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DEC 6 1975

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF WATER AND
HAZARDOUS MATERIALS

December 1, 1975

Mr. W.B. Papageorge
Manager, Product Acceptability
Specialty & Process Chemicals
Monsanto Industrial Chemicals Co.
800 N. Lindbergh Boulevard
St. Louis, Missouri 63166

Dear Mr. Papageorge:

Pursuant to your request attached is a copy of the paper "Environmental Levels of PCB's." Also attached, is a contractor's report describing PCB levels in soil samples taken from the area surrounding your facility in St. Louis.

If I can be of any further help, please contact me on 202-755-6956.

Sincerely yours,

Vincent J. DeCarlo

Vincent J. DeCarlo, Chief
Monitoring & Information Systems Branch
Office of Toxic Substances (WH-557)

MONS 093647

ENVIRONMENTAL LEVELS OF PCB's

Doris J. Ruopp
Vincent J. DeCarlo
U.S. Environmental Protection Agency
Washington, D.C. 20460

ABSTRACT

Since the 1966 discovery in Sweden that chlorinated biphenyls were widely dispersed in the environment their environmental levels have been the subject of many studies with the results indicating that PCB's can have adverse ecological and toxicological effects. However, a well planned national approach to environmental sampling has not been attempted thus hindering making a national assessment of the PCB problem. This paper reviews the levels that are currently being found in the environment.

INTRODUCTION

Since the 1966 discovery in Sweden that chlorinated biphenyls were widely dispersed in the environment, their levels have been the subject of many studies both abroad and in the United States. Extensive laboratory and environmental measurements indicate that PCB's can have adverse ecological and toxicological effects, are very resistant to environmental degradation and are being discharged by many different sources.

This paper will focus on the current PCB data base in an effort to assess the PCB levels in the environment on a national basis.

ENVIRONMENTAL PCB SOURCES

Before the PCB data base is examined, it would be of interest to review how these chemicals get into the environment. The major sources contributing to the environmental levels of PCB's are industrial effluents, manufacturing processes, consumer and industrial waste materials, sewage treatment facilities and accidental spills. Lacking extensive air and soil data from these sources, available water data are shown in Table 1. The 5 major PCB spills in 1973-75 all involved transformers. In 4 of those incidents, the PCB's were spilled on soil while in the fifth the transformer was dropped on a pier and the contents were spilled into the water. In the latter incident, 283 gallons were spilled and it was estimated that only 70-90 gallons were recovered. In all cases the material that could be recovered was drummed up and entombed at a cost approaching $2.3 million.

REVIEW OF THE PCB DATA BASE

To assess the scope and extent of PCB's in the environment, all national surveys and national data bases maintained by the U.S. Environmental Protection Agency (EPA) were examined, including STORET, the national water quality storage and retrieval system, the National Soils Monitoring Program for Pesticide Residues and the Human Monitoring Program. In addition, data from special data bases maintained by the United States Geological Survey and the open literature were also examined along with available unpublished reports. Using these data, maps were constructed showing the concentrations of PCB's in urban soils and the aquatic environment.

The data from the national surveys show that a great deal of effort has been expended and continues to be expended but that the data are very limited. On examination, all States are believed to show some level of PCB contamination. In Table 2 States which had significant levels in at least one medium are listed with their reported PCB levels for surface and ground water, bottom sediments and fish. In Table 3, a number of localized studies are listed along with the reported environmental data. In all these studies the most extensive measurements have been in fish.

TABLE 1

ENVIRONMENTAL SOURCES OF PCB's

SOURCE	EFFLUENT WATER CONCENTRATIONS (ppb)
PAPER MILLS	
Wisconsin[1]	0.1 - 18.5
WASTE PAPER MILLS	
Wisconsin[1]	18.5
INDUSTRIAL EFFLUENTS	
California[2]	0 - 76
Wisconsin[2]	.04 - 0.25
Ohio[2]	0 - 17
Michigan[3]	.1 - 7000
MUNICIPAL WASTE WATER TREATMENT PLANTS	
Michigan[3]	0.5
Wisconsin[1]	.05 - 17.0
Ohio[2]	10 - 17
California[2]	0.16 - 76
CAPACITOR AND TRANSFORMER FACILITIES	
New York[4]	2800
Massachusetts[5]	42.5
PCB MANUFACTURING FACILITY	
East St. Louis[5]	.87
SPILLS	Variable

