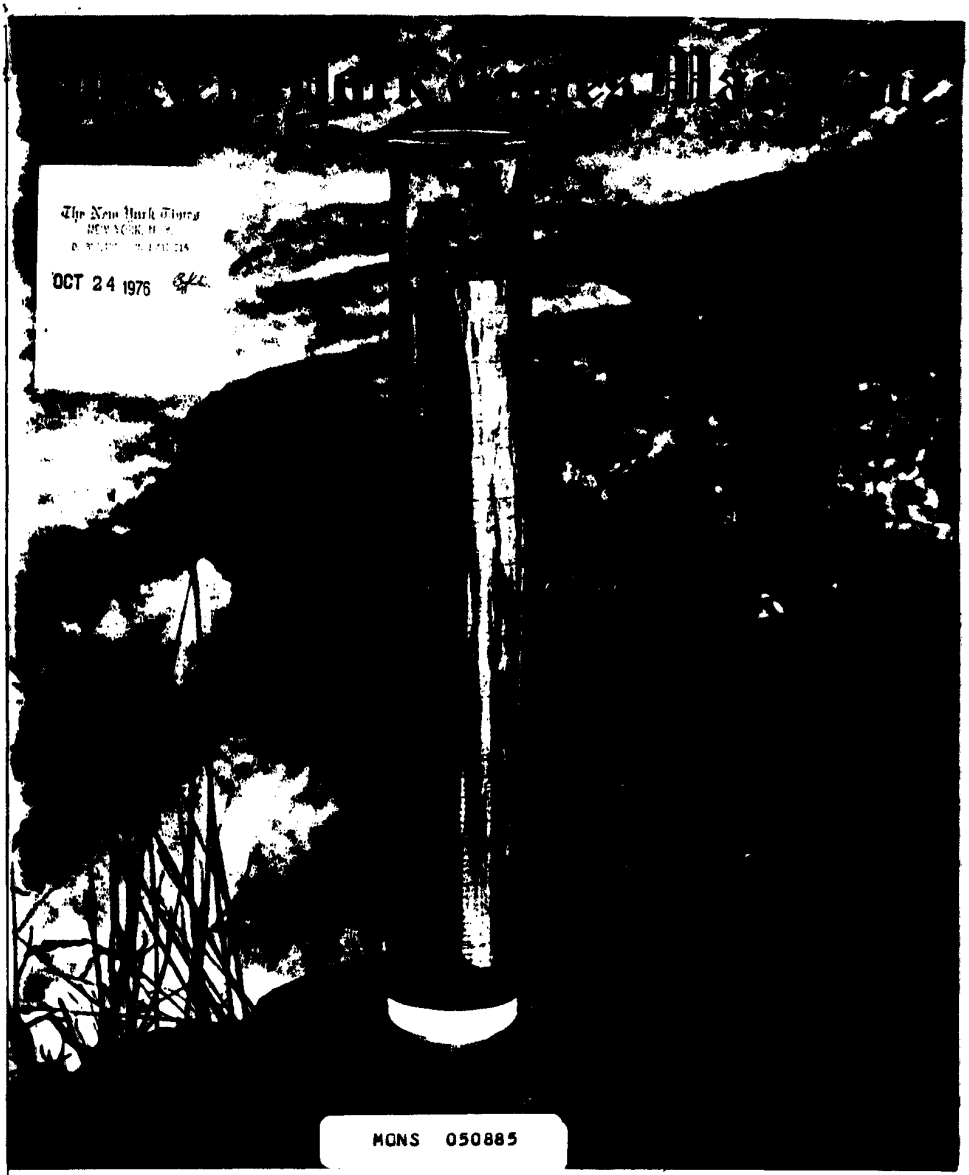


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The New York Times Magazine

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Cover

In the background, the Hudson River, where campaigns against familiar forms of pollution are finally beginning to show results. In the foreground, PCB's, or polychlorinated biphenyls—less familiar and invisible in the water, but highly toxic. Some 500,000 pounds of PCB's lie at the bottom of the river, and no one is sure what to do about them. Page 16.

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FOR THE HUDSON, BAD NEWS AND GOOD

The bad news:

PCB's don't smell or turn fish belly up. But they can make people sick—and they lie in heavy concentrations at the bottom of the great river.

By Peter Hellman

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 brilliantly clear, slightly viscous liquid.

