Monsanto INDUSTRIAL CHEMICALS CO.

FROM (NAME & LOCATION): E. S. Tucker - T2F

DATE: February 20, 1974

CC: R. E. Keller - T1B
R. H. Munch - T1B

SUBJECT: EPA's PCB EFFLUENT GUIDELINES

REFERENCE:

TO: W. B. Papageorge FEB 21 1974
B1ND

1. Description of PCB's

   a. Chemical
   b. Physical
   c. Degradation
   d. Definition of PCB's which could result in environmental problems.

Commercial chlorinated biphenyl products, of which Aroclors are examples, are produced by direct chlorination of biphenyl, the degree of chlorination being chosen to provide desired properties. As the degree of chlorination is increased, the products vary from mobile liquids to more viscous liquids and finally to waxes and solids. Lubricity, boiling point, and fire resistance also increase with increasing chlorination. These materials are inert, chemically resistant, and readily soluble in most common organic solvents. They distill in the range of 275-450°C and have water solubilities of 25-200 ppb. However, in all cases the products are multicomponent mixtures and not single entities as implied by the commonly employed acronym PCB. In fact, the commercial mixtures can theoretically have as many as 211 different components containing 0-10 chlorine atoms per biphenyl molecule. While it is well understood and accepted that each chlorinated biphenyl isomer has a unique set of physical and chemical properties, it is apparently not understood that each isomer also bioaccumulates and biodegrades at a different rate.

This lack of understanding is amply reflected in the definition proposed in the EPA Toxic Pollutant Effluent Standards (FR 38, #247, p. 35395, sec. 129.09a) and we quote: "As used in this subpart, the term: Polychlorinated biphenyls (PCB's) means materials containing the biphenyl group which have been chlorinated to varying degrees. There are 210 possible different PCB compounds."

We object to this definition because it implies that all chlorinated biphenyl isomers are of equal environmental concern, i.e., that they all persist and bioaccumulate in the

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same manner in our environment. It has been well established by academic, government, and industrial researchers that this is simply not true. Environmental monitoring programs have clearly demonstrated that, with the exception of direct high level controllable release near points of manufacture or use, that the PCB's found in our environment are the more highly chlorinated ones, i.e., those containing predominantly 5 or more chlorine atoms per biphenyl molecule (1, 2, 4, 5, 6, 7, and 8)*. This is true even though the lower chlorinated biphenyls have constituted >65% of all the PCB's manufactured over the years. This is strong evidence that the less chlorinated isomers degrade rapidly. It further suggests that even under conditions of unrestricted use, and without special precautions to prevent release into our environment (which is truly not the case now), that the less chlorinated materials degrade rapidly enough to prevent bioaccumulation.

More recently it has been demonstrated in the laboratory that biphenyl, some pure chlorinated biphenyl isomers, and commercial PCB products readily undergo bacterial degradation at rates dependent upon the number of chlorines per biphenyl molecule (10, 11, 12, 13 and 14). There are also good indications that ambient environmental PCB levels are decreasing at rates more rapidly than predicted (3, 9).

On the basis of these data we believe it to be unrealistic to consider all chlorinated biphenyls equivalent in terms of persistence and bioaccumulation as does the proposed regulation. We therefore suggest that, for environmental purposes, the definition of PCB's focus upon those which are truly of concern and we recommend that a more suitable definition would be, "Polychlorinated biphenyls (PCB's) means materials containing the biphenyl group which is chlorinated and which have been shown to persist and rapidly bioaccumulate in the aquatic environment. These chlorinated biphenyls are identified as those components having gas chromatographic retention times greater than 54, relative to p,p-DDE = 100, under the standard conditions (recommended in the EPA PCB test method." 5 Cl + above

In suggesting this definition we want it understood that we are not proposing the unrestricted release of the lower chlorinated biphenyls. We only suggest that the data indicates that our environment has shown the capability of handling these materials when large amounts were unknowingly released and that this coupled with the industrial restriction of sales to critical non-dispersive uses, with emphasis on recycle and proper disposal, has already brought this aspect under control.

* Paul Wright has additional references.

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2. Analysis

a. Method
b. Sampling

Attached to this memo is a copy of the revised EPA PCB test method which Jim Lichtenberg (Cinn. EPA) sent me. It has been cleaned up considerably; however, my earlier comments are still applicable (EST/WBP, EPA's PCB Effluent Guidelines, 1-17-74).

E. S. Tucker

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attachments

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REFERENCES

* Composition of PCB's found in environmental samples.

** Environmental levels.

1)* Crosby, D. G. and Moilanen, K. W.: Bull. Environ. Contam. Toxicol. 6, 372 (1973).

