PCBs
An Enforcement Crisis

By Phil Garner
Photography by Floyd Jillson

BLUE-GREEN water smelling faintly of chemicals flows furiously into a tributary of the Tugaloo River from an electrical capacitor plant in South Carolina. The water contains polychlorinated biphenols (PCBs) above accepted levels. The plant has been ordered to clean up its discharges into the creek, but it remains open, still discharging. Fishermen in Lake Hartwell, in the meantime, have been warned not to eat what they catch.

Water is discharged at four points from an electrical transformer plant in Rome Ga., into streams which flow into the Coosa River. Some of the water contains PCBs above accepted levels. The plant management, already taking measures to clean up its PCB discharges, privately informed a state regulatory agency it would cease production of PCB-bearing equipment in 1977. In the meantime, contamination of the river continues and the plant remains open. The river, however, has been closed to commercial fisherman by the same state agency.

The detection of accumulated PCBs in fish from both Georgia rivers -- at levels well beyond those tolerated by the U.S. Food and Drug Administration-- sent anti-pollution enforcement machinery into accelerated action bringing into focus some generally overlooked facts about the protection offered the public.

Despite the Water Pollution Control Act of 1972, with its system of discharge permits administered by the Environmental Protection Agency or by approved state agencies, the major portion of the policing of toxic discharges into the nation's waterways is left to the plant managers themselves.

And, even when the plant managers report toxic contamination beyond tolerated levels, they are seldom faced with drastic enforcement action.

So long as plant managers impress enforcement officials with the good faith of their efforts to correct violations of permit requirements, they are allowed to continue to contaminate the waterways.

Staff can't keep tabs on 12,000 permits, says EPA enforcement chief Paul Traina.

ONLY when PCB levels in fish reached the point of immediate danger to humans who might eat them did the Atlanta regional office of the U. S. Environmental Protection Agency order the offending plant to correct matters.

"We deal with some 12,000 permits," explained Paul Traina, director of the enforcement division of EPA's regional office in Atlanta. "We have limits in terms of people who work for us. At present we have 30 or 40 people who look at these reports."

The history of the PCB cases in South Carolina and Georgia contain a picture of well-intentioned action both by plant managers and EPA officials, which nonetheless allowed continued pollution of the waters.

The PCB polluter in South Carolina is the Sangamo Electric Co., whose plant is in Pickens, on a tributary of Town Creek. Sangamo uses PCBs in the production of capacitors.

Capacitors are devices consisting of two or more conductor plates separated by a dielectric and used for receiving and storing an electrical charge. The dielectric is an insulator that allows the passage of lines of force of an electrostatic field but does not conduct the current. Capacitors at the Sangamo plant, as at most capacitor plants, contain PCBs as the dielectric, a function for which its heat-resistant features make it well suited.

The major producer of PCBs is the Monsanto Co., which sells the fluid under the trade name Aroclor. The basic raw material in the various Aroclor compounds is biphenyl, which is manufactured from pure benzene. The

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biphenyl is first chlorinated with anhydrous chlorine in the presence of ferric chloride to produce crude PCBs, and then distilled to obtain the finished product.

MONSANTO'S PCB production in 1974 was 40,406,000 pounds of which 34,005,000 pounds were sold in this country. PCBs were first manufactured in 1929, but it was only in 1966 that PCBs were discovered in fish, birds and other animals. Three years after being discovered as a global contaminant, PCBs were the cause of an outbreak of disease in Yusho, Japan, in which more than 1,000 persons were affected after eating contaminated rice oil.

In 1972, a presidential task force reported that PCBs were found in all parts of the environment and could bioaccumulate to extremely high levels in fish. The Monsanto Co. voluntarily restricted its sales of PCBs to firms using them in "closed systems" such as capacitors and transformers.

Japan banned production or import of PCBs entirely.

In 1973, the Organization for Economic Cooperation and Development (OECD) prohibited the use of PCBs in member countries except in certain closed systems.

