Monsanto

JUN 15 1971

FROM (NAME & LOCATION) W. B. Papageorge - St. Louis

DATE June 10, 1971

cc H. S. Bergen
C. J. Smith

SUBJECT PCB ENVIRONMENTAL PROBLEM
MAY STATUS REPORT

REFERENCE

O

P.J.A Marrn - Brussels
W. S. Clark
J. R. Durland - Tokyo
E. V. John
R. E. Keller - Queeny
R. M. Kountz
T. L. Gossage
P. S. Park
W. R. Richard
J. R. Savage
E. P. Wheeler
P. B. Hodges

MARKETING:

Safeway Stores, San Jose, California - converted small FR system to Therminol 66.

Jiffy Fry Foods, Crookston, Minn. - questioning our edict to replace all FR systems in the food industry by way of their parent company (Foremost-McKesson). They claim it is impossible to contaminate system in spite of fact they presently have about 5000 cases of french fries under test that may be contaminated with Therminol FR-1. We are pushing them to convert in June/July slack period.

MCS 1016, distilled Aroclor 1142, has been officially designated as Aroclor 1016.

ENGINEERING:

CEA 2415 - Waste Incineration

The department check-out and water batching was completed and waste aroclor feed to the incinerator was started during the week of May 26. Until personnel could get a good feel of operations, feed rate was held to about 60% of design and temperature was maintained at about 2,200°F. At these conditions and with a feed material rich in mineral oil, the aqueous stream from the scrubber to the sewer was within specification. The vapor stream to the atmosphere from the scrubber was also within specification. The schedule is to shut down briefly this week for correction work on the natural gas piping and the water quench tube.

CEA 2417 - Aroclor Distillation Aroclor 1016

Due to a recent process change in the monochlorobiphenyl process and quantity needed, extensive changes were required and this has delayed drafting. The modified Engineering Flow Diagrams are now complete and drafting is moving rapidly on the piping isometrics which will be followed by the steam tracing drawings. It is still anticipated that the project will be mechanically complete by the first of August. Construction has continued on all elements of the project not affected by the monochlorobiphenyl variance.

CEA 2451 - NC-Phosphate

Process design was virtually complete when an associated project CEA 2371 was cancelled. We are now modifying the NC phosphate project to pick up some required facilities which were included in CEA 2371. Current plans are to complete the design and then wait for plant construction manpower for the installation which is expected in early 1972. Installation of facilities for the interim run in June is nearly complete.

Research obtained a laboratory centrifugal extractor to prove we can adequately wash the product. These tests were successful after several experiments.

CEA 7817 - Monoisopropylbiphenyl

Currently, this product is being custom manufactured for our one customer's evaluation. With the anticipation that a contract will be obtained for long-term supply, an evaluation grade capital cost and manufacturing cost estimate was made for several alternates and submitted to the Business Group. Engineering is now awaiting a decision by the Business Group.

JAPAN:

The response to PCB has been very abrupt in Japan and all use of an Aroclor 1242-type fluid has been terminated in NCR capsules for copy paper. Furthermore, imports of Pydraul have also been subjected to critical review and Pydraul 312-A is demanded instead of Aroclor products which contain "PCB". All this leaves MMK with substantial capacity for biphenyl and Aroclor but very low demand. We also are limiting sales to "closed systems", which primarily involves transformers and ballast condensers.

EUROPE:

1. Legislation, effective January 1972, in Sweden will ban the use of PCB's, except under license. Licenses will be granted for electrical uses such as capacitor impregnation.

2. We discussed with Dr. Lennart Hannerz of the National Swedish Environment Protection Board the concept of ecologically acceptable PCB products. His view was that such products, if approved, would be licensed in preference to other PCB products for specific uses.

3. Liljeholmens were not convinced of the need for a new degradable capacitor impregnant, but have not yet been advised of Dr. Hannerz's view.

4. Nokia (Finland) were much more interested in the idea of a degradable impregnant.

The Finnish authorities, although less sophisticated than in Sweden, could take a tough line on the use of PCB's and Nokia are anxious to do all they can to counter the threat to their capacitor business. They are changing from water washing of their capacitors to solvent cleaning to reduce effluent contamination.

MEDICAL:

Norton Nelson, Ph.D., New York University informed the Medical Department late in the month that the Advisory Committee of the President's Office of Science and Technology, which he serves as chairman, has preempted the Pesticide Advisory Committee of EPA in evaluating the PCB problem. Nelson's committee is the one which resulted in our discussion with Professor Serafim of MIT and a representative of the Massachusetts Audubon Society last February.

