PROGRESS REPORT
ORGANIC CHEMICALS DIVISION
TECHNOLOGY DEPARTMENT

REPORTED BY	FOR	DETAILS	REPORT NO.	DATE
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LOCATION	JOB NOS.
St. Louis - S. Second Street	2-21-760.01-13480, 85010, 16300

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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 (Nov.-Dec. 1971), ∿96 environmental and research samples have been analyzed for polychlorinated biphenyls (PCB's) by electron capture gas chromatography (EC/GC). Analysis of these samples represents a minimum manpower expenditure of ∿330 hours.

A table showing the sample sources, types, and the level and Aroclor found as well as the support objective is presented in the details section. PCB's typical of our Aroclor products have been found at levels above and below recommended guidelines in:

- Coated paper products manufactured by Champion Paper Company.
- Film wrap and paperboard products from the St. Regis Paper Company.
- Raw materials used by P.P.G., Industries at their New Martinsville, West Virginia plant.
- Plant effluent samples from one Monsanto plant site and five customer plant sites.
- Hydraulic fluids from several GMC plants and an imported VW.
- A fish sample taken from a river associated with a GE plant site.
- One Monsanto product and two competitive products.

PCT's typical of Aroclor 5432 and Aroclor 5460 have been found in:

- Plant effluents from one Monsanto manufacturing site and one customer plant site.

A table showing the sample sources, types, and the level and 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:

- On site PCB methodology review and training for a laboratory representative of P.P.G. Industries.
- Attendance at the Monsanto-Environmental symposium and presentation of three papers on PCB related topics.
- General internal and external analytical consultation.
- Distribution of Aroclor methodology and reference standards.
- Preparation of a PCB position paper with Dr.'s Munch and Vodden.
- Additional work on the Berg perchlorination procedure.
- Presentation of the PCB story to Westinghouse representatives.

FUTURE PLANS

PCB Analysis

1. Five J. F. Queeny monthly sewer effluent composite samples.
2. Nine spiked standard water method check samples with General Electric, Pittsfield, Massachusetts.
3. Paperboard, water, pulp and paper samples from Alton Box Board Company.
4. Thirty-four hydraulic fluid and plant effluent samples from Buick Motor Division, Flint, Michigan.
5. Twenty-one round robin exchange samples with plant laboratories.
6. Two commercial samples of Finish.
7. Two commercial samples of Electro Sol.
8. Soil migration study of Aroclor 1016.

W. J. Litschgi

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TABLE I
CUSTOMER SERVICE

Sample Source	Sample Matrix	# of Samples	Level Found	Associated Aroclor	Support Objective
St. Regis Paper Co. Dallas, Texas	Film and Paper Extracts	12	N.D.* to PPB	A-1242	Pollution Control
Champion Paper Co.	Coated Paper	4	PPM	A-1242	Pollution Control
General Motors Central Foundry Bedford, Indiana	Settling Pond Water	1	PPB PPB PPB	A-1242 A-5432 A-5460	Pollution Control
P.P.G. Industries	Raw Materials	3	PPB	A-1242	Pollution Control
Chev. Motor Grey Iron Div.	Machine Oils Plant Effluents	43 3	Per Cent PPB	A-1242 A-1242	Pollution Control
General Motors Corp., Buick Div.	Settling Pond - Water, Oil & Sludge	4	PPM to Per Cent	A-1242	
General Electric Pittsfield, Mass.	Plant Effluents	5	PPB	A-1242 A-1260	Methodology Check
General Electric Rome, Georgia	Fish	1	PPM	A-1254	Pollution Control
		COMPETITIVE PRODUCTS			
Ag. Division Nitro	Santoquin	1	PPB	A-1242	Determination of level and sources of competitive animal feed additives.
	CaMHA	1	PPB	A-1242	
		MANUFACTURING SUPPORT			
J.F.Queeny	Sewer Effluent Composites	7	PPB	A-1242	Pollution Control
W.G. Krummrich	ACL-59	5	PPB	A-1242	Det'n of level and sourc of PCB contamination of dishwasher soaps
		RESEARCH AND DEVELOPMENT			
Imported VW Automobile	Fluids	4	N.D. to PPM	A-1242 A-1254	Determine if fluids in foreign cars are a sourc of PCB contamination

*None Detected

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DETAILS (Cont'd)

Customer Service

St. Regis Paper Company, Dallas, Texas

A number of film and paperboard materials used to package food products were analyzed for PCB's by EC/GC. The samples were extracted by St. Regis and cleaned up by Monsanto in accordance with Analytical Chemistry Method 71-35. This support was provided St. Regis to assist them in locating significant sources of PCB contamination in their products.