1. Kleinert, S. J., Environmental Status of PCB in Wisconsin, May 8, 1975, Wisconsin Department of Natural Resources.
2. PCB's and the Environmental, Report of the Interdepartmental Task Force on PCB's, National Technical Information Service, 1972.
3. Statement of Concerns of the Lake Michigan Toxic Substances Committee Related to Polychlorinated Biphenyls, June 1975. Prepared by Karl F. Bremer, USEPA, Chicago, Ill.
4. Unpublished Data - Royal J. Nadeau and Robert P. Davis, Investigation of Polychlorinated Biphenyls in the Hudson River, Hudson Falls-Ft. Edward Area, August 1974.
5. Field Sampling and Analysis of Toxic Pollutants: Interim Report, Battelle, Pacific Northwest Laboratories, August 1974.

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WATER

On the basis of the national aquatic environmental data collected in 1971-1972 and in 1974, a continuing widespread accumulation of PCB's in water, sediment and fish appears to be occurring. However, no trend analysis is possible with the available measurements. For example, whole water measurements have been taken throughout most of the country but those states reporting non zero readings are few in relation to the number of states showing zero concentrations. This is due both to the low solubility of PCB's and to the usual analytical procedure that limits detectability to the 0.1 ppb level. More meaningful water concentrations were obtained in the Lake Ontario[1] and Orange County, California[2] studies where concentrations in water at the ppt (ng/l) level were measured. At these levels, changes in PCB concentrations could be found with distance and time and could be related to other measurable parameters such as PCB concentrations in sediment, flora and fauna.

SEDIMENTS

Since PCB's are relatively insoluble, it is not surprising that bottom deposits have shown significant concentrations. Although 30 states collected samples in the 1974 study, 15 had less than 4 stations reporting and showed zero readings. Of the remaining 15, with at least 4 reporting stations, 13 showed detectable concentrations. Since the 13 states involved were not necessarily the same in both studies, only a very broad comparison may be made, i.e., five states had lower concentrations, four states were higher and four did not sample again.[3] We may conclude, then, that in these states with any monitoring effort in the 1974 study, PCB's are present in bottom deposits and the levels are not any lower than in the 1971-72 study. Considering the persistence of PCB's, a significant proportion of the nation's waters are now affected and will continue to be.

SOILS

The National Soils Monitoring Program is a small sampling effort studying only 5 urban areas each year. However, PCB's were detected in three of the five cities sampled in each of the years for which data are available, 1971-73. Of the 22 positive readings 17 of them were below 1 ppm. Of the cities sampled in 1973, Pittsfield, Mass., was of particular interest because it has a large transformer and condenser plant using large quantities of PCB's. Six different sampling sites within one mile of the plant show no detectable PCB residues. In contrast, the soil surrounding another facility in Illinois using PCB's in the manufacture of investment casting waxes was recently measured for PCB content. Samples taken in an area one-quarter mile radius around the plant ranged in value from 0.77-5.2 ppm. The PCB's identified were mixtures of Aroclor 1260 and dechlorobiphenyl. Levels up to 1.8 ppm Aroclor 1260 were found at 1-1/4 miles from the plant. Samples were collected from this facility as part of a study being conducted for the Office of Toxic Substances at sites suspected to have PCB concentrations. Other sites sampled in March of 1975 were in the vicinity of an investment casting company in Michigan and the PCB manufacturer in Illinois. Surface soil samples were collected at each site up to a distance of approximately one mile from the plant boundary, at 1/4 mile intervals in all directions. PCB's were detected in soils at both sampling locations. Concentrations ranged from the detection limit of 0.001 ppm to over 20 ppm. The distribution of all PCB's analyzed appears higher near the plant site and generally decreases with distance from the site.[4] Details of the sampling sites and the concentration levels measured are shown in Figure 1.

