Monsanto

FROM (NAME & LOCATION): W. B. PAPAGEORGE - ST. LOUIS

DATE: FEBRUARY 8, 1971

cc H. S. BERGEN
J. MASON

SUBJECT: PCB ENVIRONMENTAL PROBLEM
JANUARY STATUS REPORT

REFERENCE:

TO :
P.J.A. MARSH - BRUSSELS
W. S. CLARK
J. R. DURLAND- TOKYO
E. V. JOHN
R. E. KELLER - 2ND STREET
R. M. KOUNTZ
T. L. GOSSAGE
P. S. PARK
W. R. RICHARD
J. R. SAVAGE
E. P. WHEELER

GENERAL:

PCB's as high as 40 ppm in fatty tissue have been detected in chickens in New York State. FDA and USDA agreed to permit 180,000 pounds to be released for food use if PCB content does not exceed 5 ppm in salvaged edible parts. Source of PCB has not been determined.

The State of Florida informed Monsanto's Pensacola Textile plant it must take emergency measures to prevent PCB's from entering the Escambia River estuary and bay and within 30 days have an approved permanent solution or face a penalty of $5,000 per day. No PCB's are present in the plant effluent. The 2.5 ppb PCB's which were detected are being extracted from sediment contaminated prior to the summer of 1969.

Dr. K. Diane Courtney, National Environmental Health Sciences Institute, Durham, N.C. who conducted terotology studies on 2,4,5-T and NTA-mercury-cadmium informed us that she found no teratogenic effects on rats with Aroclor 1254 and Aroclor 1260. She plans to repeat her studies using laboratory mice.

Legislation has been proposed in the Massachusetts House of Representatives banning the discharge of PCB's to the environment. A public hearing is scheduled for February 8, 1971.

MARKETING:

Pydraul Reformulations - will be completed by our March 1 deadline. Most of the Pydrauls have already been reformulated, and assuming on February 15 our reformulated Pydrauls 135A, 230A, 312A, 540A, and 150A pass the Factory Mutual Fire Test, our work will be done.

General Motors, Phosgene Issue - seems to be under control. Elmer Wheeler and Raleigh Garcia will visit G.M. Tonawanda the week of February 8 to try and get them to issue a memo which will specify the Pydrauls as non-hazardous. Based on some telephone conversations Raleigh has already had, he thinks there is a fair possibility of accomplishing that goal.

U. S. Steel, Christy Park - converted to Vital 29. Though this competitive fluid is lower in price, Raleigh Garcia is convinced the move was primarily based on environmental considerations. To our knowledge, this is our first major loss of business for ecological reasons.

Pydraul A200-B - is now fully accepted by Johnson Motors and Chevrolet-Massena as a complete replacement for Pydraul A-200.

5-drum dielectric spillage on common carrier cleaned up so future contamination of anything not possible.

Tankcar of fluid from G.E. at Rome, Georgia coming into WGK for incineration.

More heat transfer FR food users switched to Therminol 66. Mrs. Pauls Kitchens was a big one this month - 60 drs. at various locations.

ENGINEERING:

CEA 2415 - Incineration - WGK

Design is nearing completion and field work was started by the plant maintenance force. Foundation work is well along and considerable pipe has been fabricated.

CEA 2417 - MCS-1016 - WGK

The project scope was modified to incorporate facilities for producing all liquid Aroclors at W. G. Krummrich plant. The concept here is that the Anniston facilities would be held in standby position. The revised scope was approved and the revised appropriation request data transmittal was issued.

Definitive design was continued and field work was started by the plant maintenance forces. Construction was a little slow in the start because outside labor forces would not support the plant's effort. At this time, approximately one-half of the drilled piers for foundations are completed and foundation work has started. This work needs to progress rapidly to permit shipping the fractionation column which is being assembled in St. Louis.

CEA 7817 - Disposal of PCB's on Solids

Quotations were received from selected vendors for various combinations of facilities. Simultaneously, Marketing was surveying Monsanto customers to better define what and how much solids would be returned. Engineering has been temporarily stopped until a forward program is established.

CEA 2451 - N-C Phosphate - JFQ

Research, Manufacturing and Engineering continued to study the process and resolve problem areas. The process is now fixed and Engineering is revising the preliminary scope and getting the capital estimate. An appropriation request data transmittal is scheduled for late this month.

JAPAN:

No new developments reported.