Dr. Nelson indicated that he would ask representatives of Monsanto to present their PCB story to the Committee in the early fall (perhaps September). The Committee is looking at arsenic, cadmium and PCB's as to where the government should put priorities in preventing environmental contamination. Nelson's informal comments indicate that his committee would need production data and use by various categories.

Congressman Ryan (DEM., N.Y.) introduced HR8576 which was referred to the Committee on Interstate and Foreign Commerce. The bill would "prohibit the introduction or delivery for introduction into commerce of the chemical compound known as polychlorinated biphenyl". The Secretary of HEW would be authorized to exempt PCB for use as dielectric fluid in capacitors, as the coolant in transformers or as a fire-resistant ingredient in heat transfer media.

The rest of the bill deals with the type of record keeping and reporting which would be required in compliance with regulations promulgated by the Secretary; inspection of the manufacturing and warehousing and use establishments; and penalties for violation of the proposed act.

Sam Pickard believes that since Congressman Ryan is not a member of the Interstate Foreign Commerce Committee, the latter will not be too inclined to hold hearings on the bill.

PUBLIC RELATIONS:

Chemical & Engineering News editorialized on May 3 on the division's PCB environmental program in an article headed "A White Hat for Industry." On May 19, Congressman William F. Ryan (New York) introduced a bill in Congress to "Prohibit the introduction or delivery for introduction into commerce of the chemical compound known as polychlorinated biphenyl." The bill exempts the use of PCB in electrical equipment and heat-transfer systems. Although the bill does not mention Monsanto, a lengthy speech by Ryan on the floor of Congress revived old charges against PCB and Monsanto made at a news conference last year. Only limited news coverage has resulted.

RESEARCH:

Aroclor 1242 and Aroclor 1016 - G.C. Results - Ruabon

Receipt of the Unilever paper has allowed re-examination of some of the chromatograms obtained earlier since these have also been obtained using similar conditions. Results obtained are given below and data of interest is attached.

Comparison of Aroclor 1242 with Aroclor 1016

Tables I and II list the components which may be present in 1242 and 1016. Comparison of the figures suggests that if the fractionation is carried out to remove penta chloro and higher compounds only, then distillation could be carried out until the Apiezon L S.C.O.T. or capillary column chromatogram shows removal of peaks from 31 (Unilever chromatogram) onwards, at present. 1016 shows no significant component after peak 21. This may indicate a wider range for the cut point

in the distillation but may also possibly mean that a good packed column might be suitable for control. It also shows that peak 31 (using Apiezon L) is responsible for all the penta compounds in the range of peaks 1-37 inclusive.

The penta compounds present in peak number 31 have tentative structures: -

24 - 2'4'6', 25 - 2'3'6'

The next observed penta components are in peak 38 and these have the structures:-

24 - 2'3'5', 25 - 2'4'5', 35 - 2'4'6' and

35 - 2'3'6' together with a hexa 26 - 2'3'4'6'

Examination of the Ministry of Agriculture Pigeon Fat Residues

1) All the dichloro compounds and many of the trichloro compounds have disappeared.

2) The relative concentrations of the high boiling components of 1242 appear little changed.

3) If the pigeon had been fed Aroclor 1016 on the present evidence there would be little trace of any PCB remaining in the residue.

4) There are indications that the residue chromatogram is showing components which may not be PCB's.

5) The peaks in early part of the chromatogram, which do not appear to be removed, probably originate from the following structures:-

Peak	(No. is equivalent to that in the Unilever Chromatogram)	Suggested Structure
18	Major component	3-2'3' and/or 4 - 2'4'
21	" "	2-2'3'5' and/or 25 - 2'5'
12	Minor component	4-2'6'
17	" "	3-2'4'
20	" "	2-3'4'
8	" "	2-4'

Peaks 18, 20, and 21 are present in Aroclor 1016 as minor components only. Peak 12 is of the same retention time as that which shows as a major residual component in Aroclor 1242 subjected to biodegradation.

The results for this residue confirm the suggestion that Aroclor 1016 feeding trials by the M of A (Tolworth) would be very enlightening. More detailed analysis of the chromatograms can be made if required but this will be time consuming and should be discussed.