TABLE 2

SELECTED STATE DATA ON ENVIRONMENTAL LEVELS OF PCB's

State	Surface and Ground Water[1] µg/l	Bottom Sediment[1] µg/kg	Fish[3] ppm
AL			1.53-5.48
AR		20-2,400	1.69-3.68
CA	0.1	20-190	
CO	0.3		
CT	0.1-0.2	5-350[2]	2.16-5.34
FL	0.1-2.1	5-3,200	0.10-1.25
GA		10-1,300	0.52-1.18
IL			1.21-11.3
IA			0.35-1.41
MD	0.1	10-1,200	0.56-1.31
MA	0.2		
MI			4.00-11.7
MN	0.1-0.3		0.44-1.09
MS		50-170	
NB			0.47-4.58
NJ	0.1	3-800[2]	0.10-4.00
NY	0.1-4.0	3-13,000[2]	2.68-9.50
OH			1.73-8.07
OR		1-5-140	0.71-3.62
PA	0.2	6-700[2]	1.94-2.48
PR	0.1		
SC		30-200	0.10-7.3
TX	0.1-3.0	7.9-290	0.10- .22
UT			0.15-2.14
VA	0.1	5-80	
WV		10	0.31_1.20
WI			1.24-14.8

1. All data in this column taken from Hans J. Crump-Wiesner, Herman R. Feltz and Marvin L. Yates, A Study of the Distribution of Polychlorinated Biphenyls in the Aquatic Environment, Jour. Research U.S. Geol. Survey 1, 603 (1972, unless otherwise noted.
2. USGS Sediment data, 1974.
3. All data in this column taken from Croswell Henderson, Anthony Inglis and Wendell L. Johnson, Organochlorine Insecticide Residues in Fish Fall 1969 National Pesticide Monitoring Program, Pesticide Monitoring Journal 5, 1(1971).

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TABLE 3
SELECTED PCB STUDIES

	Fish (ppm)	Water (µg/l)	Sediment (µg/kg)	Plankton (ppm)
LAKES				
Lake Ontario[1, 2]	0.14 - 9.17	0.035 - 0.097	43 - 245	3.4 - 11.8
Lake Erie[3, 4]	0.2 - 7.8			
Lake Superior[5]	0.3 - 5.6			
Lake Huron[6]	0.16 - 11.0			
Lake Michigan[6, 9]	0.1 - 165.3		3.72 - 636	
Cayuga Lake[10]	3.4 - 9.7			
Lake St. Clair[16]	tr - 3.8	0.1 - 0.2		
RIVERS				
Iowa				
Mississippi River[11]	0.9 - 5.5			
Texas				
Brazos River[12]		0.1 - 0.5		
Utah				
Green River[12]		0.1		
New York				
Hudson[13]	7 - 350	1.0 - 2800	6.6 - 6,700,000	
Michigan				
Saginaw River[6, 14]	6.9 - 165.3	0.1 - 0.21		
Kalamazoo River[7, 15]	<0.01 - 164.56	0.1 - 0.45	100 - 560	
Portage Creek[7]		0.1 - 0.48	10 - 475,400	
Wisconsin				
Milwaukee[8]		.02 - 2.17		
MARINE ENVIRONMENT				
Atlantic Ocean[17, 18]	0.038 - 0.190	0.0009 - 0.0036		
Bay of Fundy[19]	0.07 - 1.54			
Gulf of Mexico/Caribbean Sea[20, 21]	0.032 - 0.059			0.157 - 1.055
Southern California[22]	0.04 - 6.6	0.0015 - 0.019		

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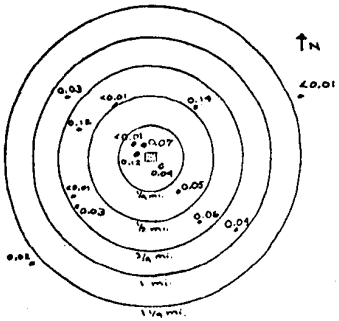
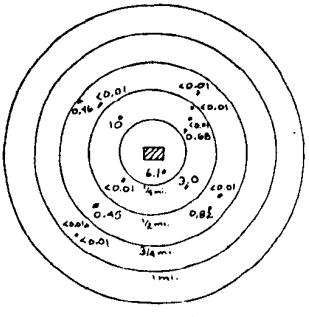
Figure 1

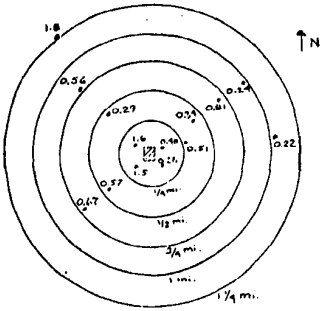
Concentration of PCB's in Soil with Distance
(ppm)