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

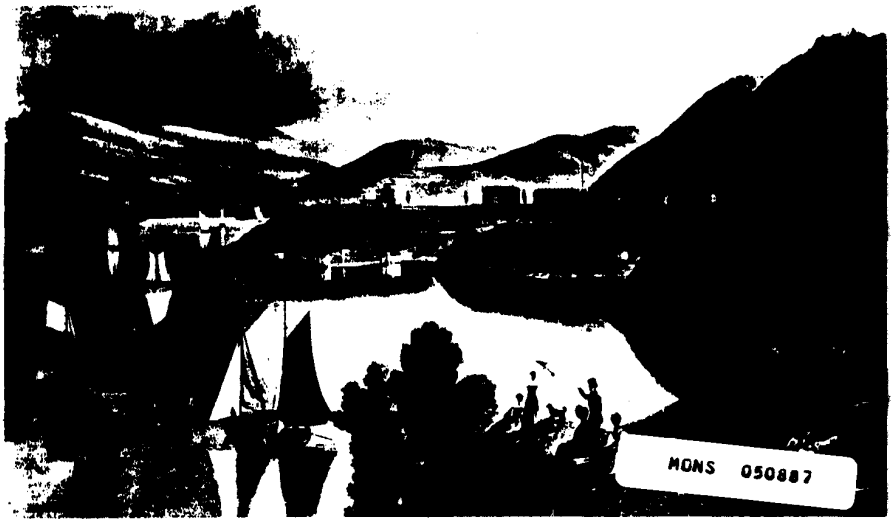
PCB's (a short for polychlorinated biphenyls, a nearly indestructible and highly dangerous group of industrial compounds that for many years seemed to be responsible for nothing but good works. The very recent "fuss" has comprised a succession of unprecedented events. First came the banning of almost all commercial fishing on the Hudson River. Then came a $4-million settlement by the polluter, G.E. And now that G.E. has all but stopped discharging PCB's into the river comes the most difficult and dangerous problem of all: What to do about some 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 G.E. corporate lawyer the positive side of PCB's. 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, seperated 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 PCB's.

At its two plants on the Hudson River, G.E. puts anywhere from a few drops to three gallons of PCB's into the tens of thousands of capacitors it makes each day. G.E. engineers, says Hart, have not found any compound equal to PCB's for high dielectric performance coupled with almost complete resistance to fire or explosion. Because PCB's 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, PCB's do their job and never misbehave.

Only in the last decade has it become obvious that PCB's are a subtle but pervasive pollutant of air, earth and water. Other (Continued on Page 20)

Peter Hellman, a freelance writer, often has fished the Hudson River.



The Hudson's serene majesty, unruffled by pollution controversy, in a lithograph, circa 1840. The view is downriver, past West Point. Map on facing page traces the river's journey from the Adirondacks to the Atlantic Ocean. Area of heavy PCB concentration, below G.E. plants, is indicated in black.



G.E.'s Hudson Falls plant. The company's best defense was that it had only been following the law.

The good news:

Controls on other forms of pollution are paying off. In most visible ways, the Hudson has not been so healthy for decades.

The Hudson has been making remarkable progress in ridding itself of the traditional pollutants along its 315-mile length. This view is endorsed even by the people whose very livelihood depends upon the river's well-being—the 70 or so commercial fishermen who put out their nets mainly in Haverstraw Bay. Until PCB's forced a ban on most commercial fishing last February, they were making ample catches of striped bass, perch and eels.

The Hudson has benefited greatly from the state's billion-dollar "Pure Waters" bond issue, which was overwhelmingly approved by the voters in 1962. Strongly backed by Gov. Nelson Rockefeller, the bond issue has enabled the state to build new water-treatment facilities even when Federal funds were slow in coming. And if the work has not gone ahead precisely on schedule, it at least has gone ahead—in stark contrast to the state's years of foot dragging on the PCB problem.