EUROPE:

Customer letter sent to all non-controllable PCB users in the U.K. advising of decision to cease sales on March 1st 1971.

All European D.S.O. Managers have been advised of this decision and background.

We are investigating press statements that restrictions or a complete ban will be put on the use of PCB's in Sweden.

At a meeting with the Marine Safety Department of the Board of Trade in London, we were informed that Aroclor 1242 had been classified under Class 9, Miscellaneous Hazardous Goods, primarily on the grounds that ecological damage could be caused in inshore waters. It was agreed that the hazard from acute toxicological effects was very slight and that classification in any higher category would not be warranted. The question of the suitability of the present Monsanto tote bins was raised. This will be investigated by our Distribution Department.

MEDICAL:

Reports on the acute vapor inhalation studies with MCS -1016 and Aroclor 1221 were received from Industrial Bio-Test Laboratories.

The data obtained in these brief studies indicate that four hour exposures to a vapor concentration of 0.64 milligrams per liter of air of Aroclor 1221 and 3.7 milligrams per liter of MCS 1016 had no effect on the test animals. The above concentrations represent approximate saturation with the air of the vapor under ambient conditions.

Dr. Keplinger of Industrial Bio-Test was queried by Dr. Garth Fitzhugh of the U. S. Food and Drug Administration as to the current results on the on-going rat reproduction studies. He was reassured that 10 ppm of 1242 show no effect and the continued indication that 100 ppm of 1254 and 1260 show no effect on reproduction.

PUBLIC RELATIONS:

Following inquiries from the Pensacola Plant and Business Week magazine, background information on Monsanto's program to control PCB was furnished. Pensacola had been receiving calls and letters following a TV show "Death of the Gulf" which partially implicated the plant and PCB. Business Week was working on a general pollution control story.

News articles and editorials from Wales have told a positive story of Monsanto's efforts to restrict sales to closed systems and to convince other manufacturers to do the same.

RESEARCH:

Biodegradation Studies - Ruabon

To investigate and define the extent to which biodegradation of polychlorinated biphenyls is likely.

A biphenyl-degrading culture (C_2) has been found to degrade many isomers of PCB. A theoretical hypothesis has been formulated, from the known degradation pathway for biphenyl, to predict which chlorinated isomers might be expected to degrade. Experimental work has largely confirmed this hypothesis although a few loose ends still remain.

The extent of degradation of a number of Monsanto products has been studied experimentally. Analytical procedures have been developed to analyze the degradation residues and technique for quantifying these residues is at an advanced stage of development. It has been demonstrated that the

order of degradability for Monsanto products is as follows:

MCS 1016 > MCS 717 > MCS 762 > Aroclor 1242, MCS 1016 being the most degradable.

Experimental work has also demonstrated that HB40 can be degraded by C_2, but as with the PCB products, quantifacation of the extent of degradation has still to be determined.

We are supporting a project at University College, Bangor, in which it is hoped to select and study cultures specifically for degrading chlorinated biphenyls. Claims to have isolated cultures capable of growing on Aroclor 1242 and 1254 have not so far been substantiated, but a new culture, C_3, which appears to degrade biphenyl through a different pathway from C_2 has been isolated. This culture is being grown at Ruabon for experimental studies.

Aroclor - Environmental Contamination - Ruabon

1. Prevention of Indiscriminate Pollution by PCB

Technical service to customers has included advice on how to avoid pollution and instruction on disposal of waste material. Analytical service has been provided in many cases to assist customers in defining their pollution problems.

We have established that the incinerator operated by Purle Waste Disposal Ltd., at Rainham is satisfactory for the disposal of liquor PCB wastes. We have had discussion with incinerator manufacturers and operators to find a suitable unit for the incineration of solid wastes, but have not yet completed this.

Advice and assistance has been given to the Newport Plant on monitoring and control of pollution. Improvements in the interception of Aroclor contaminated drain-water and in pollution-control generally, coupled with routine monitoring of the plant effluent, have resulted in a steady decrease in the average level of PCB's., but occasional high levels indicate the need for constant vigilance.

2. Technical Cooperation with National Authorities

During the year we have maintained close relationships with a number of national authorities in the U.K.; these have included the Nature Conservancy, the Ministry of Agriculture Fisheries and Food and the Government Chemist. In the Netherlands, the University of Utrecht

and the TNO organization have been visited; in Sweden we have liaised with the National Environment Protection Board. Through meetings, discussions and correspondence with numerous societies and organizations interested in various aspects of the environment we have presented Monsanto's technical contribution to the PCB problem and have, in general, received complimentary comment regarding Monsanto's attitude.

