Monsanto

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

July 13, 1971

cc H. S. Bergen
C. J. Smith

SUBJECT PCB ENVIRONMENTAL PROBLEM
JUNE STATUS REPORT

REFERENCE

TO : Messrs. P. J. A. Marsh - 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:

Initial results show excellent recoverability at WGK on decomposed Therminol FR fluids. New fluid specs reached on seriously decomposed TT. A 6,000 gallon TC of Therminol FR-1 from Union Carbide next on schedule.

ENGINEERING:

CEA 2415 - Waste Incineration

The incinerator has been operated briefly at the design rate (based on pure Aroclor 1242) of 1250 lb./hr. and the PCB specification of 0.001 lb./hr. in the aqueous effluent has been met. One operating problem, hot spots in the Hastelloy quench column, has been overcome by use of larger water spray nozzles.

Late in the month, holes appeared in the sidewall near the base of the scrubber. Upon inspection, several areas in the scrubber were discovered to have lost their flaked glass reinforced polyester lining and significant erosion was noted at the tangential connection from the quench pot. John Zink personnel and the lining vendor will make a proposal for repairs.

The incinerator is down for repairs to the scrubber lining.

CEA 2417 - Aroclor 1016 Distillation

All engineering work (including drafting) was completed on this project during the last week in June. WGK

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plant construction are still estimating the week of August 2 for mechanical completion.

The decision was made to start up initially on Aroclor 1016 rather than on monochlorobiphenyl. Underwriter's Laboratories have completed their test work and classified Aroclor 1016 the same as Aroclor 1242. We will, therefore, produce Aroclor 1016 semi-continuously in the column without the need of a forecut material to be first removed.

CEA 2451 - NC Phosphate

All engineering effort is suspended pending a review of this project by the Business Group scheduled for early August.

CEA 7817 - Monoisopropylbiphenyl & Benzl Toluene

Currently, monoisopropylbiphenyl is being custom manufactured for evaluation by one customer. A decision on a contract from this customer was expected in early July but engineering has not yet received notice of this decision. A simplified modification of the MIPB process was evaluated. A preliminary evaluation of manufacture of benzl toluene, a potential substitute for MIPB, was also performed. This evaluation indicated that benzl toluene may be produced at a slightly lower cost than MIPB.

JAPAN:

At MMK, we are under substantial critical pressure from both national and prefectural ministries, because the available data have been insufficient to satisfy them on the improved biodegradation of Aroclor 1016. Even though it is obvious that the data show comparatively rapid removal of chlorinated isomers in the lower range, the presence of Cl_4 and higher chlorinated compounds is criticized — even if these may be only one-tenth of the concentration in Aroclor 1242. Since the effluent from the Yokkaichi plant, where our Aroclor unit is located, discharges into a large bay which is extensively used for fishing and oyster cultivation, reduction of higher chlorinated biphenyls to an economic level in 1016 is still considered a potential threat. We shall need any additional degradation data on Aroclor 1016 before we can introduce Aroclor 1016 as an improved product over Aroclor 1242.

EUROPE:

1. Legal difficulties make the provision of free PCB waste disposal through Purle impracticable. The contract with Purle will be for disposal of Newport arisings.

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2. There have been no major developments in U.K. or European press comments.

3. I.E.C. delegates have been asked to report on national facilities for disposal of Askarel wastes.

MEDICAL:

The two-year chronic feeding studies in rats and dogs with Aroclors 1242, 1254 and 1260 have been completed except for half of the animals which are being maintained on a pcb-free diet for an additional period up to 60 days to determine rate of clearance of pcb's in the tissue. Final reports are in preparation awaiting the results of micropathology examinations of the animals sacrificed at the end of the two years and those being continued for the additional 60 days.

The three generation rat reproduction studies with the same compounds have been completed and the final report is in preparation.

The chicken and egg production studies were completed and reports received some time ago, except for the extension of the study with 1242. The final report on this extension has been received in which the study was repeated using test diets of 2, 4 and 8/ppm (whereas the original study used levels of 1, 10 and 100). The original report showed an affect at 10 per ppm in the diet. At 2, 4 and 8/ppm, there were no effects on egg production, quality (candle), specific gravity or eggshell thickness. The only effect noted was slightly lower percent hatch of eggs from the 4/ppm and 8/ppm groups.

The teratology studies have been completed and the final reports are in preparation. We have been told verbally that there were no teratological effects observed with any of the compounds.

Ninety-day rat and dog studies are underway with Aroclors 5432, 5442 and 1221 at levels of 10, 100 and 300/ppm in the diet. In the case of MCS 1016, the dietary levels are 30, 100 and 300/ppm. All of these levels were selected after due consideration of the previous chronic studies and the 90-day studies with Aroclor 5460 done some time.

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At the end of the month some additional data on fish toxicity was obtained from other outside laboratories. These data will be examined and reported on next month.