Even when it was most abused by human and industrial wastes, however, the remarkable Hudson has always remained, with the exception of a single miserable stretch, more intensely vital than perhaps any other American river. Indeed, it hosts a far richer variety of fish life near the great metropolis at its mouth than it does near its unsposied source at Lake Tear of the Clouds on Mount Marcy, highest mountain in the Adirondacks. Far upriver, the water runs clear, cold and fresh. But it can support only a modest population of fish, primarily trout and smallmouth bass. As the river flows down toward Corinth, it gets deeper and darker. Largemouth bass, pike and carp are most at home in this stretch, which is hardly better or worse than any other medium-sized, long-exploited river. It is only in the 50-mile stretch beginning at the doorstep of the General Electric plant at Hudson Falls that the river has been defeated abjectly. Walled, canalled, constricted and dammed, the Hudson here has been reduced to little more than a sink that must accept waste from the appallingly filthy lower Mohawk River as well as from its own banks. In summer, this portion of the Hudson can stink, and it is very hard to find any living fish here at all.

Once the flow is well clear of Albany, changes both visible and invisible occur. As low hills roll toward the distant, plum-toned Catskills to the west, the river almost miraculously rids itself of the upstream poisons. The City of Poughkeepsie actually uses this water, after treatment, for drinking. Twenty miles farther south, at Newburgh, the forested hills close in and rear up sharply over the river. This is the Highlands, and its 15 miles are the least-spoiled, most-dramatic section of the river. Here, at the jut of land called World's End, just across from the ramparts of West Point, the river plunges to its greatest depth of 216 feet. In sight of that spot, just two miles upstream, Storm King soars 1,300 feet almost straight up with the bulk and violent power that make it resemble a huge bear. There is nothing quite like the Hudson here. Other rivers cut scenically through the Appalachians, of course, but only the Hudson cuts with such a sharp, deep stroke, and only the Hudson does it without rising above sea level.

As suddenly as the Highlands have reared up, the river widens out just above Peekskill into the majestic and serene estuary that overwhelmed Henry Hudson, inspired a school of American painters and caused Henry James to advise that a "decent respect for the Hudson would confine us to use of the boat." The estuary is divided by Croton Point into Haverstraw Bay and, directly below, the Tappan Zee. It is here, 42 miles inland, that the Hudson is widest—3.3 miles. Grand as it is, what is most remarkable about this estuary is the unique mingling of huge volumes of fresh water from the Adirondack watershed and salt water from the Atlantic shelf. During the spring runoff, salinity may be almost zero at the Tappan Zee Bridge. In late summer, when rain has been scarce, the upward push of the tide may bring a level of two-thirds sea water. Blue crabs can then be seen scuttling happily on the pilings, not only of the Tappan Zee, but also of the Bear Mountain Bridge, 45 miles from the Battery. And it is not unusual to see a school of bluefish chopping up bait fish on the surface—at the very hour, perhaps, when fishermen looking for such a sight off Barnegat Light are being skunked.

In this meeting of fresh and salt water, rocked by the tide, the river

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is constantly being agitated. Though the salt water, being heavier, should sink to the bottom, there is actually almost no difference in salinity at any level and, compared with a lake of similar depth, little difference in temperature. Despite its surface calm, the Hudson here is a cauldron, and the product is life. At Glens Falls, 220 miles upriver, hardly more than a dozen species of fresh-water fish can be found. Here in Haverstraw Bay are more than 80 species, of which about half are commonly thought to exist only in salt water. This portion of the river, in fact, is where shad, herring, striped bass and the ancient, lumbering sturgeon come each spring to bear billions of young. Without Haverstraw Bay to act as their nursery, the entire mid-Atlantic seaboard would be an inestimably poorer place.

The best place to get a sense of the life in this estuary is, of all places, the vicinity of the three Con Ed nuclear plants at Indian Point. The power company is busy studying fish life here to see how best to minimize damage from these installations. With two local power companies, it has hired a division of Texas Instruments to do a monumental sampling of everything that moves in Haverstraw Bay. Small and large boats bearing the T.I. symbol can be seen zipping around the estuary at all hours and seasons. And back at the labs, behind the complex of docks at Indian Point, scientists are busy weighing, measuring, cutting open, puréeing and pickling vast numbers of fish.

On a fairly typical business day here one morning last summer, a small Boston whaler manned by two graduate students in biology set out from the docks at 10:30 and sped two miles upriver to a shallow cove. Almost at the bank, they hurled out a 30-foot net into water that appeared too shallow, in fact, to catch fish. But their net filled with no fewer than 37 of a striped bass's favorite fish, slender and silvery alewives, slightly less than a pound each. Out in the middle of the bay, meanwhile, passed the trawler Pocahontas, biggest of the T.I. boats. It was making a seven-minute trawl at a depth of 35 feet. Too often, the trawling nets are ripped open by anchors, ancient wrecks and other submerged obstacles. This trawl, however, comes up with 6 small striped bass, 29 white perch, 2 infant bluefish, 2 catfish, 18 tomcod, 1 Atlantic sturgeon, 10 American eels and what seems like a zillion mini-flounders called hogchokers.

