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Chemical Week

Signs point to big year for fertilizer sales
Corfam hasn't soured Du Pont on venture analysis
Monsanto plays policeman to solve environmental problem



ICI sets its cap for world markets

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Pollution cop's lot not 'appy

Despite complaints from government and customers, Monsanto is pushing ahead with $2-million plan to curb pollution by PCB

William Papageorge, manager of environmental control for Monsanto's organic chemicals division, is in a spot few would envy. He has the ticklish job of guiding the company's $2-million research and control program aimed at halting pollution of the environment by its polychlorinated biphenyls (PCBs).

The trouble is, the government doesn't think the program goes far enough—but some of Monsanto's PCB customers (who have been asked to pitch in and help) think the company has overreacted.

Despite the headaches, Monsanto is pushing ahead with its program, which has four main objectives: (1) eliminating open-system applications of PCBs, such as in coatings and plasticizers; (2) controlling spillage or other loss from closed-system operations; (3) developing a less-persistent type of PCB; (4) eliminating loss or contamination during manufacture.

Latest step: next month at Monsanto's Sauget, Ill., plant a new, $500,000 incinerator will begin complete destruction of more than 500,000 lbs. of contaminated Aroclor, the company's tradename for PCB used as an insulating and heat-transfer fluid. The material, recalled from customers, is now being stored in several 10,000-gal. tanks at the plant.

Sole Supplier: As the lone U.S. manufacturer of PCBs (at Anniston, Ala., as well as Sauget), Monsanto was the only company that had to respond to evidence presented early in '70 that these materials are in the family of persistent chlorinated hydrocarbons that build up in animals and affect their reproductive cycles. (Among other things, PCBs were linked with thinning of peregrine falcon egg shells.)

Papageorge says: "We don't know how serious a hazard PCB is to the environment—no one really does." But he adds that the company recognizes that PCBs are turning up in the environment and has decided to do something about it.

Long History. PCBs were originated by Swan Chemical in '29 in response to the electrical industry's need for an explosionproof insulating fluid for transformers. Mineral oils (still used in more than 85% of electrical insulating applications) have a stability problem that makes them potentially hazardous.

Power surges in electrical equipment causes arcs—and enough of them can vaporize mineral oil so that the next arc can ignite the vapor. It's not a big risk, but it is enough to warrant use of stable PCBs (which can withstand temperatures up to 1,600 F) in substations located in populated areas and around expensive industrial equipment.

Monsanto, which makes biphenyls as a basic commodity, took over Swan in the early '30s, now is sole supplier for the U.S., England and Canada. PCBs are also made in France, Germany, Italy, Japan and the Soviet Union.

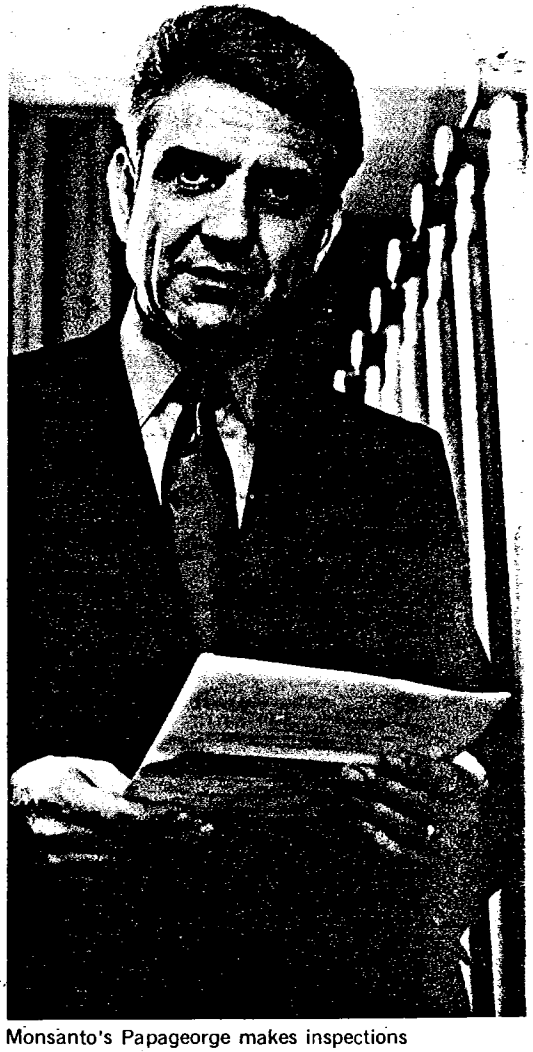
Soon after Monsanto took over, new applications opened up for PCBs as industrial heat-transfer media. The next major push for new markets was in '60, when a Monsanto technical bulletin was published to promote the use of PCBs in sealants, chlorinated rubber, adhesives, printing inks and insecticides.