It must be emphasized that the above interpretations have been made using the retention data from Unilever directly. This means that identifications based upon retention time of known compounds, N.M.R. identifications and retention indices have all been given the same weighting.

Aroclor 1016

Peak (Unilever Chrom)	Component	Cl No.
1	Diphenyl	-
2	2	1
3	2 - 2'	2
4	25	2
5	24	2
6	2 - 3'	2
7	2 - 2'6'	3
8	2 - 4'	2
9	2 - 2'5'	3
10	2 - 2'4'	3
11	2 - 2'3', 3 - 2'6'	3
12	4 - 2'6'	3
13	4 - 4'	2
14	2 - 2'4'6', 25 - 2'6'	4
15	2 - 3'5', 3 - 2'5'	3
16	4 - 2'5'	3
17	3 - 2'4'	3
18	3 - 2'3', 4 - 2'4'	3
19	3 - 2'3', 4 - 2'4'	3
20	2 - 3'4'	3
21	2 - 2'3'5', 25 - 2'5'	4

Where components are given twice retention data is not sufficient to differentiate between the two peak positions.

Components Present in 1242 but removed by distillation from 1016

Peaks 1 - 21 considered to be present as in 1242

Peak (c Unilever Girrom)	Component	Cl
22	2 - 2'4'5', 24 - 2'5'	4
23	2 - 2'4'5'	4
24	3 - 2'3'6'	4
25	24 - 2'4', 23 - 2'5', 3 - 2'4'6', 26 - 3'5', 4 - 2'4'6',	4
26	4 - 2'3'6'	4
27	23 - 2'4'	4
28	2 - 2'3'4', 23 - 2'3'	4
29*	? If penta, may be 26 - 2'3'6' or 26 - 2'4'6'	Possible
30	3 - 3'4'	
31	4 - 3'4', 25 - 3'5', 24 - 2'4'6', 25 - 2'3'6'	3, 4
32	23 - 3'5', 4 - 2'4'5'	4
33	23 - 3'5', 4 - 2'4'5'	4
34	25 - 3'4'	4
35	2 - 3'4'5', 3 - 2'3'4'	4
36	4 - 2'3'4'	4
37	23 - 3'4'	4
38	24-2'3'5', 25-2'4'5', 26 - 2'3'4'6', 35-2'3'6', 35-2'4'6'	5 &
39	24 - 2'4'5'	5
40	23 - 2'4'5', 25 - 2'3'4'	5
41	25 - 2'3'4'	5
42*	24 - 2'3'4', 34 - 2'3'6'	5
43	24 - 2'3'5'6', 25 - 2'3'4'6', 235 - 2'4'6'	6
44	24 - 2'3'4'6', 236 - 2'4'5'	6
45	26 - 2'3'4'5', 34 - 3'4', 234 - 2'4'6'	4 &

* Peak 29 structures postulated by RAL.

Electrical Fluids - R&D Europe

A request from Nokia (Finland) for assistance in removing Aroclor from the water used to wash finished capacitors has resulted in some work on filtration of water/detergent/Aroclor emulsions through porous polyethylene developed by the Plastics Division of Nokia. Results so far show that the level of Aroclor can be reduced readily from about 20 ppm to around 2 ppm. There is evidence from changes observed in isomer distribution that the lower chlorine isomers are preferentially absorbed by this filter.

Biodegradation - Ruabon

Collaboration with the Ministry of Agriculture laboratory at Tolworth has yielded some interesting results on feeding of PCB products to pigeons and quail. Capillary column GLC analysis of residues after feeding A1242 and A1016 show that there is very rapid degradation of most of the isomers present in 1242 and practically all of 1016. The results on 1016 are preliminary, but look very encouraging.

Bio-Test Tissue Analysis - St. Louis

A review of the status of the Aroclor toxicity studies and associated tissue analyses was held 5-11-71 with representatives from Industrial Bio-Test Laboratories and Monsanto's Medical Department, Specialty Product group, and the Applied Sciences Section. Minutes of the meeting were published and a plan for the analysis of the tissues generated in these studies developed.

Freezer space for the storage of tissues in St. Louis has been obtained and Industrial Bio-Test Laboratories has been requested to transfer all tissues from the 2 year chicken and rat studies to St. Louis.

PCB analysis of all tissues from the 3 month and 12 month sacrifices of the 2 year study with rats have been completed. Upon completion of the analysis of the tissues from the final 24 month sacrifice, the PCB residue levels will be correlated with toxicity results and a review held.