PUBLIC RELATIONS:

Press coverage of congressman Ryan's bill, to regulate the uses of PCB, was extremely light. Reprints of articles from Chemical Week, New Scientist and Chemical & Engineering News were sent to over 200 science editors of the largest daily newspapers. The National Industrial Pollution Control Council released a report on the proper use and disposal of electrical insulating liquids. The brochure generally praised industry's voluntary efforts to control the use of these materials.

RESEARCH:

Bio-Test Tissue Analysis

Approximately one-third of the tissues from the 24-month sacrifice of the 2-year study with rats have been received. PCB analysis of these tissues is partially complete. The remainder of the tissues from the 24-month sacrifice will be shipped by Bio-Test during the week of 6-20.

Carcasses, tissues, and chick samples from the 2-year study with chickens are now stored in St. Louis. PCB analysis of these tissues will begin shortly.

Biodegradation Testing — St. Louis

Aroclor 1016 and Aroclor 1142 Distillation Residue

SCAS testing of Aroclor 1016 and its distillation residue at a feed rate of 5 mg/7 day cycle has been completed. Sampling and analysis of these units, without feeding of additional material, will continue to determine which homologs are most refractory toward degradation. Testing of these materials is scheduled for completion 8/1/71.

Poly-Chlorinated,-Brominated Terphenyls and Polybrominated Biphenyls

EC/GC methods are now in hand which will allow us to detect and measure nanogram quantities of polychlorinated terphenyls, polybrominated terphenyls and polybrominated biphenyls. The method has been tested for Aroclor 5432, Aroclor 5442, Aroclor 5460, Arobrom 5465, and hexabromobiphenyl. Optimum

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concentration ranges varied from less than one ug/ml to approximately ten ug/ml. This sensitivity should be adequate for monitoring the SCAS testing of these materials. The SCAS testing of Aroclor 5432 and Aroclor 5460 has been scheduled to be completed during the month of September. Testing of the remaining materials will start early in October and be completed during November.

Additionally, analysis of tissues from rats exposed to Aroclor 5460 indicates that this detection procedure should also be applicable for the analysis of laboratory exposed biological samples.

Work will also be initiated to determine if suitable extraction, clean up, and separation procedures can be developed for the isolation of PCT's from PCB's and other potential interference known to be present in environmental samples. If this can be achieved, then the EC/GC detection procedure developed can be extended to the screening of general environmental samples for PCT's.

Aroclor 1105

Two gas sampling trains were constructed to sample the chlorinator off-gas at WGK for biphenyl and monochlorobiphenyls. The chlorinator off-gases were sampled during production of 1105 and the biphenyl and monochlorobiphenyl levels determined for inclusion in the tentative process.

EC/GC and UV procedures were used to measure the levels of PCB's and biphenyl in gas scrubber samples from experiments evaluating the use of crude 1142 to scrub biphenyl from chlorinator off-gases. The analytical data indicated that 99% of the biphenyl could be removed in this manner.

The process engineering group was in need of a method for measuring the settling rate of hydrated lime in Aroclors so treated to remove hydrochloric acid. The standard Karl Fisher procedure used to determine water was checked and found to be applicable for the measurement of hydrated lime. The procedure allowed them to complete their studies.

Aroclor Pollution Study — Anniston

Aroclor Removal From Waste Water by Adsorption-Clarification

Tables I and II list the results of a test in which Donoho clay (locally available clay containing 95% silica) was evaluated as an adsorbent at the following test conditions: 2.5 gpm flow, clay conc. of 480 and 240 ppm, and 1.5 polymer

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conc. The two clay conc. were made up by combining one part Bentonite clay and three parts Donoho clay. Donoho clay would not flocculate in the presence of the flocculating agents. Results of these tests were quite similar to tests run at these same test conditions using Bentonite clay alone. These tests concluded the testing phase involving Aroclor removal by adsorption on silica-type adsorbents.

The powdered carbon adsorption phase of the work plan was initiated on 6/2 at a powdered carbon concentration of 50 ppm. Test results of this study are incomplete at this time but carbon does seem promising at the 50 ppm concentration level.

(See Tables I and II)

Biodegradation — Ruabon

Samples of Aroclors 1016, 1242 and 1254, degraded in the presence of cultures C_2 and C_3 for 50 days, are being analysed by capillary column/electron capture GLC. Results should be available within a few weeks. Packed column analysis has indicated considerable degradation of A1242 and A1016, but capillary column analysis is needed for identification and quantification of residues.

Additional shake-flask equipment is now available which more than doubles our capacity for biodegradation samples. Our plans for future work include studies of MCS1043, 2,2'-dichloro diphenyl ether, Aroclor 5460, Aroclor 5432 and mixtures of 5460/1221 and 5432/1221. We will also be looking at HB30, HB40 and MIBP in more detail and at effects of mixed cultures, especially on Aroclor 1016.