The discovery, by analysts at the Ministry of Agriculture's Infestation Control Laboratory of relatively high levels of PCB's (40% chlorine) in small cardboard drums was one of the first reported findings of the lower chlorinated PCB's in the environment. This report was a major factor in influencing NCR/Wiggins Teape to change from Aroclor 1242 to HB40.

Although spasmodic press reports have appeared relating PCB's to the sea-bird incident of late 1969, the NERC report on the incident has not yet been published. The final draft, of which we have been promised a copy, has not yet been agreed amongst all the contribution.

We made technical presentations to the other European manufacturers of PCB products as part of a plan for unified action in Europe.

The paper on "Askarels-Environmental Pollution" was presented at the August CIGRE meeting in Paris and a modified version made available to the Conference on PCB's at Stockholm in September. This paper was well received.

Environmental Studies - Ruabon

During a visit to B.I.C.C. at Helsby we introduced MCS-1016 as a potential replacement product for Aroclor 1242. In a general discussion on pollution problems, with the Technical Manager, it was clear that BICC are anxious to cooperate. They will also look for any technical improvements which MCS-1016 might provide and report on to the results of the trials.

There has been some U.K. press reaction to the publication in "Nature" of the report by A. V. Holden, at Pitlochry, that PCB's are present in sewage sludge which is being dumped in the Clude and Thames estuaries. This is the report on the work which Holden described to us last May. The "Guardian" report links this with the bird-kill in the Irish Sea in late 1969. We are still awaiting the draft of the NERC report on that incident. The PCB story has now been superseded, at least temporarily, in the U.K. press by the "mercury in tuna fish" scare.

Biodegradation - Ruabon

We have still failed to degrade the 2,3,3',4,5-pentachlor biphenyl using the C_2 organism, using a technique similar to that used successfully with the 2,2'3,3',4',5'-hexachlor biphenyl. Work is still continuing with this and with 4,4'-dichlor biphenyl.

A new soil culture (C_3), claimed by workers at University College, Bangor, to degrade biphenyl by a different mechanism from C_2, has been used to degrade Aroclor 1242 and MCS-1016. Preliminary results confirm that degradation occurs, but we do not yet have information on the pattern of degradation.

Work is progressing on the analytical procedures for quantification and identification of residues. We are now able to identify a number of peaks and by a process of elimination suggest probable identification of other components. We hope to give figures for quantifying total residues in degraded Aroclor 1242 and MCS-1016 during the next few weeks. This information will be extremely useful in "selling" MCS-1016 against competitive products.

Environment & Applied Sciences Analytical Chemistry Group

G.E. Samples

The analysis of milk samples, submitted by G. E. Pittsfield, Mass., for PCB's have been completed. The electron capture (EC) chromatograms of the extracts, although appreciably altered, were most similar to our production Aroclor 1254-Aroclor 1260 type materials. The levels found ranged from 24.0 - 29.3 ppb apparent PCB's calculated as Aroclor 1254. A second set of samples was requested to verify these results. They are in hand and will be analyzed as soon as possible.

Bisphenol A - JFQ

Three samples taken from a current lot (QM-852) of Bisphenol A were analyzed for PCB's. The material contained 26 ppb PCB's calculated as Aroclor 1242. Aroclor 1242 was used as the standard, although lighter chlorinated biphenyls were also present. The EC chromatograms were not identical with either Aroclor 1232 or Aroclor 1242.

Anniston Plant Fish Survey

The analyses of all fish collected in the last survey of the streams associated with our Anniston plant for chlorinated hydrocarbons (Aroclor 1242, Aroclor 1254 and DDE) are greater than 50% completed (55 samples). The levels found in the completed samples have been forwarded to the Anniston Plant personnel. They, in turn, have identified 6 "target" species on which we will focus future analytical efforts in order to decrease the required man hours needed to complete the analysis of this set of samples.