Environmental protection officials thought all those measures added up to an effective, comprehensive program that would "take care" of the PCB problem, recalled Russell Train, EPA's administrator. "Instead," Train said in a recent speech, "more than three years later, we find that, although PCB levels in food have steadily declined, PCBs are present in our environment to a far greater degree and at higher levels than we have previously thought."

Train urged passage of a toxic substances control law, pointing out that five years have passed since such a law was recommended by former president Richard Nixon. "Since that time," said Train, "we have introduced into the commercial market an estimated 600 chemical compounds annually. We have done so without any systematic, advance assessment of their potential impact upon public health."

Meanwhile, continuing research has pointed toward PCBs as a cancer-causing agent. A 21-month exposure of rats to Aroclor 1260 caused cancer of the liver in the animals. Female Rhesus monkeys exposed to levels as low as 2.5 parts per million (ppm) and 5.0 ppm (the FDA's current danger level rating) developed facial acne, loss of eyelashes, irregular menstrual cycles, and had early abortions and stillbirths. Infants born to monkeys in the trials contained PCBs in their tissues at birth and continued to be exposed to them through their mothers' milk. The infant monkeys developed skin lesions and 60 percent of them died within four months of birth.

Follow-up studies of the Yusho, Japan, incident made by a leading Japanese scientist, showed that five of the Yusho victims died of cancer of the liver within five years of eating the contaminated rice oil. The connection between PCBs and liver cancer was considered definite in two of the cases.

The EPA recently reported that PCBs had been found in tests of milk of mothers who live in 10 states in this country. The average PCB level in the tests was 1.7 ppm, well over the FDA allowed maximum of 0.2 ppm for infant and junior food.

Because PCBs are nonbiodegradable, they accumulate in the sediment of streams and lakes and in the aquatic food chain. Thus, even small amounts discharged into the water can build to dangerous levels when concentrated in predatory fish at the top of the chain.

The crisis over Sangamo Electric's pollution of Lake Hartwell began with a "routine" sampling of fish by the South Carolina Health and Environmental Control Agency. South Carolina is one of several states which have taken over the permitting process from the federal government.

On August 11 of this year, a South Carolina official called the EPA's water laboratory in Athens, Ga., to ask for verification testing of some alarming findings. Elevated levels of PCBs had been found in fish while monitoring Lake Hartwell. The next day three fish fillets were sent to the laboratory, where the results were verified. Values as high as 100 ppm (the allowable level was 5 ppm) were found in fish in the Twelve-Mile Creek area of the lake.

A WARNING was issued to the public and testing continued. A biologist was sent from Athens to assist South Carolina biologists. On Aug. 20, the DHEA and the state of South Carolina continued their advisory against eating fish from the lake.

In the meantime, state and federal environmental officials visited the Sangamo Electric plant. The plant manager had earlier taken considerable care to seal off the PCB operation from the

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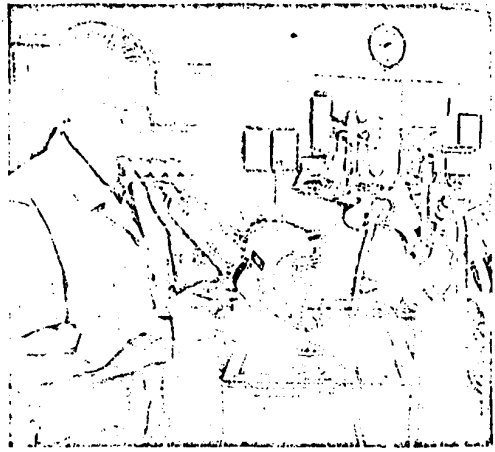
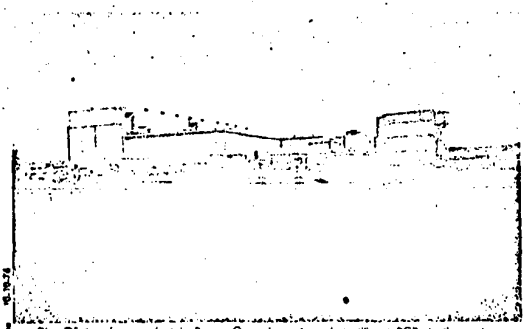


An EPA scientist operates part of the complex equipment used to detect PCBs.



