Polychlorinated Biphenyl (PCB)

- A PRESENTATION TO THE EFFLUENT STANDARDS AND WATER QUALITY INFORMATION ADVISORY COMMITTEE
- BY MONSANTO INDUSTRIAL CHEMICALS COMPANY
- NOVEMBER 29, 1973

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I certainly appreciate the opportunity to participate in this meeting of the Effluent Standards and Water Quality Information Advisory Committee. My name is Bill Papageorge. I am Manager, Product Acceptability, for the Functional Product Groups of Monsanto Industrial Chemicals Company.

In this presentation, I would like to consider several questions about polychlorinated biphenyl (PCB). Why was it developed and produced? What has industry done to keep it out of the environment? What has Monsanto done to contain the product through improved manufacturing procedures? What are the problems involved in sampling and analyzing PCB's in manufacturing effluents? And finally, is PCB biodegradable?

I would also like to present some comments on the so-called Toxic Pollutant List.

And finally, I would like to summarize the points I'm trying to make.

Polychlorinated Biphenyl (PCB)

- **WHY WAS PCB DEVELOPED AND PRODUCED?**

The chemical structure of PCB has been known for nearly 100 years. It was not until the late 1920's that a use for PCB was found - as a dielectric fluid in transformers and capacitors. Its properties (stability, fire-resistance, high dielectric strength and conductivity) seemed perfectly suited to these electrical applications, where high-voltage arcing, serious fires, and damage to property and people could result.

Monsanto began commercial production of PCB in 1929. Other uses soon developed: in heat-transfer fluids (because of its fire resistance), in lubricants (because of its stability), and for water-proofing.

As long as proper industrial hygiene practices were followed, the manufacture of this product represented no safety or handling problems for employes.

- **WHAT HAS INDUSTRY DONE TO KEEP PCB OUT OF THE ENVIRONMENT?**

In the late 1960's, sophisticated analytical procedures were developed which could detect very minute quantities of PCB in nature. Following this breakthrough, researchers discovered that PCB could possibly be affecting certain forms of wildlife.

As more data were developed, Monsanto voluntarily undertook a two-phased program to keep the product out of the environment.

- *FIRST: WE LIMITED SALES*

First: we limited sales of PCB for use in many, many applications where there was any danger of it getting into the environment. Today, PCB manufactured by Monsanto Company is sold only to the electrical industry, where it is used in closed systems as a dielectric fluid in transformers and capacitors - applications where there are no known substitutes of acceptable quality and none that are fire resistant.

In addition, representatives of the transformer and capacitor industries, utilities, and governmental agencies (under the initial auspices of the National Electrical Manufacturers Association) formed the American National Standards Institute Committee C-107. This committee issued guidelines (which have already been supplied to the committee) for handling and disposing of dielectric fluids. They reflect the industry's understanding of the need for proper control.

- *SECONDLY: WE DEVELOPED AN AGGRESSIVE CONTROL PROGRAM AT OUR MANUFACTURING LOCATION.*

Secondly: since 1969, we have invested more than 22 man years of work and millions of dollars in this program. Since we are quite proud of our results, let me take a few minutes to summarize it:

--In our manufacturing area, we have taken a number of significant steps to contain PCB's. In essence, we have made the department a "concrete bathtub". Drainage is directed to trenches and piping, and then to one of two 3,000-gallon settling basins. This insures PCB containment in case of accidental spill or equipment failure.

We have also installed an incinerator to safely dispose of PCB's. This is accomplished through incineration at or above 2000° +F.

When small quantities of PCB's are collected into the settling basins in the manufacturing area they are later pumped into drums, and eventually incinerated. In the incinerator area itself, drainage is directed to trenches and piping which flow into a 10,000-gallon basin. Recovered PCB's are periodically pumped to storage, or incinerated.