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.

Meeting with National Swedish Environment Protection Board at Solna, Sweden, 25 May 1971

This meeting was arranged so that we could discuss the PCB environmental problem and the attitude of the Swedish authorities to the use of PCB products. In particular, we wished to ascertain the reaction of the authorities to the concept of degradable PCB products.

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TABLE I

Aroclor Removal From Waste Water By Adsorption-Clarification

Test Conditions:

Flow to clarifier - 2.5 gpm
Clay con. in feed (120 ppm Bentonite clay
(360 ppm local clay (95% silica))
Polymer conc. in feed - 1.5 ppm

Volume Throughput (Gal.)	Avg. Influent Conc.				Avg. Effluent Conc.			
	1221	1242	1254	1260	1221	1242	1254	1260
2,400	100	27	NDA	NDA	37	NDA	NDA	NDA
5,200	200	64	NDA	NDA	50	4	NDA	NDA
8,800	148	44	NDA	NDA	8	3	NDA	NDA
12,400	63	34	NDA	NDA	5	NDA	NDA	NDA

TABLE II

Test Conditions:

Flow to clarifier - 2.5

Clay conc. in feed - 60 ppm Bentonite clay + 180 ppm local clay

Polymer conc. in feed - 1.5 ppm

Volume Throughput (Gal.)	Avg. Influent Conc.				Avg. Effluent Conc.			
	1221	1242	1254	1260	1221	1242	1254	1260
3,300	74	18	NDA	NDA	16	3	NDA	NDA
6,900	190	37	NDA	NDA	56	2	NDA	NDA
10,500	780	640	NDA	NDA	21	7	NDA	NDA
14,100	80	40	NDA	NDA	21	6	NDA	NDA

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Legislation in Sweden will ban the use of PCB products from January 1972 except under license. Licenses will be granted in special cases, for example for impregnation of high voltage electrical capacitors and as transformer coolants.

Hannerz was very interested in our concept of a non-persistent PCB product and said that they would recommend the licensing of such a product in preference to existing products if it could be demonstrated that it would not accumulate and was functionally acceptable.

Detail

Hannerz outlined the Swedish policy on PCBs. The National Swedish Environment Protection Board had recommended to the government that restrictions should be placed on the use of PCB products. Legislation was introduced to ban the use of such products from January, 1972 except under license. Such licenses would be granted to responsible manufacturers for specific applications such as impregnation of high voltage capacitors and as transformer coolants; they would be coupled with stringent requirements for reclaim and disposal of wastes.

We outlined to Hannerz our concept of a degradable PCB product and showed him some of the results of the analysis of residues after degradation of 1242 and 1016 by micro-organism cultures and after feeding trials to pigeons and quail. These results demonstrated quite well that considerable degradation could be expected, particularly for 1016, and Hannerz was clearly very interested in the outcome of these developments.

He questioned the effect of temperature, especially in the case of degradation by micro-organisms since in Scandinavia temperatures would be low. We indicated that some work on the effect of temperature would be possible in shake-flask experiments.

Hannerz said that in his view, a PCB product which did not accumulate in the environment would be acceptable and he thought that such a product would be licensed in preference to other products, provided it was satisfactory functionally. The problem which faced the authorities was how to decide that a particular product would not accumulate and, whilst the work which Monsanto had done was very valuable, he would like to see an experiment to demonstrate more directly whether or not the product would accumulate. This, he thought, might be done in a 'pond experiment'. Such a pond would be a miniature ecosystem containing plant and animal life from micro-organisms to fish. If the product under examination could be added to the pond in significant quantities without showing an accumulation in the fish at the top end of the food chain, he would regard this as good evidence of acceptability.

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We promised to consider the possibility of such an experiment and agreed to discuss with Hannerz or one of his people how one might be set up. We suggested that one of the technical people from the Swedish Environment Protection Board might like to visit Ruabon to discuss the analytical results on degradation residues and perhaps discuss further these ideas for a pond experiment. Hannerz agreed this would be useful and suggested that Jensen, who was on vacation during our visit, would probably do this.

During our discussion we also outlined the Monsanto actions which had been taken in North America and the United Kingdom to limit the applications of PCBs. Hannerz was obviously impressed by Monsanto's responsible attitude and wishes to take a constructive attitude himself to resolve the PCB environmental problem without preventing essential uses of these products.

MANUFACTURING:

Anniston Plant

Current Level

Aroclor losses during June, 1971 averaged 1.01 lbs./day (122 ppb). Breakdown of numbers are:

Normal level	49 ppb	0.41 lbs./day
Digging in HCl neutralization pit	73 ppb	0.60 lbs./day
Totals	122 ppb	1.01 lbs./day

Spills

There were no Aroclor spills during June, 1971.

W. B. PAPAGEORGE

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