The GE transformer plant in Rome, Ga., cleaned up, but still put PCBs in the water.

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rest of the plant. There was, at that point, no evidence to show whether the PCBs in the lake were coming from the plant.

THERE was another possible source. Sangamo had contracted with a waste disposal firm to get rid of its discarded materials, including damaged capacitors and used filters. The waste was going to several dumps. Visiting the sites, investigators found ruptured capacitors and filters lying in the open near flowing streams. They took soil and water samples in and around the dumps.

Testing at the plant site was also begun. Sangamo operates under a permit issued in 1974, requiring that any discharges into the small creek nearby contain PCBs only on a "non-traceable" level. What does "non-traceable" mean?

"It means," said Cliff Hawkins of the South Carolina Environmental Protection agency, "that if there are any traceable amounts of PCBs in the stream, we'd better not find them!"

"No trace," said Paul Traina, "means one part per billion (ppb) in water. That's background level, what you'd normally expect to find anywhere. The human mind can't really contemplate how little that is."

Sangamo had for some time, however, been reporting more than traceable amounts of PCBs. The company had been required by its permit to sample daily in Town Creek and three times per week at its discharge ponds.

"Sometimes they reported non-detectable, sometimes 5 *or 8 ppb*," *Traina recalled*.

The report for March 1-May 31 showed a 3.9 ppb average reading of PCBs and a maximum reading of 27 ppb. The report for Dec. 1 - March 1 showed an average reading of 5 ppb and a 14 ppb maximum reading. Data from the last two months before the crisis occurred showed readings of 3.5 ppb.

Why had Sangamo been allowed to continue in violation of the limits set by its discharge permit?

"The charts from 1974," Traina explained, "showed a steady decline in PCB levels."

It had appeared to Traina and his staff that Sangamo was cleaning up its operation, although it was evident that PCBs still were being discharged into public waterways.

ONE reason for a less than firm enforcement policy, Traina indicated, is, as he puts it, "The test for PCBs is not that precise."

Furthermore, Traina said, limited manpower requires his office to set priorities.

"We were aware of the PCB levels," said Traina. "But we were *also aware the data showed a continuing downtrend.*"

Traina did write Sangamo in May, before the Lake Hartwell crisis, asking for a meeting with company representatives to discuss the PCB levels at the plant. The level then was about the same as it reads currently, Traina said.

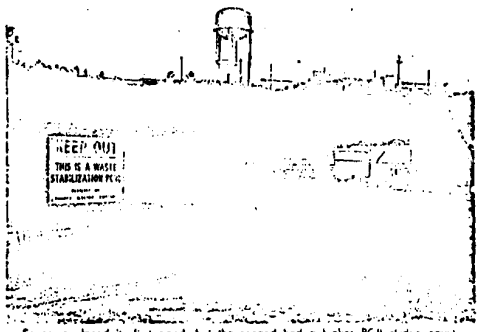
When EPA representatives returned to the plant to take readings shortly after the Lake Hartwell warning was issued, however, they found that the discharge into Town Creek from Sangamo registered 8 to 11 ppb.

"The company's own data showed that, in fact, the PCB area was not sealed off properly," said Traina. "We found readings of 50 ppb coming from the manufacturing area, in manhole water samples."

There was another surprise for EPA surveillance people.

Sangamo had sent its wastewater through two settling ponds before discharging it into Town Creek. Previously, before PCBs were found to be harmful, the company had allowed them to enter the wastewater system. EPA expected, therefore, to find some PCBs in the first pond, which had recently been bypassed. Readings from the sludge in the first pond showed 43 - 48 ppb in the sediment. Tests in the second pond, where discharge water still went before entering the creek, showed astronomical PCB readings of 14,000 ppb in the sludge.