Bigger pickings awaited another T. I. boat when it traveled almost up to the Bear Mountain Bridge at noon to check three stationary nets that had been set four hours earlier. In the first net were a pair of 20-pound carp, heavy-scaled and ponderous. In the third was a magnificent 49-pound striped bass, its glistening back flexing powerfully and its gills flaring angry red as it was disentangled from the net, measured and thrown back. Ardent fishermen can spend a lifetime hurling baits into a chill and inhospitable ocean surf in hopes of catching such a prize. A female or "cow" striper like this one can release up to 10 million eggs into the current where, after being fertilized by attending males, they float free for several days until they hatch. It is now thought that at least 10 to 20 percent of all mid-Atlantic striped bass start their lives here on a Hudson River current.

The oddest craft afloat on Haverstraw Bay this day is a 43-foot houseboat whose stern has been drastically modified by a pair of high booms that support a large trawl-and-winch system. This curious hybrid is the creation and domain of William Dovel, a fish biologist for the Boyce Thompson Institute, a private research facility in Yonkers. The T. I. seem wave to Dovel, but he is not very enthusiastic about waving back. He regards them warily as big-business, researchers, with big budgets and big Ph.D.'s. Dovel is a loner with hardly any budget and no Ph.D.

Dovel is in the midst of a pioneering project that tracks Atlantic sturgeon when they return to the Hudson after as long as 10 years at sea. Dovel trawls up the smaller sturgeon from his own boat, but for the large ones, he depends on a network of commercial fishermen who call him, whatever the hour, when they find one in their nets. Then Dovel rushes over and implants the fish with a sonic tag that sends out an underwater beep with a range of several hundred feet. He releases the "tagged" sturgeon and, from his houseboat, shadows the sonic beep.

Today is the 16th day Dovel has been following a sturgeon, which is now on the bottom about 40 feet ahead of the boat and only a mile from where it was caught. Dovel already has shadowed it 24 miles upstream to Newburgh. Three days from now he will lose contact 38 miles south at the George Washington Bridge, where the sturgeon presumably heads out to sea. This sturgeon was four feet long, which is nothing for a Hudson River specimen. In his lab, Dovel has one pickled in a coffin-sized crate—a 175-pound creature 7-feet long, the catch last spring of a commercial fisherman named Charlie White.

Besides the pickled sturgeon, Dovel keeps another interesting exhibit in his lab at Boyce Thompson. It consists of 20 pairs of one-quart glass jars lined up on a long table. Each pair contains a sampling of the Hudson River at various points along its full length. In each pair, the first jar simply contains river water, sampled for human-induced bacteria levels. The second jar contains a representative sampling from that same point of phytoplankton, the basic microorganisms on the food chain. For upstream, where the river is almost wild, the jar bacteria count is not high, but neither is the plankton level. As the samples progress down toward Haverstraw Bay and below, the water gets dirtier, of course, but the samples also show correspondingly more small creatures. The jars from Haverstraw Bay and even from Yonkers fairly teem with tiny crustaceans—pearly, translucent and black-eyed. Many of these samples were taken in sight of oil tanks, factories and even open sewers—yet the resilient Hudson shrugs all that off and approaches the virgin richness of an unspoiled estuarine marsh. — P. H.



Symbolic sloop: The Clearwater, replica of ships that plied the Hudson in colonial times. To publicize the cause of cleaning up the river, it has served as a concert stage for Pete Seeger and a floating classroom.



Sturgeon patrol: William Dovel and Marc Crandall of Boyce Thompson Institute in Yonkers examine a 100-pound sturgeon from the Hudson. Dovel also tags live fish with sonic devices to track them up and down the river.