Agway Company

A research representative of Agway Company was instructed on the techniques Monsanto uses to analyze biological samples for PCB's. During his visit several samples of commercial chicken chow, chicken muscle and eggs were analyzed for PCB's. EC gas chromatography indicated that PCB's were present in all samples analyzed including an egg composite extracted in Agway's research laboratories. The presence of tri, tetra and penta chloro biphenyls in the Agway extract was confirmed by GCL mass as well as EC/GC. The estimated levels of PCB's (as Aroclor 1248) found in the feed ranged from 0.10 - 0.17 ppm and in the muscle from 0.29 - 1.55 ppm. The EC/GC and GC/mass analysis of an egg composite sample remains to be completed.

Biodegradation Testing

SCAS Statistical Study

The statistical study of the semi-continuous activated sludge (SCAS) variables has now been in progress for three weeks of the required eight weeks. Monitoring of the SCAS units will continue until the complete set of data has been accumulated.

HB-40 - MIPB

Three weeks of the final four week sampling period have been completed. Ultraviolet analysis confirms that HB-40 and MIPB continue to degrade at the previously observed rates.

TCB, Aroclor 1221 & 2,2'-Dichlorodiphenyl Ether

Analysis of daily samples from these units continues. One more week of sampling is scheduled to determine if the SCAS tests with these materials can be wrapped up or if they should be continued.

Aroclor 1254, Aroclor 1242, MCS-1016 & MCS-1043

Theoretically, the environmental residence time of the above materials should decrease significantly from left to right because of the decreasing levels of refractory PCB isomers in each. To date the SCAS testing of these materials has not shown consistently different bacteriodegradation rates. However, statistical analysis of the last set of SCAS data points did show significant evidence of biodegradability for MCS-1043, some evidence of biodegradation of MCS-1016 and Aroclor 1242, and no evidence of biodegradation of Aroclor 1254. This coupled with the MCL C_2 data which also indicates that MCS-1016 is more degradable than Aroclor 1242 leads us to believe that if the SCAS test continues our optimizing degradation differences will be measurable. In February, after the completion of testing of current compounds, the units being fed the four PCB test materials will be monitored again. It is hoped that the longer acclimation period in conjunction with a switch to a longer feeding cycle (48 hours versus 24 hours) will produce measurable degradation rates this time. These tests will require 4 to 5 weeks to complete.

In the meantime, J. Mainprize of MCL has been contacted and has agreed to calculate relative degradation rates for the materials they studied by comparison of the EC traces before and after exposure to the C_2 culture.

Aroclor Pollution Study - Anniston

Aroclor was removed from the plant effluent by filtration of the neutralization pit solids on which Aroclor was adsorbed and by adsorption on the filtration media. Aroclor concentrations (100-8,000 ppb) in the plant effluent were consistently reduced to 10 ppb upon passing through a four (4) inch diameter tube (packed to a bed depth of 5.5 inch with activated carbon) at flow rates up to 350 cc/min. In the sand filtration study conducted under similar operating conditions, the Aroclor levels in the effluent were not consistently reduced to the target level ($<$ 10 ppb). The present of 200-1000 ppm of solid particles (size range 1.5 - 250 μ) tended to blind the filter, thus setting a maximum limit on the pressure and flow at which the unit had to be operated.

Conclusion

1. Aroclor is removed from the plant effluent by the filtration of the solids on which Aroclor was adsorbed.

2. Aroclor is adsorbed on activated carbon within a very short adsorption zone.

3. The effectiveness of sand in removing Aroclor is not sufficient at the experimental bed depth.

4. Solids removal is a primary concern in any final clean-up method.

Future Work

1. A pilot adsorption study has been conducted in a series of 5 inch diameter columns. These results are being compiled for an evaluation and recommendation. A report will be issued by 1/28/71.

2. A pilot clarification (flocculation) unit is scheduled to be put in operation by 1/29/71. This unit will also be used to carry out semi-continuous adsorption studies with other finely divided solids.

Dielectrics

Capacitor Fluids

Research reported on a series of dielectric fluids with dielectric constants from 3.5 to greater than 20 which could be replacements for Aroclor 1242. We are seeking an optimum combination of the following variables: dielectric constant, biodegradability, fire resistance, suitable physical properties and manufacturing cost. We prepared electrical grade 2,2'-dichlorodiphenyl ether, overcoming problems of high power factor with new clean-up procedures.

Three new diphenyl sulfones were prepared for evaluation: p-cyclohexyl-p'-methyl diphenyl sulfone, p-ethyldiphenyl sulfone, and 4-methyldiphenyl sulfone. We are seeking suitable solvents to blend with these sulfones.