"*That was something we*



Sangamo closed its first pond, but the second had a higher PCB sludge count.

just didn't expect," said Traina "We still don't understand it."

How the PCBs enter the wastewater system at all is difficult for the experts to understand. Water is not an essential component of the manufacturing process. The problem does not lie in removing PCBs from the process stream of such plants, but in preventing them from entering waste water lines.

Most PCB contamination of waste water results from pump leaks into cooling waters, spills, or inadequate personal hygiene habits. The other major suspected source is the continued leaching of surface water through areas of old spills.

In the manufacturing process, capacitor bodies, each containing a machine-wrapped bolls of alternating paper and aluminum foil, are placed in a chamber. The chamber is evacuated and prefiltered dielectric oil is introduced until it covers the capacitors. The vacuum assures that the paper will be well-soaked with the fluid.

AFTER the filling operation, the vacuum is released, excess fluid is removed to the holding tank, and the capacitors are sealed and decoiled.

Even if PCBs were not leaking somehow into the discharge water of the plant, they were certainly entering the nearby streams due to inadequate disposal methods.

Although neither EPA nor the State of South Carolina was regulating the method of disposal of PCB-contaminated wastes from the plant, the importance of proper disposal methods was generally known among members of the industry.

IN January of 1974, for example, the National Electrical Manufacturers Association approved and published standards for handling and disposal of PCBs. Among the alterna-

Discharge water, coming from the pond, enters a creek

tives offered to dumping on the surface of the ground were thermal incineration, physical chemical treatment, solidification, gelatinization and the use of a scientific landfill consisting of lined cells with sump pumps at the bottom for recycling PCB-laden leachate into chemical treatment plants.

At Trotter's dump, one of the disposal sites used by the contractor for Sumpter, large piles of discarded capacitors, dielectric oil drums, and oil PCB filters lay on top of the earth, some less than 50 feet from two small streams which eventually feed into Town Creek.

Water readings in the streams produced small levels of PCBs, Traina said, but were taken during dry weather. A good rain would be expected to deposit PCBs into the water, Traina said.

The company, said Traina, has agreed to remove the PCB contaminated wastes to a suitable landfill, sealed and

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ocess with cover plants.

In an order issued in September, EPA declared that Sangamo had violated the terms of its discharge permit and ordered that the company cease discharging into the first settling pond within 24 hours (the company had already ceased using that pond); that the company, within 30 days, come into compliance with all terms of its permit; and that the company begin monitoring PCBs in its discharge on a daily basis and filing reports on a weekly basis (which the company was already doing).

"The reason for allowing them 30 days," said Trainis, "is that we recognize a number of uncertainties, especially in measurements."

What happens if tests after 30 days reveal continued PCB discharges on similar or higher levels?

"If they can't or won't comply with the order," said Trainis, "our option is to issue another order giving them some more time, or to refer the matter to the federal attorney for his action under the Water Pollution Control Act, under a penalty of $10,000 a day for each day they stay in violation, or we could get an injunction."

The existence of those penalties, along with a provision for jail terms in criminal actions, form the chief defense by EPA of its system of allowing plant managers to perform their own PCB monitoring.

In the meantime, PCB contamination of Lake Hartwell continues as before.

THE General Electric transformer plant in Rome, Ga., has no processing waste water system. Water is not used directly in making its transformers, which are filled with a PCB dielectric GE calls Pyranol.