Sample Description	PPM PCB's Found	Aroclor
SR-1, Shipping carton for bread bags - printed	0.01	1242
SR-2, Shipping carton for bread bags - unprinted	0.04	1242
SR-3, 3" core from film roll	0.47	1242
SR-4, Board from back of Wicket	0.81	1242
SR-5, Printed film from press	0.23	1242
SR-6, Polyethylene bags for bag machines (Kroger design)	0.08	1242
SR-7, Asphaltic tape from shipping cartons	None Detected	1242
SR-8, BF-103, film from extruder	0.11	1242
SR-9, BF-109 Film from extruder	0.32	1242
SR-10, Pre-seal adhesive from roll stock shipping cartons	0.53	1242
SR-11, St. Regis Blank	0.07	1242
SR-12, Yellow ink solids (Kroger Design - Sple 6)	0.19	1242

The PCB levels found in the above samples were corrected for the Monsanto chemical clean up blank (2 ppb) but not for the St. Regis blank of 74 ppb.

Champion Paper Company

Several coated paper samples prepared by Champion Paper Company were analyzed for residual PCB's. The PCB's are minor contaminants in the polychlorinated terphenyls a component of the paper coating fluids. The PCB levels found in the coated paper and paper coating fluid were as follows.

Sample Description	PCB's Found	Aroclor
1. APL CC No. 27 Mach.	31 PPM	1242
2. APL CC No. 10 Mach.	43 PPM	1242
3. FL No. 20 Mach.	29 PPM	1242
4. Micron II CFB	2.3%	1242

DETAILS (Cont'd)

General Motors - Central Foundry

Recent efforts by Central Foundry have reduced the hexane extractable oils from their settling ponds to an acceptable level of 3-5 ppm. In the past a direct correlation existed between the PCB level and the hexane extractable oils, this sample was analyzed to determine if this correlation is still valid. The levels of PCB's and PCT's were as follows: 0.03 ppm - Aroclor 1242, 0.04 ppm - Aroclor 5432, and 0.10 ppm - Aroclor 5460.

P.P.G. Industries, New Martinsville, West Virginia

Recent pressure by P.P.G.'s customers for guarantees that their products contain no PCB's have forced their research laboratories to set up for PCB analysis. In an effort to help them evaluate their problem in the interim several raw material samples were analyzed for them. The materials analyzed and the levels found were as follows:

Sample Description	PPM PCB's Found	Aroclor
50% Lye (E-2848)	0.007	1242-1248
Silica 11/4/71 (HS-LC-404 IPES No. 125)	0.290	1242-1248
Ohio River Water	0.003	1242-1248

A P.P.G. laboratory representative was also given an on site review and demonstration of Monsanto methodology for Aroclor. The main concern is apparently over the level present in the Silica which is employed as a binder or filler in paper products associated with food packaging. The most probable source of PCB's is a Therminol FR-2 heat exchanger unit that the plant operates.

General Electric, Rome, Georgia

One crappie taken from waters associated with General Electric's Rome, Georgia plant was submitted for PCB analysis. The fish was filleted, skinned, and analyzed for PCB's. It contained, on a wet weight basis, 2.5 ppm of PCB's calculated as Aroclor 1254.

General Motors Corporation

Due to continued pressure from Michigan State Regulatory agencies concerning PCB releases into the environment Monsanto has been analyzing a number of plant effluent and hydraulic fluid samples for them. The results of our analyses are as follows.

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Buick Division, Flint, Michigan

Sample Description	PCB Level	Aroclor
So. Bottom (12/19/71)	0.06%	1242
No. Bottom	0.13%	1242
#18 No. Top Holding Tank (10/19/71)	0.18%	1242
#19 No. Top c̄ Oil in Holding 1:2 (Skimmed:Holding)	0.33%	1242

Chevrolet Motor Division, Saginaw, Michigan - Grey Iron Plant

Hydraulic Fluid Samples

Sample Description	Level Found	Aroclor
1. #1 Hot Box - #1 Core Room	49.8%	1242
2. #2 Hot Box - #1 Core Room	28.4%	1242
3. #3 Hot Box - #1 Core Room	10.0%	1242
4. #4 Hot Box - #1 Core Room	58.3%	1242
5. #5 Hot Box - #1 Core Room	2.9%	1242
6. #6 Hot Box - #1 Core Room	42.5%	1242
7. #7 Hot Box - #1 Core Room	12.8%	1242
8. #8 Hot Box - #1 Core Room	7.5%	1242
9. #12 Hot Box - #1 Core Room	10.1%	1242
10. #2 Conv. Core Mold Machine	15.8%	1242
11. #2 Conv. Drag Mold Machine	17.7%	1242
12. #2 Conv. Cape So.	47.4%	1242
13. #2 Conv. Drag So.	45.7%	1242
14. #4 Conv. West	22.5%	1242
15. Conv. East	53.5%	1242
16. #7 Mold Line - Code MM	4.1%	1242
17. #7 Mold Line - Drag MM	2.1%	1242
18. #7 Mold Line - #1 Unit	1.9%	1242
19. #7 Conv. - #2 Unit	5.9%	1242
20. #7 Mold Line - #3 Unit	1.5%	1242
21. #7 Mold Line - #4 Unit	1.1%	1242
22. #7 Conv. - #5 Unit	0.9%	1242
23. #8 Conv. - Cape Mold Machine	18.6%	1242
24. #8 Mold Line - Drag MM	3.6%	1242
25. #8 Mold Line - #1 Unit	38.4%	1242
26. #8 Conv. - #2 Unit	53.2%	1242
27. #8 Mold Line - #3 Unit	27.7%	1242
28. #8 Mold Line - #4 Unit	33.8%	1242
29. #8 Conv. - #5 Unit	36.8%	1242
30. #8 Conv. - #6 Unit	21.1%	1242
31. #14 Conv. - Cape Mold Machine	23.4%	1242
32. #14 Conv. - Drag Mold Machine	32.7%	1242
33. #14 Conv. - Electric Furnace	41.7%	1242
34. #15 Conv. - Cape Mold Machine	29.6%	1242
35. #15 Conv. - Drag Mold Machine	33.0%	1242
36. #17 Conv. - Cape Mold Machine	9.6%	1242