The insecticide use has drawn fire in recent years, but Monsanto says the U.S. Agriculture Dept. originally suggested that PCBs could be used to extend the life of some pesticides if added as inert material.

Pulling out of the open-system market does not appear to be a big loss for PCBs. Some 200,000 lbs. of material destined for such use has been bought back by the company, will be shipped for use in closed systems. As a service to former open-system customers, Monsanto has prepared a list of suggested replacements for PCBs in adhesives and coatings—some more expensive, some cheaper. The PCB insulator market, though limited, seems secure. But as heat-transfer media, PCBs are being challenged by several new competitors, who are stressing environmental safety (*see, p. 39*).

Early Concern: The first signs of trouble for PCBs turned up in '66, when a Swedish biologist, Soren Jensen, identified these materials in the bodies of fish.

In '68 Monsanto began studying the Swedish work. One problem: separating



Monsanto's Papageorge makes inspections to help check loss of PCB to environment.

PCB from the other chlorinated hydrocarbons like DDT and DDE that were known to be prevalent in the environment. To identify PCB (present in parts per billion quantities) gas chromatography, electron capture and mass spectrophotometry methods had to be refined.

Robert Risebrough, marine biologist at the University of California (Berkeley), identified PCB in San Francisco Bay area birds in '69. Risebrough's work received wide circulation in *Environment* (Jan/Feb, '70) just one month after Monsanto began its control program. The company ran into more trouble when Representative William Ryan (D., N.Y.) called for a ban on the product (*CW, Apr. 22, '70, p. 17*).

Says Risebrough: "There is no evi-

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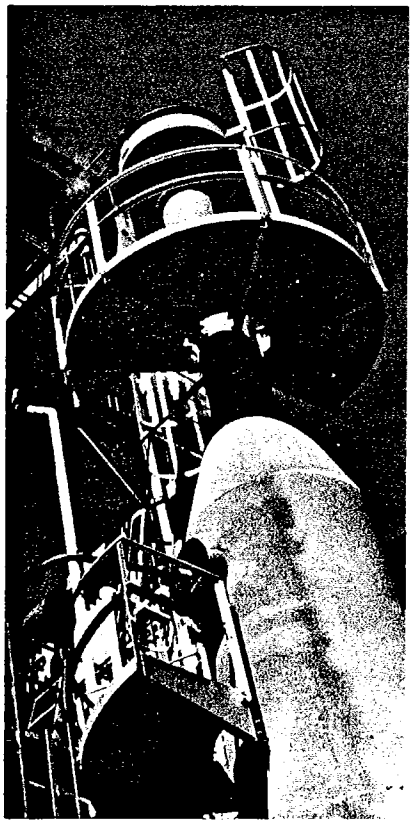
dence to indicate that PCBs in the environment are likely to reach levels that would cause severe injury or death from short-term exposure. The possible PCB hazard, like so many environmental hazards, is one of long-term, low-level exposure."

Even though Monsanto has stepped up the program to control escape of PCBs into the environment, Ryan says further measures are necessary. To encourage government supervision of Monsanto's controls, which he says is the only way to assure their success, Ryan is preparing a report on PCBs in the environment, which is expected out around May 1.