In the manufacturing area, we have also rerouted rupture disc lines and atmospheric vents through catch tanks, or redirected them to settling basins. This insures that if a rupture does occur, PCB's will not get into the environment, but will be contained in a controlled area.

We also provide nitrogen blanketing on storage tanks to eliminate any "breathing" of the tanks and resultant PCB escape.

We have installed mist eliminators in vapor lines - once again to eliminate the possibility of PCB's leaving the manufacturing area through these lines.

Finally, we have replaced underground sewers with above-ground sewers, and repaired or combined others, so that we can monitor the effluent from the department. In addition, this will prevent any unknown buildup of PCB's in our sewer systems or any contamination of PCB's into other sewers.

Much of the success of our efforts also depends on maintaining a high housekeeping level in the department itself. Among the housekeeping responsibilities our operators have assumed are these:

--All pumps are checked for leakage on every shift. Drip pans that collect leaks are emptied into scrap PCB drums.

--All leaks are reported and documented so that corrections can be made and settling basins observed.

--"FloorDry" is used to absorb any liquid PCB's that have spilled or leaked. If it becomes necessary to flush PCB's to the settling basin, a minimum amount of water is used.

--Sampling drums and scrap-PCB drums are quickly palletized, labeled, and transferred to the incineration area.

Through these kinds of programs, we feel we have literally built a "concrete bathtub" to catch and safely dispose of PCB's at our manufacturing location.

--We have also developed sophisticated systems to monitor our effluent. Monitoring effluent streams for PCB's is not an easy effort. Measurement can be changed dramatically by taking the sample at different places along the sewer main, by changing the level at which the sample is taken, by changing the speed at which the sample is taken, or by varying the velocity of the effluent. But we have purchased the best available laboratory equipment, which enables us to determine PCB content in the parts-per-billion range. Here again, however, many factors affect our findings. Dr. Scott Tucker, our analytical expert, advises that the minimum detection level of PCB's on a routine basis contained in distilled water is one part per billion (± 25%). If "dirty" water - i.e., that containing other materials which

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interfere with the determination of PCB - is analyzed, the minimum detection level is 100 ppb ± 25%. Monitoring is a very tricky business. But we feel with our experience and acquired "know-how", we're doing the best possible job. And we do this job 24 hours a day, 365 days a year.

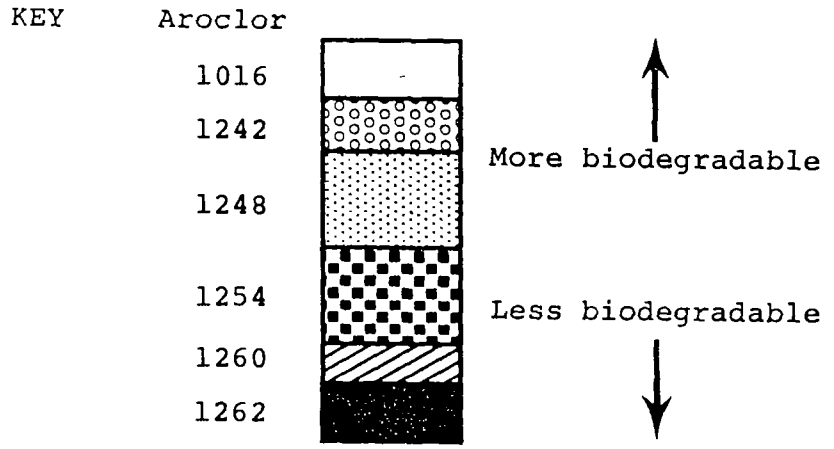
We have also established loading and shipping safeguards to minimize accidental PCB loss during transportation. Specific written instructions are on every container we ship.