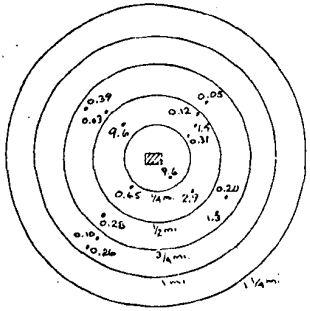
Aroclor 1260
Investment Casting Company



Aroclor 1242
PCB Manufacturer



Aroclor 1260
Investment Casting Wax Manufacturer



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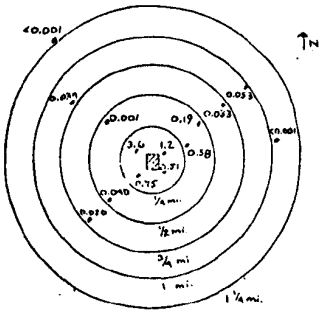
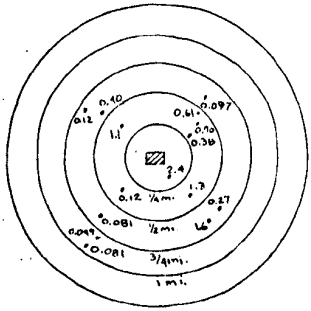
PCB Manufacturer



decachlorobiphenyl
Investment Casting Wax Manufacturer



decachlorobiphenyl
PCB Manufacturer

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AIR

PCB measurements in air along with the related transport studies are practically nonexistent. Harvey and Steinhauer[5] have reported levels ranging from 3.9 - 5.3 ng/m3. Air measurements by Bidleman and Olney for Rhode Island ranged from 2.1-9.4 ng/m3 and from 0.21 - 0.65 ng/m3 at Bermuda.[6] Snow melt water data from Wisconsin ranged from zero to 0.24 ppb. The suggestion has been made that atmospheric fallout may be the most significant source of PCB discharge to the waters of the state of Wisconsin.[7]

FISH

Fish have been studied on a nationwide basis by the Department of the Interior since 1967. In the 1969 study, PCB levels were identified in fish from 35 states.[8] Data from the nationwide sampling programs, 1970-1973, are currently being prepared but were not available for this report. Consequently, nationwide fish data are not available any more currently than 1969, with the exception of the isolated studies listed in Table 3. The 1969 national study showed PCB levels generally within the FDA 5 ppm guideline. In the Great Lakes area, PCB levels in fish from Lake Michigan were so high, 7.6-10.9 ppm, that FDA seized shipments of coho salmon in May 1975.[9]

Although transport mechanisms are not well known and would vary through different ecosystems, it is interesting to consider the Lake Ontario Ecosystem Study summarized in Table 4. From this study an estimate of biomagnification is possible giving a sediment to fish ratio of 1:120. The FDA guideline of 5 ppm in the edible portion of fish corresponds to a sediment concentration of 41 ppb - a figure exceeded in all 13 states reporting through USGS in 1974.

HUMANS

With PCB's as widespread across various media as they are, it is expected that levels would be identified in humans as well. The Human Monitoring Program, in 1972, found that 3035 out of 4102 samples from 31 States showed levels ranging from less than 1 ppm to more than 3 ppm. In 1973, 964 out of 1277 samples from 28 States again showed levels in the same range. In both years approximately 75% of the adipose tissue analyzed contained some polychlorinated biphenyls. Unfortunately we do not know age, occupation or residential histories of the cases involved so it is difficult to trace the levels back to the potential sources.

CONCLUSIONS

Although there are many national and state groups collecting environmental PCB data, limitations in the current data base prevent one from making a uniform national assessment of PCB environmental levels. It appears that if a well planned national approach to sampling were attempted, the data base could be improved in a very short period of time.

TABLE 4

LAKE ONTARIO ECOSYSTEM[1]

FISH, µg/g	
Alewife	.14 - 4.36
Smelt	1.40 - 3.49
Slimy Sculpin	1.58 - 9.17
WATER, ng/l	38 - 97
SEDIMENT, ng/g	43 - 245
NET PLANKTON, µg/g	3.4 - 11.8

1. Haile, C. L., Veith, C. D., Lee, C. F., Boyle, W. C., Chlorinated Hydrocarbons in the Lake Ontario Ecosystem (IFYGL) June, 1975.