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Hudson River

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such pollutants have been detected in the environment recently—most notably, the highly toxic insecticide Kepone. In fact, three weeks ago, the U. S. District Court in Richmond, Va., fined the Allied Chemical Corporation $13,378,000 for dumping Kepone into the James River. But none of them has turned up with such alarming frequency as PCB's in all kinds of living organisms, from tiny crustaceans to human beings. Just last summer, the U.S. Environmental Protection Agency found the chemical in the milk of mothers in 10 different states. The effect of PCB's is, at worst, fatal and, at best, unknown. And, thanks to G.E., nowhere is there a greater concentration of PCB's at loose in the environment than in the Hudson River below the capacitor plants at Hudson Falls and Fort Edward. Due to high levels of PCB's in resident and migratory fish all the way down to its mouth, more than 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 G.E. has discharged any significant quantities of PCB's into the river. The current daily discharge is less than one pound. By next summer, G.E. will stop using PCB's 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 PCB's in pipes and the soil around the plants from leaking into the Hudson. The principal supplier of PCB's, Monsanto Company, has announced it will stop producing the compounds by the end of October 1977.

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

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

When the state at last confronted G.E. a little more than a year ago, the situation had all the makings of a bitter and protracted court battle of the sort that Reserve Mining Company and a raft of public agencies have fought over Reserve's waste discharges into Lake Superior. The August agreement, by contrast, was accomplished by negotiation after a rigorous but comparatively swift extudicial hearing sponsored by the D.E.C. 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.

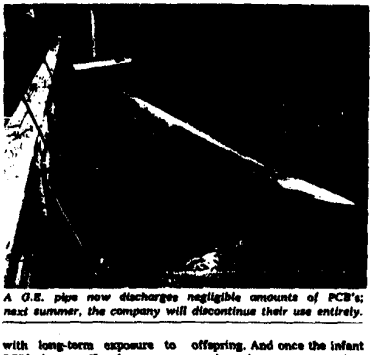
The truth is that PCB's have been around for some 45 years without producing the kind of dramatically obvious effects that might have caused G.E. or any other user to think twice about dumping them in a river. They don't smell, lie in slicks atop the water or turn fish belly up; they simply sink to the bottom. At the same time, they are extraordinarily useful to industry. Besides their use in capacitors and transformers, PCB's have proved invaluable in products as diverse as hydraulic fluid, adhesives and carbonless carbon paper. By 1960, they were being manufactured in the United States, Russia, Japan and at least six European countries.

Then, in 1964, a Swedish scientist named Sören 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 PCB's. 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 PCB's in plankton and in large eagles—the bottom and top of a wildlife food chain. That, and the fact PCB's 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 PCB's, rising unburned from incinerators because of their low flammability, could travel long distances by attaching themselves to airborne dust particles, raindrops and snowflakes.

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 PCB's 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 PCB's—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 PCB's—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. has always asserted that workers

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A G.E. pipe now discharges negligible amounts of PCB's; next summer, the company will discontinue their use entirely.

with long-term exposure to PCB's 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 PCB's, supplied an ever-growing demand for the product all through the 1960's, 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 PCB's. A tiny amount—just 0.164 parts per million (p.p.m.) — stopped mink reproduction. A larger amount — 3.57 p.p.m. — killed all the adult minks. Even this last figure is well under the maximum of 5 p.p.m. 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 PCB's to rats and produced tumors. Another, James Allen, a pathologist at the University of Wisconsin, fed PCB's to monkeys and produced the symptoms of the Yusho syndrome, including reproductive problems. In female monkeys that were fed PCB's at the F.D.A.'s permissible level for humans, 5 p.p.m., only one in eight gave birth to normal offspring. And once the infant monkeys began nursing, they were subject to further hazards. Since PCB's moves rapidly into fatty parts of the body, the substance became concentrated in the mother's milk. Hence, the level of PCB's 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 PCB's in "closed systems"—that is, in transformers and capacitors, where the substance is sealed in and not exposed.

"Open systems," by contrast, put PCB's 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 PCB's into the soil. Though Monsanto acted voluntarily, it surely would have been forced into such a ban by a Federal task force then studying PCB's. 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 4,800 tons, and the bulk of it went to the two capacitor plants on the Hudson River. Despite clear evidence of big problems with PCB's, no red flag had yet gone up here. As late as Dec. 31, 1974, in fact, G.E. would be granted a Federal permit, with the full blessings of the D.E.C., 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 several years.