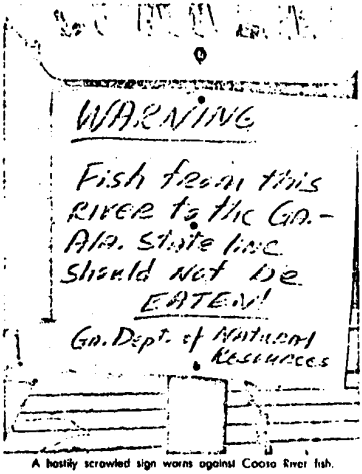
In October of 1973, GE applied for a permit to discharge cooling water back into a tributary of the Coosa River. Shortly afterward, in June of 1974, the Environmental Protection Division of the Georgia Department of Natural resources received a complaint from a citizen who lives near the plant. The water in a creek near her house, she reported, had turned black and oily. The first inspection of the GE facility by a state EPA staff member resulted June 12, 1974. The plant had been in existence since 1956.

"Because their plant has no processing waste water systems, we didn't even work with it until the complaint was filed," said Leonard Ledbetter, director of the environmental protection division of DNR.

Now, then, do PCBs from the plant reach the Coosa River, recently closed to commerical fisheries because of high levels of PCBs in fish there?

The GE plant employs four discharges into surface waters, in addition to a discharge into the city of Rome's sanitary sewer system. The surface water discharges dispose of storm water runoff, cooling water, a floor drain tied in a PCB area and normally without discharge), hydrostatic test water overflow from a cooling water spray pond and steam condensate.

Two of those discharges flow into Dry Creek, a tribu-



A hastily scrawled sign warns against Coosa River fish.

tary of the Oostanaula River, which flows into the Coosa. The other two surface discharges flow through a small stream into Horseleg Creek, which runs into the Coosa River.

A permit to discharge into the streams was issued to GE in Rome Dec. 31, 1975, to expire on Sept. 30, 1976. No limitations were placed on PCBs, but the plant was required to monitor its discharges and report the results to DNR.

"Poor housekeeping in the plant," reported a DNR investigator, "had caused significant contamination of soil on the plant property."

Composite samples on the plant grounds showed PCBs in the soil ranging from less than 1 ppb up to 786 ppb.

GE began cleaning up its operation. New waste oil and waste PCB tanks were installed. A catch basin for overflow from radiator flushing was put in. "Bathtubbing" of loading areas was accomplished, theoretically sealing them off from other drainage systems. Oil-water separators were installed at two of the discharge points which were receiving most of the oil and PCB pollution. Leaky valves were plugged in oil-storage dikes.

Earthen dikes holding the PCB-laden oils were concreted over to stop leaching out of the chemicals.

Contaminated soil was put into drums and shipped to a chemical landfill in Texas. The same disposal methods were applied to all PCB-related wastes from the plant.

And, the clincher: The plant promised to phase out entirely the manufacture of PCB-containing transformers and the use of PCBs by June 30, 1977. In the face of such cooperation, no one felt an inclination to insist upon complete compliance with the FDA standards for PCB discharges.

In a water sampling made by EPA and DNR in February, 1976, readings at five stations ranged from 330 ppb to no traceable PCBs.

Water samplings made in June showed PCBs at two discharge points ranging from less than 1 ppb to 8 ppb.

IN both cases of known PCB contamination of Georgia waters, pressure was applied to the offending plants by regulatory agencies only after PCB levels constituting danger to humans was found in fish.

Found in violation of its discharge permit, Bangamo Electric Co. in Pickens, S.C., could have received much stiffer treatment than the 30 day clean up order. For fear it polluted was closed to fishing while the plant stayed open.

Promising to stop use of PCBs by June of 1977, the GE transformer plant in Rome, Ga., continued to place traceable amounts of PCBs into the Coosa River. The GE plant remains open, the Coosa River is closed to commercial fishing.

Overworked and understaffed, the EPA enforcers look with hope toward the enactment of the Toxic Substances Control Act, which had passed the House and Senate in varying versions and was assigned to a conference committee.

If enacted, the measure would regulate the chemical industry on the manufacture and use of toxic chemicals and give EPA the authority to enforce the regulations.

The industry would be required to pretest new chemical substances and EPA would have to confirm the testing before they could be put into use.

"If you're really going to control it," said Train of PCBs and other toxic chemicals, "you've got to stop it at the source." ⊡