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Polychlorinated Biphenyl (PCB)

MONS 093660

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

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

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.

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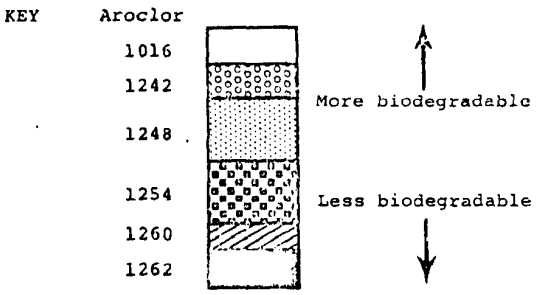

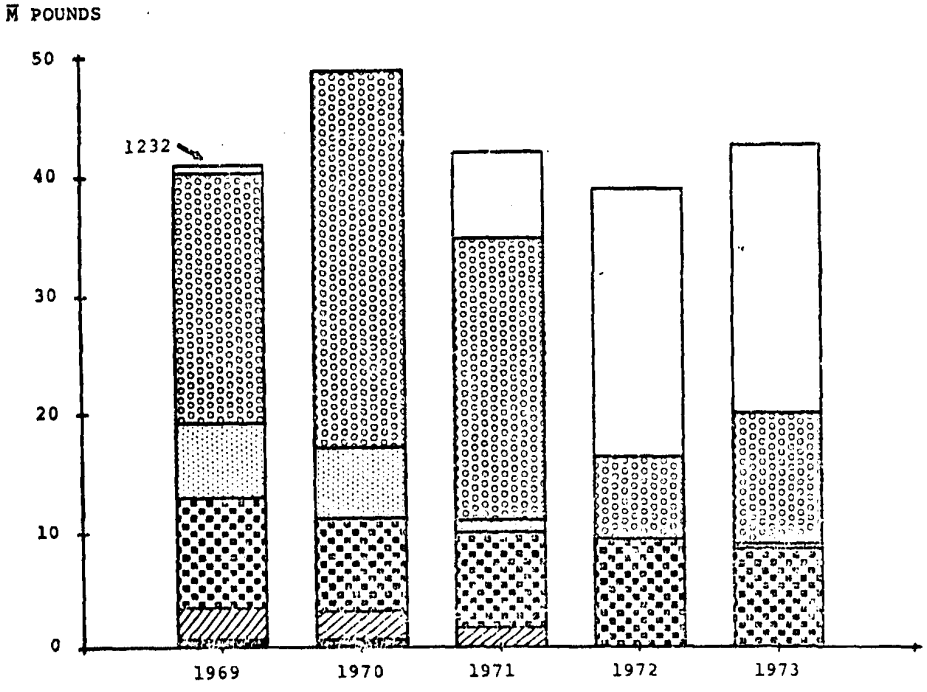

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•IS PCB BIODEGRADABLE?

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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.

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.

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

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.

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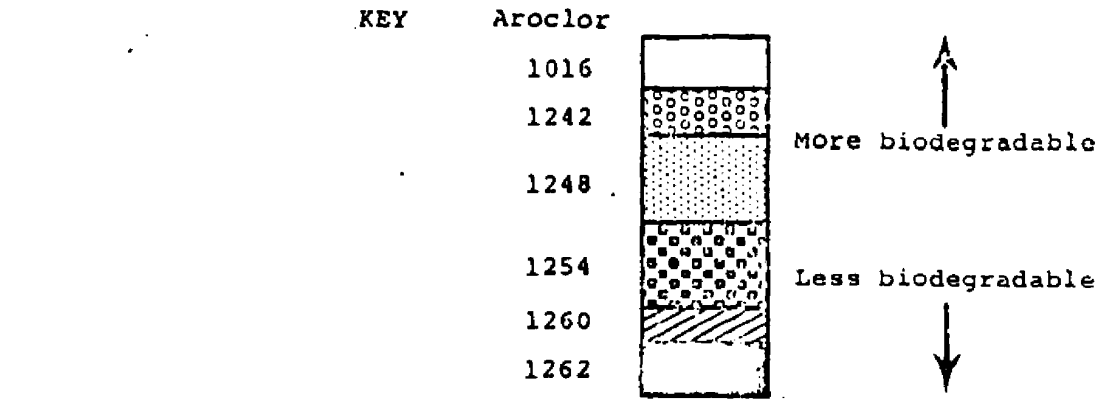

