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PCB - Articles

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Future PCB outbreaks unlikely: Monsanto

OUTBREAKS OF PCB's such as appeared in the North Carolina fish meal incident last summer are extremely unlikely to recur in the future, according to the environmental protection director for the Monsanto Chemical Co., St. Louis, Mo. Monsanto is the only United States manufacturer of PCB's (polychlorinated biphenyls).

W. A. Papageorge traced the history of the use of PCB's, including their recent emergence as a potential polluter of environment and foodstuffs, and told how Monsanto has moved to avert possible future contamination. His talk was heard at the Midwest "Quickie" Seminar of Poultry and Egg Institute of America at Kansas City in December.

Are any new outbreaks of PCB's likely? "Extremely unlikely," Papageorge said, "unless some process or application has escaped our attention . . . It's inconceivable, unless someone has stockpiled PCB's and is secretly using them."

Monsanto has discontinued supplying PCB's for most uses, especially for any application remotely connected—directly or indirectly—with food or feed for animals. The action was taken due to recently uncovered data concerning PCB's in the environment.

What are PCB's? Papageorge said in high school chemistry we learn that when you put benzene under proper temperature and pressure, you produce some hydrogen and biphenyls (two benzenes together). If you add chlorine, it attaches itself randomly to the benzenes. The product "is not a pure chemical, but a godawful mixture, depending on how many chlorines are attached."

The resulting PCB's have certain valuable properties, however. It is fire resistant, doesn't react with acids or alkalines, and has good insulating properties that last forever.

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Initially, PCB's were manufactured, starting in 1929, by a small Alabama company, to supply a nonflammable, nonexplosive fluid for use in electrical transformers. Today, this is the most valuable use of PCB's—because of its ability to "resist breakout when the transformer arcs internally" so that "explosive gases are not formed."

If a transformer should rupture, PCB's mean "you don't have the situation of a flammable fluid scattered in all directions."

The only substitutes known for PCB's in these electrical applications are mineral oil and air, Papageorge said, but these require much larger units and are dangerous and cannot be used unless the transformer is isolated in remote country—such as is seen in isolated electrical installations surrounded by high fences to keep people away.

In the 1930's, Monsanto acquired the Alabama company and has continued to be the only American PCB manufacturer. It was found that PCB's were valuable in capacitors, which allow transmission of electricity over long distances without loss of power. In this period of power blackouts, this use has increased dramatically because of need to transmit power over long distances.

Because of PCB's characteristics of resisting breakdown, new uses were found during the mid-1950's. Papageorge continued. PCB's were attractive as ingredients in the following products:

- **Paints.** PCB's help paint withstand corrosive environment. Uses extended to marine paints and paint for factories working with corrosive materials. PCB paint has also been used on concrete surfaces and for traffic lanes. It was not used in normal interior paints, however.
- **Sealants.** PCB's were attractive to caulking manufacturers because it would allow material to stay pliable for years. PCB caulk was used in modern skyscrapers to fix glass panes permanently, the caulking promising to last the lifetime of the building.
- **Inks.** Only in specialty printing inks were PCB's used. It helped inks withstand ultraviolet lighting deterioration. It wasn't used in common or newspaper inks.
- **Adhesives.** Its attractive properties were its flowability in application of adhesives.
- **Carbonless copy paper.** PCB's made possible use of copy paper without carbons.

With extended uses, PCB's, "more and more were starting to get into our environment," Papageorge said. "PCB's range from materials that have about the same consistency and clearness of water to solid types that look like wax or resins. PCB's that look like water have little viscosity and have small amounts of chlorine in them. The more chlorine added, the more viscous PCB's become, until they finally become solid."

Due to problems in manufacture, Monsanto was aware quite early that it needed to be careful in application of PCB in the plant and for customers. "We warned customers to ventilate rooms properly, don't get it on your hands, wash hands after handling it, etc., primarily oriented to industrial hygiene practices known through the years. But at no time were we aware this material could be harming the environment."

In 1966, when Swedish investigators identified the unknown material that interfered with insecticide analysis as being PCB's, "we at Monsanto were frankly surprised and disbelieving," Papageorge said.

As reports kept coming in that PCB's were out there in the environment, Monsanto in late 1967 decided to "have a look."

"We developed our analytical methodology, capable of detecting this material down to parts per *billion*—a new standard since no attempt had been made to operate at such a low concentration before.

"The analytical methodology is as sophisticated as any that we're aware of in the business. It takes experienced chemists and expen-

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sive equipment. Those of you who have had this work done for you by labs are aware it's expensive work."

Sometime in 1968, "we convinced ourselves that, sure enough, this material was out there in the environment. The next question was: *what harm does it do?*

"Throughout 1968 and 1969, we received reports of PCB's being found in some sports fish, fish-eating birds and shellfish. The problem appeared to be one of possible harm to some species of wildlife in the environment and it appeared to be the more highly chlorinated versions.

"No one had detected the lower chlorinated materials. This led us to believe, initially, that the latter were probably degrading and not really a program."

Monsanto began a multi-pointed program:

- Continue refining analytical capabilities.
- Begin trying to develop replacement products.
- Start animal feeding studies.
- Initiate biodegradation studies.
- Educate customers as to potential problems.

The two-year feeding studies on beagle dogs, white mice and White Leghorn chickens were completed last summer. The higher chlorinated materials were fed at 100 parts per million (p.p.m.). They affected dogs and mice in terms of weight gain and causing enlarged livers.

Livers were not damaged but appeared to be growing larger to cope with this new, strange substance. The lower chlorinated materials had no effects on mice or dogs.