Clamping Down: Nevertheless, Monsanto insists it is taking vigorous steps to stop accidental distribution of PCBs into the environment—so vigorous that some customers have complained.

"Some of our customers have accused us of overreacting to the dangers," Papageorge says, "but we're intent on following through on any possible loss of PCBs to the environment."

First step in Monsanto's crackdown was to halt sales for any application where entry into the environment could not be controlled. In most cases the company was able to spot orders for such uses by the quantity requested. It also has stopped selling Aroclor through distributors.



At Sauget, Ill., plant, $500,000 incinerator will destroy waste PCB at 3,000 F.

Order size also is the tip-off on potentially polluting heat-transfer applications of PCBs. Papageorge points out that new material bought in small quantities invariably is for makeup in systems to replace what is lost when samples of the liquid are taken periodically during operation. Monsanto has shut off sales for such use in the food industry because of the risk of direct contamination if any of the PCB escaped into the food.

Educating Customers: To back up its policy, Monsanto has set up an education program for its customers, showing how to avoid losses during use and handling of PCBs. Papageorge says he has found the best way to get cooperation from a user is to go directly to the company's president or vice-president.

"In every case we've gotten a good response," he says, "because there is no substitute for PCB, or at least no economical substitute." (The material sells for 20-25¢/lb.)

"We tell our customers that if they ignore us, we may be forced to stop selling them PCBs . . . and the message usually gets through," adds Papageorge. To back up the message, Papageorge makes personal inspections of customers' unloading facilities to make sure spill-prevention programs are working.

Recover or Destroy: One of the main objectives of Monsanto's program is to keep PCBs away from water supplies. Papageorge notes that once the material gets into the water, it spreads out, leading to widespread effects.

To prevent this, Monsanto is buying back at full price materials sold to customers for other than closed-system use. The company also reprocesses PCBs contaminated by arcing or other means. PCBs are recovered by passing contaminated material through a series of clay filters.

The new incincerator at Sauget will give Monsanto a way of handling PCBs that cannot be recovered or reused. It will charge 3¢/lb. for destroying spent material.

One complaint against PCBs has been that when plastics coated with these materials are placed in incinerators at relatively low temperatures the PCBs are not destroyed. But the new, 10-million-lbs./year incinerator built for Monsanto by John Zink (Tulsa) will operate at 3,000 F, reduce PCBs to carbon dioxide and water.

Hydrochloric acid formation will be prevented by use of a scrubber and by neutralization of the resulting fluid.

Plant Practice: Monsanto's PCB manufacturing operations have experienced an equal tightening of standards. "You get a feeling of bone dryness in the plant," says Papageorge. "There is none of the hosing down you find in most chemical plants."

Other measures include complete monitoring of all vents and traps for leaks at all sample points. All tanks are "buttoned up" so that operators don't have to look in. And all of the air and gas that escapes the plant is passed through a Brink mist eliminator. In addition, process temperatures were lowered to prevent vaporization.

Monsanto even provides clothing for all the workers, and after the clothes are cleaned all the cleaning fluid is collected for destruction in the incinerator.

For PCBs used in capacitors, the little boxes on poles that boost electrical power, Monsanto is installing a distillation column, scheduled to go onstream in June, to produce a PCB without the persistent isomers. The material can then be further chlorinated for transformer use. The problem with capacitors is that they are small, hard to collect after they have been replaced. They could easily end up in a land fill, crushed so that the material inside leaks onto the ground.

Seeking Substitutes: Monsanto admits to looking for some substitutes for PCB. What the company has primarily gained from the PCB furor was an awareness that it must test all new products for environmental effects.

"We don't yet know what tests will be required, what data will be acceptable, or even what animals to test on," says Papageorge, "but we have worked out a checklist approach for all new chemicals. We hope we'll be batting 1.000 when the federal government details its toxic substances act."

Meanwhile, Monsanto feels it is well on its way to providing an effective program for controlling PCB. It still questions some of the identification procedures under which PCB has been indicted. But the company is betting that closing the open-system market will end the threat.

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