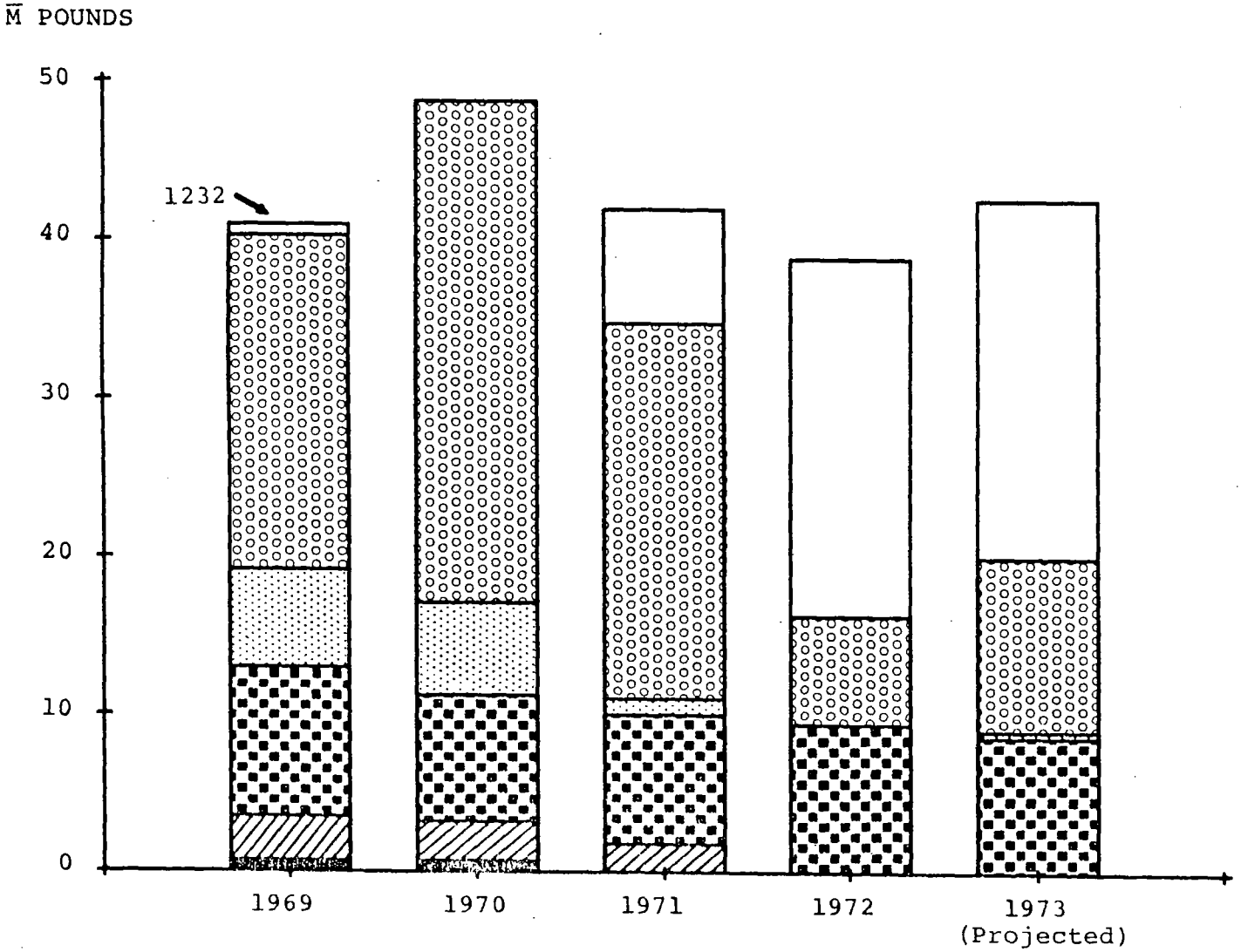
--And finally, we have provided facilities for safely disposing of used PCB's returned from customers. As I mentioned above, we installed a specially designed PCB incinerator, at a cost of $790,000. We have received an operating permit from the Illinois EPA for this incinerator, which meets all EPA requirements. This incinerator completely destroys PCB's received either from our manufacturing area or from customers.

