

ROBERT L. METCALF

2002 GOLFVIEW DRIVE

URBANA, ILLINOIS 61801

April 4, 1969

Dr. W. R. Richard
Organic Chemicals Division
Monsanto Company
800 N. Lindbergh Boulevard
St. Louis, Mo. 63166

Dear Bill:

Thank you for your letter of March 31, which arrived today. I am attaching a report of the visit to Industrial Bio-Test which covers the information I received there and includes some conclusions and recommendations which you may find of interest. I can only conclude from reviewing the data that there is a serious problem.

As I indicated the Bio-Test Program in the main seems sensible. My overall impression is that some of the toxicology is more extensive than warranted. I feel that the PCB problem will have to be attacked by doing something to prevent further environmental contamination rather than by defensive action. The latter in the case of DDT has not done anything to still the public outcry. It seems clear that environmental contamination by such highly stable lipid soluble substances is highly undesirable and must be corrected.

I am personally quite interested in this problem and think it important to determine the extent of biodegradability of the various typical PCB's. Perhaps we can look into this matter in our laboratory as this falls into the general purview of my Frasci Foundation and Public Health grants on environmental biodegradability. If you could provide small samples of the various typical Aroclors and in particular a few milligrams of known chlorinated biphenyl compounds, we shall plan to study their possible hydroxylation in the model Udenfriend system and if we can work out the methodology will look at one or two in our small experimental ecosystem test for biodegradability.

I shall continue to follow this problem with interest and will hope to discuss it with you early next month when I am in St. Louis. Meanwhile do not hesitate to call me if I can be of help.

Yours sincerely

Bob

Robert L. Metcalf

DSW 372255

136

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April 2, 1969

REPORT AND COMMENTS ON MEETING ON CHLORINATED BIPHENYLS
IN THE ENVIRONMENT AT INDUSTRIAL BIOTEST LABORATORIES,
CHICAGO, MARCH 21, 1969

Robert L. Metcalf

From the background data presented it appears that something of the order of 80 million pounds of polychlor biphenyls (PCB) are produced annually. These products contain from 3 to 9 chlorine atoms per molecule and become increasingly inert and stable to environmental oxidation with higher degree of chlorination. However, about half the production is in the 3-chlorine atom variety (Aroclor 1242).

At first thought it seems unlikely because of the major uses of PCB in capacitors, transformer oils, heat transfer fluids in closed systems, that these materials could be the source of the substantial degree of environmental contamination reported. However, about 40 million pounds annually is stated to be used as plasticizers, hydraulic fluid, adhesives, and in carbon paper. From this amount a very substantial percentage must escape into the environment as waste. Because of the apparent high stability of PCB, amounts entering the environment would be degraded very slowly and it seems possible that at least 10 million pounds annually may become environmental contaminants. Since the PCB's were introduced commercially in 1929 there have been 40 years of production. If this has averaged 50 million pounds per year, then about 2×10^9 pounds have been made and perhaps 2×10^8 pounds have entered the environment. Because of the apparent stability of these compounds most of this amount may still be circulating in the global ecosystem and this is suggested by the levels reported by Holmes et al. (1967) and Risebrough et al. (1968) in animal tissues which are quite comparable to those found for DDT. Both PCB

DSW 372256

125
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and DDT are extremely stable and water insoluble and have been produced in roughly the same total amounts over the past 30 years.

Thus it seems quite reasonable to conclude that the environmental contamination described for PCB is due to waste amounts of these compounds. This, coupled with the thorough evidence from mass spectrometry strongly suggests that there is an important environmental quality problem involved in wastes of PCB.

Experimental Work Planned at Industrial Biotest.--

This laboratory is highly experienced and seems quite competent to provide standard data required by FDA for evaluating the safety (or hazard) of agricultural or industrial chemicals. The long term feeding studies on rats and dogs will doubtless serve to indicate the chronic toxicity hazards of chronic ingestion of the PCB at ppm levels and this will almost certainly result in severe liver damage at some reasonable level. The chicken reproduction investigations at 0.01, 1, 10, and 100 ppm should be considerably more meaningful particularly in regard to studies of egg hatchability, shell thickness, etc.

While the fish toxicity investigations will be interesting, I cannot see that they are particularly relevant or necessary at this time and I would think this data could be obtained from Fish and Wildlife investigations, etc., and will undoubtedly be forthcoming, unsolicited.

Conclusions and Suggestions.--

It seems to the writer that the evidence regarding PCB effects on environmental quality is sufficiently substantial, widespread, and alarming to require immediate corrective action on the part of Monsanto. The defensive measures presently inderway will do little if anything to

DSW 372257

134

refute the evidence already presented. I would suggest the following:

- 1.. A substantial analytical program to monitor air and water effluents from Monsanto plants producing PCB and also those of major customers.
2. Prompt correction of effluent conditions where PCB can be demonstrated.
3. Serious consideration of curtailing sales of PCB for uses such as plasticizers, adhesives, and carbon paper where waste is certain to enter environment.
4. Review of disposal and recovery methods for PCB in capacitors, transformers, heat transfer fluids, and hydraulic fluids. Emphasize to customers importance of preventing environmental contamination.
5. Thorough investigation of environmental fates of various PCB's including photochemical oxidations, chlorination in water systems, etc.
6. Biochemical and electron microscopic study of levels of PCB ingestion which cause proliferation of endoplasmic reticulum and induction of multifunction oxidases in chickens and rats (perhaps these are partially included in present Industrial Biotest experiments).
7. Begin investigations of possible biodegradable substitutes for PCB's as plasticizers, adhesives, fire resistant hydraulic fluids, etc., anticipating loss of these markets as a necessary corollary of environmental problems. Are, for example, chlorinated diphenyl oxides or diphenyl sulfides suitable for these uses. They should be considerably more biodegradable.

DSW 372258

133