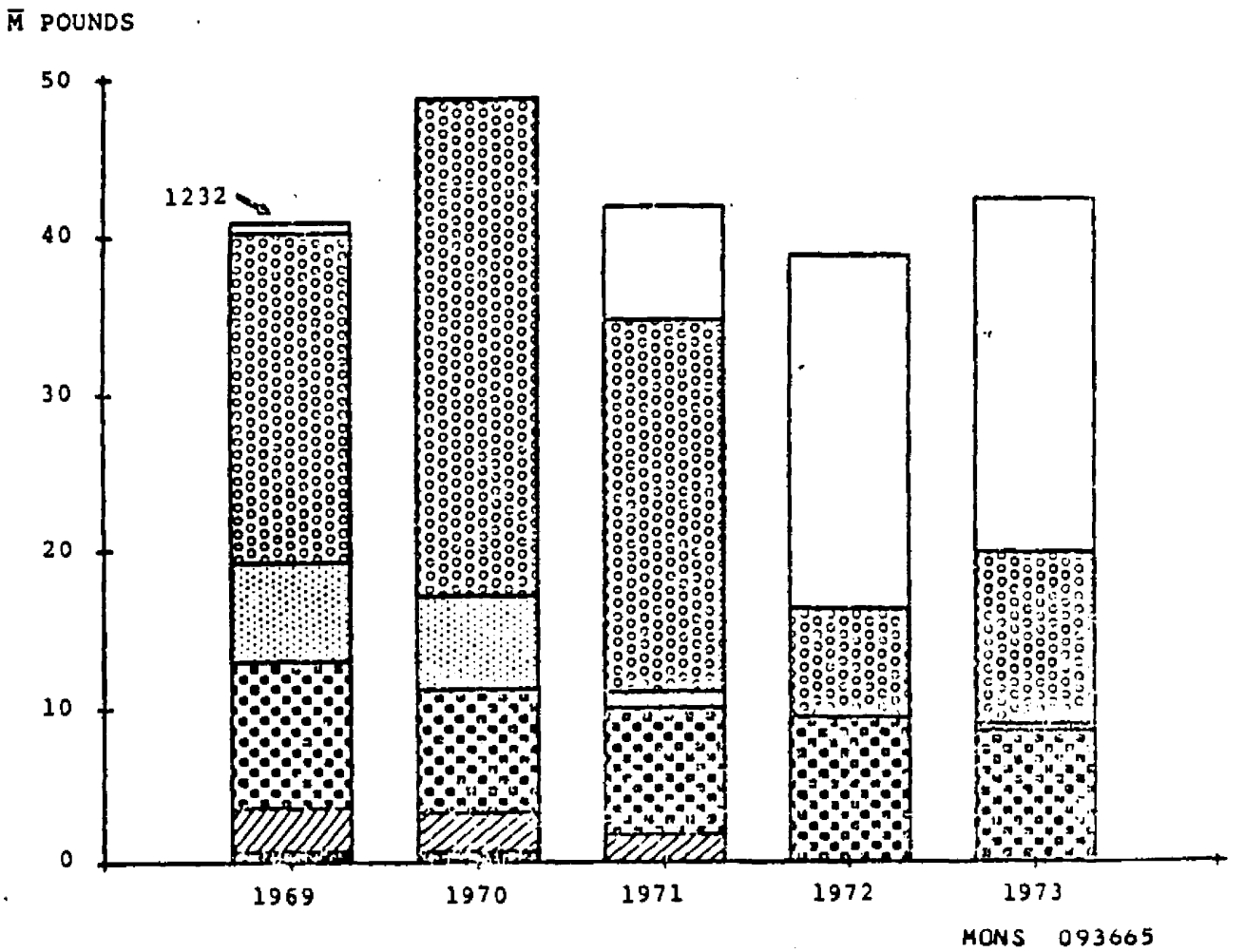

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