G.E. scarcely could have hid

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Biologist Dovel in his lab. Jars containing samples from the river reveal that Haverstraw Bay "approaches the virgin richness of an unspoiled estuarine marsh."

its massive PCB discharges, and it never tried. The company had stated baldly that it had been dumping PCB's into the Hudson for a long time at the rate of at least 30 pounds a day. The D.E.C., in approving G.E.'s various permits over the next few years, limited the dumping of certain chemicals — Kjeldahl nitrogen, for example—but it never mentioned PCB's.

Even if the D.E.C. was somehow unaware of the alarms sounded by the experimental research on PCB's, it couldn't have missed the conspicuous presence in its own department of Ward Stone. A wildlife pathologist and militant opponent of PCB's, 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 PCB's. The cost of such an initial analysis, he figured, would be no more than $2,400. Noting his particular concern for increasing "juvenile mortalities" in sea birds on Gull Island in Long Island Sound, Stone ended that memo with the warning that "PCB's pose a great threat to the same species that the chlorinated - hydrocarbon pesticides threaten."

In the next few years, Stones memos became more pointed. He began to hop around the state to dig up soil samples where utility poles had fallen and spilled PCB's 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 p.p.m. of PCB's 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. . . ."

It is plain that, for all his dedication to the job, Stone did not exactly have a gift for gentle persuasion. On May 28, 1974, for example, cutting through several bureaucratic layers, he wrote directly to Carl Parker, chief of the department's Bureau of Fisheries: "I am quite worried about PCB's and feel that their presence is one of the more important wildlife management problems of our time but expect little recognition of this problem in a department that looks at such things as deer poaching and party permits as the leading conservation problem of the day."

If Stone's bluntness got him nowhere from the inside, there is no evidence that anyone could have done better from the outside. As far back as 1971, Robert Boyle—a senior writer for Sports Illustrated, ardent fisherman and author of a book on the Hudson that is remarkable for both its information and its passion—wrote to Parker warning of lab tests he had personally commissioned that showed contamination of roe from Hudson River striped bass at levels as high as 11.4 p.p.m.

"These are grim figures and I certainly think the state should warn fishermen not to eat striped-bass eggs," wrote Boyle. Parker's reply, according to Boyle, was "derisive."

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 E.P.A. 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. This was hardly a brilliant idea, of course, since G.E. had been announcing its PCB discharges in permit applications for years. Nadeau and Davis found extraordinarily high levels of PCB's in the water, river mud and living creatures in the vicinity of the G.E. 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 p.p.m. 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 E.P.A.'s National Water Quality Laboratory in Duluth, Minn. Dr. Veith had first come up against PCB's as a graduate student working on the mink problem in the 1960's. Now he was watchdogging PCB's 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 ten." Veith wrote a review of that report, emphasizing its seriousness, and sent it off to the director of the E.P.A. regional office in New York. It was forwarded, in July of last year, to Ogden R. Reid, who had been Commissioner of the D.E.C. 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 PCB's. 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 PCB's 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 G.E. plants (78,000 p.p.m. at the Hudson Falls outflow), but how low they were just a few hundred yards upstream (practically negligible). As a result of new surveys, the record established by Nadeau and Davis with their rock bass was easily broken by many fish. The new record holder was an American eel containing 575 p.p.m. of PCB's. It would have supplied a consumer with more than half his lifetime PCB limit as set by the F.D.A. And in Canada, where the maximum PCB content of edible fish is 2.5 p.p.m. rather than 5, that single meal would have easily exceeded the lifetime safe limit.

Given such testimony, it came as quite a

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surprise when G.E. introduced its own expert witness, Gerald Lauer of Ecological Analysts, Inc., who presented his finding that fish taken from below the two plants did not contain PCB levels in excess of the current standard of 5 p.p.m. Upon cross-examination, Lauer had trouble deciphering his own notes and tables. It turned out, furthermore, that the laboratory in Tennessee that had made the analysis had botched the job. G.E. withdrew Lauer's testimony.

G.E. did better with its basic "affirmative defense," which held that it had applied for and been granted both state and Federal permits to discharge PCB's. How could it be penalized for scrupulously following the law? Sofaer agreed that this argument had "more than superficial appeal." But it was not enough to excuse G.E. from the general requirements of its permit, which forbade the company to violate state water-quality standards even if the precise prohibitions were not spelled out. Accordingly, Sofaer ruled that "G.E. has discharged PCB's in quantities that have breached applicable standards of water quality . . . injured fish, and . . . destroyed the viability of recreational fishing in various parts of the Hudson River by rendering its fish dangerous to consume."