The higher chlorinated materials also affected reproduction capabilities. The second generation had difficulty in reproducing a third generation in terms of litter size, mating and survival of pups.

Nothing in the experiments indicated that PCB materials were highly toxic, Papageorge stated.

With the chickens, the lower chlorinated materials did show some effect. The first warning signal was lower hatchability of the egg. It was found that at 2 p.p.m. there was no effect, but at 4 p.p.m. some showed up.

"This was the first indication we had that the lower chlorinated materials could also be a problem."

What did Monsanto do? "We saw it as an environmental problem and we had better get out of the business." By late 1969, a plan was formulated to drop all PCB business that could not be controlled in terms of escape into the environment.

Animal experiments revealed that reproduction capabilities were adversely affected, but nothing indicated that PCB materials were highly toxic.

It's easy to reach such a decision in the conference room, but difficult to implement. "There are thousands of customers involved and many don't appreciate environmental problems. Many businesses depend entirely on this one product and they don't have research departments and resources to find alternative materials.

"It was an emotional situation. In some quarters, we were hailed as heroes—usually by the person who hasn't been affected—and in other quarters we were S.O.B.'s.

"By May, 1970, we dropped all businesses where PCB's might leak into the environment, such as paint, adhesives, sealants and ink. The only businesses we would continue to serve were electrical transformers, electrical capacitors and heat transfer systems."

Papageorge explained that in commonly used steam heat transfer systems, water is heated into steam and the steam is transferred to the process for sterilization. It condenses as it cools and is returned to be recycled. The recycling is carried on as a closed system, within pipes. The pipes heat and only their exterior surfaces are in contact with the material to be sterilized.

PCB's were used for this system because they can withstand extremely high temperatures without being vaporized. "This means when you design the system, you don't need safety valves or the high-pressure design of steam systems."

These should be closed systems and with proper maintenance can be operated as such. Monsanto figured that, with proper care, they could live with such a system.

"When the unfortunate North Carolina fish meal contamination broke, we realized we had neglected one very important consideration: attitude of the operators, and ability to inspect, repair and maintain the closed system.

"Also, in a system like this, the problem must occur before you can locate it."

As a result of the fish meal incident, Monsanto reviewed its policy and decided it was too much to expect *all* heat transfer systems to be *entirely leakproof* at all times. So it was decided not to service any heat transfer system related—directly or indirectly—to food or animal feed.

Monsanto went to each such customer, helped them drain and flush the units, and gave them re-

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placement fluids. The PCB's were then destroyed by Monsanto. All of this was at no cost to the customer.

Unfortunately, no fluid except PCB's is fire resistant. Within a month three units had suffered fires. Many customers had to go back to insurance underwriters and were told they must install additional fire protection systems, sprinklers and fire walls.

Monsanto also decided to sell no PCB's for any new heat transfer systems, regardless of application. And a program was begun to try to convince all remaining heat transfer applicants to change over to other fluids.

"The sources of PCB's that could affect your business are no longer being supplied," Papageorge declared.

Since PCB's do not break down easily, they will continue to contaminate the environment for some time, but not in massive outbreaks, he thinks.

Source of PCB's in recycled paper products was the PCB that carbonless copy paper contained, plus some possibly from inks and adhesives used on boxes and containers. Some small use of PCB's was made in special paper coatings.

All of these products are recycled and carry PCB's into the recycled product. "Much PCB contamination being observed today in cereal and cracker boxes may well be third generation because PCB's are so persistent. It will be with us for some time to come."

Monsanto took the lead in alerting foreign manufacturers of PCB dangers. At first they were politely ignored, but now these firms are taking similar steps, about a year behind Monsanto.

Could PCB's continue to be used in food-related applications by companies that import the substance? Unlikely, Papageorge said. The foreign companies say they cannot realistically accept such business because of the consequences. Monsanto is monitoring imports and has found no evidence of PCB's being sold to domestic companies by foreign firms.

There are two PCB producers in Japan, one in England, West Germany, France, Spain and Italy. All are following Monsanto's lead except Italy ("they haven't recognized that PCB's are a problem") and Spain ("they don't listen").

Monsanto has no way of knowing steps being taken inside the Iron Curtain where there are producers in East Germany, Russia and Rumania.

Since PCB's don't break down easily, they will continue to contaminate the environment for some time, but massive outbreaks are unlikely.

Japan was slow to recognize the problem but is now moving so fast on regulations and control that they may exceed the concern of the Scandinavian countries, where PCB's are being banned.

Are PCB's being used in heat transfer units to process ingredients such as fish meal in foreig countries? No, Papageorge sai Steam sterilization is being use in all operations outside the U. S

Is there danger that PCB's ca escape from old transformers i to the environment when they ar being dismantled? Papageorge sai all users of such transformers ar constantly warned not to dispos of them randomly. They are t be returned to Monsanto for dis posal. Any company found not t be cooperating would not be abl to secure equipment containin PCB's in the future.

"Anyone causing trouble will b dropped. We can't stand this sit uation any longer," he said.

How are PCB's destroyed? Mon santo has a specially built incin erator at St. Louis, believed to b the only one capable of destroy ing PCB's. Heat in the firebo reaches 3,000 degrees F. Nea this point, PCB's ignite and "take off with a roar like a jet engine The flame is incandescent and on can't look at it long with the naked eye."

Products of the combustion are water, carbon dioxide and muriatic acid. "We can't dispose of muri atic acid straight up the stack bu we scrub it. We end up with a weak acid that is neutralized and treated along with other wastes

Monsanto charges a nomina three cents per pound to dispose of PCB's—which is a break-even cost, Papageorge explained. "We don't intend to make profit from our customers' problems."

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