2)* Panel on Hazardous Trace Substances: Environ. Res. 5, 249 (1972).

3)** Food Chem. News 10/1 p. 2: "No PCB residues that could be quantitated have been found in FDS's last 10 market basket surveys, FDA says - - -"

4)* Koeman, J. H., et. al.: Nature 221, 1126 (1969).

5)* Jensen, S., et. al.: Nature 224, 247 (1969).

6)* Sissons, D. and Welti, D.: J. Chromatog. 60, 15 (1971).

7)* Bagley, G. E., et. al.: J. A.O.A.C. 53, 251 (1970).

8)* Bidleman, F. F. and Olney, C. E.: Science 183, 516 (1974).

9)** Dr. George Harvey, Woods Hole Oceanographic Institute - personal communication - see EST/WBP memo "EPA's PCB Effluent Guidelines", 1-17-74.

10) Evans, W. C. and Lunt, D., Biochem. J., 118, 54 (1970).

11) Cantelani, D., Sorline, C., and Trecean, V., Experientia, 27, 1174 (1971).

12) Ahmed, M. and Focht, D. D., Can. J. Microbiol. 19, 47 (1973).

13) Ahmed, M. and Focht, D. D., Bull. Environ. Contam. Toxicol., 10, 70 (1973).

14) Tucker, E. S., Saeger, V. W. and Hicks, O., submitted to editor Bull. Environ. Contam. Toxicol. 2-5-74. Copy attached.

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PROGRESS REPORT
ORGANIC CHEMICALS DIVISION
TECHNOLOGY DEPARTMENT

REPORTED BY	FOR	DETAILS	REPORT NO	DATE
W. M. Mees W. J. Litschgi E. S. Tucker	January- August, 1971	Yes	1	8-30-71

LOCATION	JOB NOS.
St. Louis - S. Second Street	2-21-760.01-13480, 85010, 16300

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*E. S. Tucker/W. M. Mees/W. J. Litschgi
*E. P. Wheeler/G. J. Levinskas

PROJECT TITLE

ENVIRONMENTAL ANALYTICAL STUDIES - RESEARCH AND DEVELOPMENT, MANUFACTURING AND OUTSIDE SUPPORT STUDIES

PROJECT OBJECTIVE

Identify, locate and assess the magnitude of Aroclor pollution problems, help determine what needs to be done to control pollution sources, verify the effectiveness of proposed pollution control procedures, guide development of recycle and/or disposal methods, and provide collaborative data for legal and regulatory purposes.

SUMMARY

During the period covered by this report (January-August, 1971), 185 environmental and research samples have been analyzed for polychlorinated biphenyls (PCB's) by electron capture gas chromatography. Analysis of these samples represents a minimum manpower expenditure of 600 hours.

PCB's typical of our Aroclor products have been found at levels below and above recommended guidelines in:

- water and sediment from 3 manufacturing sites and 10 customer sites.
- fish meal, bakery meal, and in chickens and eggs of chickens fed feed manufactured from these materials.
- paperboard coatings.
- milk from the Ohio Department of Agriculture.
- Vermicelli.
- four Monsanto products, 6 customer products, and one competitive product.

A table showing the sample sources, types, and the level and type of Aroclor found as well as the support objective is presented in the details section.

Additional external and internal support has been provided in the form of analysis of samples for plant pollution and process development, on-site methodology training, analytical consultation and distribution of Aroclor reference materials.

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FUTURE PLANS

Samples Scheduled for Analysis

1. J. F. Queeny monthly plant effluent composite(s) (1+).
2. N.C.R. monthly 24-hour composite plant effluent(s) (1+).
3. Frigidaire Division monthly composite plant effluent samples (2+).
4. Westinghouse (S. Boston, Va.) plant effluent, sediment, and oil samples (7).
5. Ag Division - Nitro plant Santoquin and CaMHA samples (27).
6. Inter-laboratory synthetic PCB exchange samples.
7. PCB analysis of "Barbecue King" barbecued chickens - Greenville, South Carolina (4).

Other

1. Distribution of PCB in whole milk (fat vs skim)(legal).
2. Review of methods used by regulatory agencies to analyze Ohio milk samples for PCB's (legal).
3. On-site PCB analytical training for St. Regis Paper Company laboratory representatives (September 9th).
4. Evaluate and publish methods for isolation and detection of PCB's in Santoquin and CaMHA.
5. Analysis of Anniston plant effluents for polychlorinated terphenyls(8).
6. Review of PCB analytical methodology for representatives of Ontario Water Resources Commission (September 1st).