Finally, we have moved toward the manufacture of a more biodegradable polychlorinated biphenyl. In 1971, we installed a new distillation column in our manufacturing department at a cost of $970,000. This allowed us to separate the higher chlorinated, less biodegradable compounds from the lower chlorinated, more biodegradable ones. Our PCB's are known by the trade name Aroclor. We manufacture different grades of Aroclor (1016, 1242, 1254, for example). The lower the grade number, the less chlorinated and more biodegradable is the product.

The attached table reflects how our production mix has changed to more biodegradable products while the production of higher chlorinated less biodegradable products has declined.

AROCLOR PRODUCTION
AT THE Wm. G. KRUMMRICH PLANT





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So I think we can safely assert that industry and Monsanto have taken strong measures to contain PCB's and keep them out of the environment.

•IS PCB BIODEGRADABLE?

I mentioned before that we are presently manufacturing more biodegradable PCB's. We feel all information points out - beyond any reasonable doubt - that many PCB isomers do degrade, and they do degrade at different rates. Under proper conditions of use and control, PCB's can be utilized without serious adverse consequences to the environment.

To support this view, we have previously sent the reports of Monsanto studies which were submitted to the Federal Interdepartmental Task Force on PCB's. Articles describing the results of biodegradation studies in activated sludges are also being prepared, and we will send copies when they are completed.

The Toxic Pollutant List

Neither Mr. Hosmer nor myself are toxicologists. We are chemical engineers.

But we would like to make some comments on the toxic pollutant list. In Section 502 (13) of the current Federal Water Pollution Control Act, the term "toxic pollutant" is defined as "those pollutants or combinations of pollutants including disease causing agents, which after discharge or upon exposure, ingestion, inhalation or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains will, on the basis of information available to the Administrator, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction) or physical deformations in such organisms or their offspring."

We have also read the Federal Register, Volume 38, No. 173, dated September 7, 1973. Part 129 (beginning on page 24343) is concerned with the Toxic Pollutant Effluent Standards.

We are concerned with the "catch-all" nature of these definitions and criteria. Depending on how they are defined and applied, the toxic pollutant list could conceivably cover all chemicals and many, many other materials which are relatively innocuous in their impact on the environment.

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We concur with the recent suggestion of the EPA's Acting Administrator (Federal Register Volume 38, No. 129, page 18044) that Congress intended the Administrator under the Act "...to be selective in determining which of the potentially large number of candidate substances actually should be listed at various times". Although not spelled out in the definition, we feel it important to consider the degree of toxicity of the substance; whether or not the substance poses a threat to man, animals, birds, the aquatic environment or some other aspect of the ecosystem.

Whether or not PCB's remain on the "enemy list", it is our recommendation that an effluent limit no more stringent than one pound of PCB per 100,000 pounds of production be established for our manufacturing operation. To keep this in perspective, this would correspond to a concentration in the Mississippi River of 1.4 parts per trillion, based on that river's average flow. We believe this concentration would have no adverse effect on the aquatic environment.

In Summary

First: Monsanto began producing PCB to fill a market need. The product has excellent qualities to fill these needs.

When the "alarm bell" sounded in the late '60's, Monsanto and the concerned industries took positive steps to keep PCB out of the environment. At our manufacturing location, we developed a many-sided program to contain PCB, and keep any of the product from the environment. Because of this, levels of PCB in the aquatic environment are reported to be lower now than before.

We feel that some PCB's are biodegradable, and we are developing supporting evidence.

Secondly: We are concerned that the criteria for the Toxic Pollutant List are too general and susceptible to "fishing expeditions". (Excuse the pun.) Whether PCB should be on that list at all is questionable.

Finally: We recommend that a limit no more stringent than one pound of PCB's per 100,000 pounds of production be established for our manufacturing location. This corresponds to 1.4 parts per trillion in the Mississippi River.

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