Pydraul Reformulations

We issued a Tentative Process for Pydraul 312A, an oil, Santicizer 711, CDP, Aroclor 5432 blend. We are seeing increasing competition from Vital 29 and Dasco FR-300 for the Pydraul 312A-type market. Vital 29 contains 56% hydrocarbon oil, 39% Reofos type phosphate ester, 5% fatty acid solubilizer plus stabilizers. Fire resistance is close to Pydraul 312 and the fatty acid has a positive effect on fire resistance.

Pydraul 540B has accumulated 700 hours on the oil gear pump with no signs of wear.

We are adjusting the spray fire resistance of Pydraul 135A and Pydraul 230A to meet FM requirements.

Pydraul 150A was formulated with improved fire resistance over Pydraul 150.

MANUFACTURING:

Anniston Plant

Current Level

Aroclor losses during January averaged 1.8 lbs/day (307 ppb). This was up from December. lbs/day up - ppb down due to 300 gpm water flow from start-up of Niran.

28 day average	138 ppb	.8#/day
Amount from Niran		(.4)
Increase due to work on sewer to stop contamination of current water flow	169	1#
	307	1.8#

Aroclor Removal From Waste Water

Issued Progress Report R&D 446-514, Report No. 1, sent to all Aroclor producing locations.

Projects & Evaluations

No. 1 HCl pit 90% complete - 2 more weeks work to do.

Revised scope of carbon collection & disposal. Will be published by end of February.

Solids removal Pilot Plant construction is complete. PR&D work is underway.

Had no spills of Aroclor in January.

MONS 099656

W. G. Krummrich Plant

PCB Levels In Sewer

A. Aroclor losses from the Aroclor Department averaged about 0.6 lbs/day with a high of about 1.1 lbs/day.

Losses from the treatment plant for the period 12/17 - 1/15 averaged 22 lbs/day (114 ppb). Range for 6 samples was 2 to 53 lbs/day (9-278 ppb).

Data gathering on Aroclor in the various plant sewers is in progress. Samples are being composited twice weekly for analysis.

Projects to Reduce Sewered PCB's from Aroclor Department

Design package for Estimate 2422 to pave and trench loading and storage areas was completed and issued in January.

Programs to Eliminate Sewered PCB's From Using Departments

Therminol system in ONA (Dept. 222) was changed to Therminol 66 during the month.

Completion of design package for 13 additional units is scheduled for 2/15/71. Changeout of all units is targeted for completion by 6/1/71.

Several alternates including use of a eutectic salt are being evaluated for the Dept. 245 (P_2S_5) Therminol unit. Evaluation is scheduled to be completed by 4/1/71.

Decision on chemical compatibility of the new Pydraul in Dept. 251 will be made by 3/1/71.

In order to reduce the risk of PCB's being sewered from washing Aroclor trailers at Rogers Terminal, all Rogers trailers containing PCB's will be washed at WGK's Rip Track.

Reach 10 ppb in the Treatment Plant Effluent

At this time, it appears probable that PCB losses to the sewer can be controlled at less than 2 lbs/day (equivalent to 10 ppb at the treatment plant) by 9/1/71. This will be accomplished by:

1. Continuing current control of losses from Dept. 246.

2. Changeout of all Therminol units to non-PCB fluids.

3. Installation of pads and catch basins at the loading and storage areas in the Aroclor Department.

4. Installation of a catch basin at the Rip Track.

Losses at the treatment plant are expected to remain above 10 ppb by 9/1/71 due to past sewer contamination. Projects to clean sewers could run several hundred thousand dollars. A preliminary estimate to clean the sewer from the Chlorine Department to the plant fence was $70,000 and another $70,000 would be required to clean from the fence to the treatment plant.

Both main plant sewers appear contaminated with PCB's (30W and 24W). Our plan is to continue monitoring the main sewers to determine extent of losses and loss dissipation rate. By 6/1/71, when essentially all Therminol units have been changed out, we should be able to extrapolate to when the PCB level should reach 10 ppb at the treatment plant without sewer cleaning. Based on this information, we should decide promptly on whether or not sewer cleaning is justified.

PCB Levels in the Atmosphere

Estimate 2675 for $6,000 expense was approved to replace the nitrogenpurge with a nitrogen blanket at the mix tanks. Project package is scheduled for completion by 3/15/71.

PCB Rework Project (Est. 2095)

Project package was issued in January.

W. B. PAPAGEORGE

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