W. J. Litschgi
W. J. Litschgi

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9-3-71

E. S. Tucker
E. S. Tucker

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DETAILS

Environmental Analytical Studies - R&D, Manufacturing and Outside Support Studies

Research and Development Support

Sample Source	Sample Matrix	No. of Samples	Level Found	Associated Aroclor	Support Objectives
R. A. Kimerle CRD	Anniston Plant effluents treated with polyelectrolytes	28	ppb-ppm	1242-1254	Establish effectiveness of polyelectrolytes for coagulation of PCB's
W. G. Krummrich TSD	Aroclor Drum Washings	8	%	1242 1254 1260	Establish effectiveness of used drum clean up

Manufacturing Support

Anniston Plant	Plant effluents	8	ppb	1242 1254	Inter-laboratory exchange samples
J. F. Queeny Plant	Plant effluent - monthly composites	10	ppb	1242	Pollution control
	p-Nitrophenetole (PNP)	1	N.D.	-	Potential contamination source - Santoquin raw material
W. G. Krummrich	Muriatic Acid	1	ppb	1248	Potential contamination source - CaMHA raw material
	Dept. 246 sewer effluent	1	ppb	1105	Tentative Process Pollution Control Data
	Chlorinator off-gases	2	mg/m^3	1105	
	p-Phenetidine	1	ppb	1248	Potential contamination source - Santoquin raw material
	Plant effluent exchange samples	7	ppb-ppm	1242	Inter-laboratory exchange samples

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DETAILS

Environmental Analytical Studies - R&D, Manufacturing and Outside Support Studies

Sample Source	Sample Matrix	No. of Samples	Level Found	Associated Aroclor	Support Objectives
Ag Division Nitro Plant	Santoquin & Santoquin AW	22	ppb-ppm	1242	Determination of level and source of PCB contamination of animal fed additives
	CaMHA	7	ppb	1242	
	MHA Acid	2	ppb-ppm	1242	
	Mineral Oil *Plant contaminated	6	ND-%	1242	
	CaMHA Competitive Product "Hy Dan" (duPont)	1	ppb	1242	
			Outside Support		
Organic Division					
General Motors Control Foundry Bedford, Ind.	Well Water	1	ppb	1242	Pollution Control
Frigidaire Div. GM Corp. Dayton, Ohio	Plant ffluents	4	ppb	1242	"
Westinghouse S. Boston, Va.	Plant effluents, sediment, and waste oil	7			"
Kimberly Clark Moriane Mill	Plant effluents	3	ppb	1242	"
Mead Paper Co. (NCR) Ohio	Plant effluents	9	ppb	1242	"
Goodyear Pt. Pleasant, W. Va.	Plant effluent	2	ppb	1242	"
Ameripol B.F. Goodrich Pt. Neches, Tex.	Plant effluents	3	ppb-ppm	6050	"

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DETAILS

Environmental Analytical Studies - R&D, Manufacturing and Outside Support Studies

Sample Source	Sample Matrix	No. of Samples	Level Found	Associated Aroclor	Support Objectives
Westinghouse Aqua-Technics Hinsdale, Ill.	Carbon treated test effluents	8	ppb	1248	Development of pollution control methods
National Cash Register Dayton, Ohio	Monthly - 24-hour plant effluent composites	7	ppb	1242	Pollution control
	Reclaimed Oil	1	>100 ppm		
General Electric Pittsfield,Mass.	Plant effluents	5	ND-ppm	1260	Pollution control
Ag Division					
Holly Farms Poultry Monroe Mill Wilksboro, N.C.	Fish Mill from East Coast Terminal	6	ppm - %	1242	Determination of level and source of PCB contamination of animal feed components
Central Soya of Athens Canton, Ga.	Products associated with commercial chicken production	8	ND-ppm	1242-1260	Determination of level and source of PCB contamination of chickens
Agway, Inc. Feed Division Ithaca, N.Y. Buffalo, N.Y.	Bakery meal, chicken feed, chicken feed components, and chicken tissues and eggs	8	ppb-ppm+	1242-1248	"
Rozansky Feed Company	Bakery Meal and Vermicelli	3	ppb-ppm	1242	Determination of level and source of PCB contamination of animal feed components
C.F. Mueller Co.	Vermicelli	1	ppb	1242	
Inter-County Farmers Coop Assoc,Inc. Woodridge,N.Y.	Chicken Feed	4	ppb	1242	

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DETAILS

Environmental Analytical Studies - R&D, Manufacturing and Outside Support Studies

Sample Source	Sample Matrix	No. of Samples	Level Found	Associated Aroclor	Support Objectives
Regulatory and Legal					
Ohio State Dept of Ag., Food, Dairies and Drugs Lab., Reynoldsburg, Ohio	Milk	1	ppm	1254	Verification of level and type of PCB's present

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