Customer and Plant Support Analysis - St. Louis

No. of Samples	Sample Source	Sample Description	Status of Analysis
25	Central Soya	Products associated with commercial chicken production	8/25 Completed Holding
8	Westinghouse Aquatechnics	Treated Plant Effluents	Completed
1	Woodson-Tenent Laboratories	Chicken Feed	Completed
2	NCR (Dayton)	24 Hour Storm Sewer Composite Reclaimed Oil	Scheduled for Completion 6/4/71
2	J. F. Queeny	Plant Effluent Composite (April and May)	Scheduled for Completion 6/4/71
1	Ohio Dept. of Agriculture, Div. of Foods, Dairies & Drugs	No. 42379	In Transit
3-4	Inter-County Farmers Coop Assn., Inc. Woodridge, N.Y.	Finished Chicken Feed	In Transit
1	Rozansky Feed	Chicken Feed R110	Scheduled for Completion 6/9/71

Biodegradation Testing - St. Louis

Aroclor 1016 and 1142 Distillation Residue

Semi-continuous activated sludge (SCAS) testing of Aroclor 1016 and its distillation residue at a feed rate of 5 mg per 7 day cycle are continuing. Analysis of the recent data is still in progress. The initial data points were somewhat erratic, as expected.

Trichlorodiphenyl Ether and Tolylxylyl Sulfone

Two new SCAS units are being started on trichlorodiphenyl ether and tolylxylyl sulfone to determine the primary disappearance rates of these materials. At the same time, development of the analytical methods that will be used to monitor these materials has been started.

Aroclor 5432, Aroclor 5442, Aroclor 5460, Arobrom 5465, and Hexabromobiphenyl

Development work on the analytical methods for monitoring these materials continues. Sampling of these units will be started as soon as the analytical methods have been demonstrated. The Aroclor 5460 SCAS unit is showing possible toxic effects from the test compound as witnessed by a decreasing sludge volume and an observable decrease in LAS degradation. Feeding of this unit has been stopped to determine if it will recover.

A review of the progress to date toward developing biodegradation testing methods was held 5/11/71.

Polychlorinated Terphenyls (PCTs)

Attempts to measure PCTs by EC/GC have not been successful. The 300°C upper temperature limit of the EC detector did not allow the column temperature to be held high enough to completely elute the PCTs. Fractions of each of the materials were eluted but the relative responses indicated that only small percentages of the higher boiling materials were eluted. This approach has been dropped and an attempt will be made to monitor total organic halogen microcoulometrically.

Aroclor Removal from Waste Water by Adsorption-Flocculation

With the exception of the last two test runs, results show that effluent with an average 61 ppb Aroclor was produced from influent water with average Aroclor level of 288 ppb by varying the clay concentration and flow. The result of tests carried out at clay concentrations of 240 and 480 ppb Aroclor and a 2.5 gpm flow show effluent quality less than 50 ppb. (See Tables I and II.) However, there is still considerable fluctuation in the Aroclor level of the effluent. There is reason to believe that some residual Aroclor is being carried out on the solids in the overflow since essentially the same effluent quality is realized regardless of test conditions. This possibility is being checked out.

At clay concentrations of 480 ppm, the economics of using bentonite clay as an adsorbent becomes questionable. Therefore, in an effort to realize the desired effluent quality (20 ppm solids and 10 ppb Aroclor) with a clarification type process, powdered carbon will be evaluated. Cheaper sources of clay are also being evaluated. The extent of these efforts are reported in the work plan issued 5/11/71.

TABLE I

AROCLOR REMOVAL BY ADSORPTION-FLOCCULATION

Test Conditions:

Flow to clarifier - 2.5 gpm

Clay concentration in feed - 240 ppm

Polymer concentration in feed - 1.5 ppm

Volume Throughput (Gal.)	Avg. Influent Concentration					Avg. Effluent Concentration				
	SS*	1221	1242	1254	1260	SS*	1221	1242	1254	1260
3,600		42	75	--	--		17	5	--	--
7,200		490	590				64	15		
10,800		80	37	--	--		46	3	--	--
11,000		33	23				8	NDA	--	--

*SS -- Suspended solids concentration in ppm's

TABLE II

AROCLOR REMOVAL FROM WASTE WATER
BY ADSORPTION-CLARIFICATION

Test Conditions:

Flow to clarifier - 2.5 gpm

Clay conc. in feed - 480 ppm

Polymer conc. in feed - 1.5 ppm

Volume Through-put (Gal.)	Avg. Influent Conc.				Avg. Effluent Conc.			
	1221	1242	1254	1260	1221	1242	1254	1260
2,250	180	68	--	--	24	NDA	--	--
5,850	470	63	--	--	57	3	--	--
9,450	163	114	--	--	43	5	--	--
13,050	960	760	--	--	57	4	--	--
16,650	94	60	--	--	26	NDA	--	--
20,250	68	11			14	1		

MANUFACTURING:

W. G. Krummrich Plant

A. Aroclor Department

A major loss of about 500 gallons occurred during the reworking of wet material that had been returned from a customer. Material boiled out of tank when heating. Rework procedures are being reviewed and enlargement of the department sump are actions being taken to prevent another incident. Exclusive of the major loss, the average daily loss from the department was 1#/day with a range of 0.03 to 1.8#/day.

B. Total Plant - Plant exit losses averaged 21#/day with a range of 11 to 61#/day. The slug flow loss from the Aroclor Department did not appear of the same magnitude at the plant exit sewer streams. Also, the treatment plant influent stream is about 3-4 times greater than the plant exit. Samples from other Sauget Village industries reveal insignificant amounts of Aroclor.

C. Treatment Plant Effluent - Average daily loss of 27#/day with range of 8# to 75#/day.

II. Project Status

Two Aroclor units in the plant remain to be changed to non-PCB type fluid. Dept. 239 unit scheduled for mechanical tie-in week of 6/15 to permit fluid change. Dept. 245 unit to change fluid week of 6/1.

The following are miscellaneous approved projects required to contain losses in the event they occur.

Estimate No.

2095 "Aroclor Scrap Rework" EDC 7/1/71
To permit proper rework of returned material to Dept. 246.

2422 "Paving and Curbing" EDC 8/1/71
To contain losses in tank car and storage area in Dept. 246.

2482 "Contaminant Collection at Rip Track" EDC 9/1/71
To permit recovery of T/C washings and drainings.

2675 "Air Pollution Control" EDC 10/1/71
Nitrogen blanket on mix tanks to eliminate atmospheric pollution at Dept. 246.

2811 "Pave Under Therminol Unit" EDC 8/1/71
Contain Material in Dept. 246.

III. Program Status

Very little PCB being found in off-gas system by sampling or trapping. Confirms calculations. No additional equipment required in off-gas system, but present traps should remain an integral part of the system.

Anniston Plant

I. Current Level:

Aroclor losses during May '71 averaged 0.60#/day (71 ppb)

II. Projects & Evaluation:

Only minor work remains on Aroclor Waste TSD projects:

1. No. 2 HCl neutralization pit will be slightly improved during annual clean-out in July. Acid sewering is expected to increase due to full storage. This makes capability for switch operation of 2 pits much more important.

2. The 36" storm sewer repairs have accomplished the goal of minimizing Aroclor infiltration into storm water.

3. A premise for collection and disposal of spent HCl carbon will be issued by 6/15. The elimination of this material from the sewer system is the final step currently anticipated in the Aroclor program.

III. Spills

There were no Aroclor spills during the month of May '71.

Newport Plant

From October 1970 to April 1971 inclusive, 51 samples of Newport works effluent have been tested for PCB content. The monthly average concentrations of PCB in the works effluent are as shown below:

	Average PCB Content	Equiv. Pounds Per Day
October	151 ppb	1.51
November	263	2.63
December	127	1.27
January	263	2.63
February	247	2.47
March	252	2.52
April	213	2.13

Changeover of Santotherm F.R. Heat Transfer Systems

The heat transfer system on the Luwas in the 4-NDPA Plant at present contains Santotherm FR-2. It has been decided not to change this over to Santotherm 66 (HB-40) because of the potential fire hazard which would be involved and precautions are being taken to minimize and contain any spills or leakages which may occur from this system.

The only other Aroclor heat transfer system in use at Newport is on the Santolube 900 Plant. Changeover of this system to Santotherm 66 is under evaluation, but no change has yet been made.

Disposal of PCB Wastes

The setting up of a system for disposal of liquid and solid PCB wastes (both from Newport works and customer plants) by incineration is being negotiated with Purle Brothers Waste Disposal.

W. B. PAPAGEORGE