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Chevrolet Motor Division, Saginaw, Michigan - Grey Iron Plant (Cont'd)

Hydraulic Fluid Samples

Sample Description	Level Found	Aroclor
37. #17 Conv. - Drag Mold Machine	30.8%	1242
38. #21A Conv. - Code MM	53.8%	1242
39. #21A Conv. - Drag Mold Machine	36.2%	1242
40. #21A Conv. - Drive	35.0%	1242
41. Ajax Electric Furnace	21.0%	1242
42. "K" Cupola-Ajax induction furnace	30.4%	1242
43. "D" Cupola electric furnace	11.0%	1242

Water Samples

1. Weir Water	15 ppb	1242
2. NF Weir Water	1.1 ppb	1242
3. Water before settling - Basin	>1 ppb	1242

Competitive Products

Ethoxyquin: Thompson-Hayward Chemical Co.	0.90 ppm	1242
DL Methionine: Nippon Soda	0.10 ppm	1242

These samples were analyzed to determine if competitive products were contaminated with PCB's. In both cases, they were found to contain a greater level than the corresponding Monsanto products.

Manufacturing Support

J. F. Queeny Plant

Clean Acid Sewer (Oct.)	14 ppb	1242
MSD Gatewell (Oct.)	70 ppb	1242
BPA East Comp. (Nov.)	<2 ppb	1242
SSS Comp. (Nov.)	<2 ppb	1242
M Bldg. Comp. (Nov.)	<2 ppb	1242
Clean Acid Sewer (Nov.)	<2 ppb	1242
MSD Gatewell (Nov.)	<2 ppb	1242

Anniston Plant

Method 71-37 (Analysis of Water and SCAS Sludge Samples for PCT's) has been developed and is currently being used. Ten samples of Anniston Plant effluents have been analyzed for PCT's by this method.

Anniston Plant (Cont'd)

Sample Description	Level Found	Aroclor
HCl Sewer - 11/17	3 ppb	5432
	1 ppb	5460
Aroclor Sump - 11/10	64 ppb	5432
	36 ppb	5460
Limestone Pit - 11/19	18 ppb	5432
	77 ppb	5460
Limestone Pit - 11/10	25 ppb	5432
	29 ppb	5460
Plant Effluent - 11/10	19 ppb	5432
	34 ppb	5460
Plant Effluent - 11/11	35 ppb	5432
	71 ppb	5460
Plant Effluent - 11/15	12 ppb	5432
	17 ppb	5460
Plant Effluent - 11/16	16 ppb	5432
	46 ppb	5460
Plant Effluent - 11/17	9 ppb	5432
	42 ppb	5460
Plant Effluent - 11/18	8 ppb	5432
	12 ppb	5460

W. G. Krummrich Plant

In the past, low level PCB contamination has been found in some machine dishwashing compounds. For this reason, five lots of ACL-59, an active ingredient in these products, were analyzed by EC/GC for PCB's.

ACL-59, KA-1044, 10/71	117 ppb	1242
ACL-59, KA-1521, 5/71	89 ppb	1242
ACL-59, KA-1006, 10/71	85 ppb	1242
ACL-59, KA-1502, 5/71	50 ppb	1242
ACL-59, KA-1027, 10/71	81 ppb	1242

Research and Development

Imported VW Automobile

Four fluids were drained from an imported VW to determine if any contained significant levels of PCB's. None were found.

TG	None detected	-
ATF	None detected	-
BF	5.7 ppm	1242
HD	17.1 ppm	1254

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Perchlorination Studies

PCB's can be treated with antimony pentachloride in sealed glass tubes at 170°C with conversion to decachlorobiphenyl. The decachlorobiphenyl can then be measured (a single peak) by EC/GC essentially free of interference. Preliminary data indicate the following yields at the 1 mcg level:

Aroclor 1254	93.5 ± 0.5 (2 points)
Aroclor 1260	82.9 ± 8.3 (3 points)
Aroclor 1242	65.1 ± 6.0 (4 points)

Berg, et al, authors of original work, claim 85 ± 5% yield for Aroclor 1254 at this level.

o, m and p Terphenyl were also perchlorinated and can be eluted as single peaks. Quantitative yields were not determined.

Attempts to perchlorinate extracts from animal tissues, which exhibited isomeric alteration, gave unexpected high values when compared to regular analysis. Additional work is planned to explain these data.