It came out during the hearings, most interestingly, that even before the PCB problem became public, G.E. already had determined that further significant discharges could be eliminated without much difficulty. PCB's 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 PCB's destroyed by ultra-high-temperature incineration.

G.E. was not the only party to lose out. Just four months after Sofaer's decision was announced, Ogden Reid found his position untenable and resigned after a year and a half as Commissioner of the D.E.C. Several things had gone wrong, but the main one was that he had picked an inopportune time to go after G.E.—the middle of Governor Carey's desperate campaign last winter to keep the state from being pulled down by New York City's financial collapse. Looking forward to the critical "spring borrowings," Carey was busy telling the financial community what a wonderful and hospitable place New York was to do business, while Reid played the heavy to one of the state's

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top corporate citizens. At one tense meeting with Carey and Reid, the G.E. board chairman, Reginald Jones, is reported to have angrily warned that he would pull all company facilities out of New York if Reid forced the two Hudson River plants to go to zero-PCB discharge before G.E. thought it feasible.

Publicly, Carey never backed off from defending Reid on the G.E. issue. But neither did he stop a vigorous frontal attack by Reid's fellow commissioner, John Dyson of the State Department of Commerce. "If zero discharge means zero jobs and three ounces means 1,200 jobs, I say we go for three ounces," said Dyson, in one of his many utterances.

Reid's downfall was hastened, no doubt, by a manner that struck many upper-level departmental bureaucrats as being peremptory and insensitive to the pecking order. As the end approached last winter, three of those bureaucrats resigned together in protest of Reid's leadership. Reid even had the Albany press sniping at him over departmental "morale" right up to the day of his resignation. At press conferences, certainly, Reid did not have Carey's light touch and fancy footwork in fending off sticky questions. At a sensitive time for the state in its relations with industry, Reid carried a big stick but walked loudly.

Though Reid is gone, replaced by Peter A. A. Berle, and G.E.'s PCB discharges are all but ended, a momentous problem remains: the estimated 500,000 pounds of PCB's on the river bottom downstream from the plants. The state has roughly $8.4 million with which to attack the problem—about $3.4 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 the one G.E. plans to use in place of PCB's.) The first step, which will cost about $1 million and take six months, is to find out what can be done. This will consist mainly of mapping the precise locations and depths of the PCB's, which now appear to be concentrated behind the eight dams on the river between Hudson Falls and Troy.

The next step will be to attempt to render the PCB's harmless. How this might be accomplished is not yet clear, though it is certain to take years. The most obvious approach—dredging up the PCB muck—presents several problems. For one thing, the task might require expensive, spe-

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cially designed dredges. Moreover, no riverside locality is likely to welcome huge mounds of PCB muck in its backyard. One possible solution, which Philip Gitlen, the D.E.C. counsel, admits is now "esoteric," would be to neutralize the substance through a complex method recently developed by a Canadian biochemist. The method uses sound waves to break up the oily chemicals and a specially developed strain of bacteria to devour them. It has worked in the laboratory, but no one knows when it will be perfected for large-scale use.

Dredging entails yet another complication: Like stirring up dust in a closed room, it might send dormant PCB's flowing into the water currents, renewing the danger to living creatures. For this reason, says Gitlen, another approach might be "to do nothing." The trouble is that, unlike dust in a closed room, PCB's don't necessarily lie dormant. In the 12 days of heaviest river flow each year, according to D.E.C. tests, as many as 10,000 pounds of PCB's may pass over the Troy dam. They will then head, unimpeded, toward the rich estuary of Haverstraw Bay, where they can do far more harm than in the already unhealthy and unproductive stretch above the Troy dam.

Even if at least some dredging is undertaken—as now appears likely—it may be three years before PCB's are actually scooped out of the river in quantity.

On an ageless schedule each spring, in the meanwhile, unbeknown to most people who live along the Hudson shores, fragile alewives and blue-back 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 and 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 will come the swift striped bass and the ancient, lumbering sturgeon. As all these fish move upstream, they will unavoidably accumulate PCB's. And, despite the landmark agreement between the company and the state, nobody knows when these fish will be free of PCB's, or free enough, at least, to allow the river to be reopened to commercial fishing. And, certainly, nobody knows precisely what the eventual effects of this subtle pollutant will be. ■

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