Aroclor

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INDUSTRIAL CONTACT REPORT

SUBJECT: Analytical and Toxicological Studies of p.c.b.'s in Environmental Samples carried out at T.N.O., Zeist, and the Institute of Veterinary Pharmacology and Toxicology, Utrecht.

PERSONNEL:

Mr. Ten Noever de Brauw	- Central Institute for Nutrition and Food Research, Zeist (T.N.O.)
Dr. J.H. Koeman	- (Institute of Veterinary Pharmacology and Toxicology), Utrecht (by telephone).
H.A. Vodden	- Monsanto
R.A. Lidgett	- Monsanto

SUMMARY:

Discussion was divided into two sections :-

1. Analytical work carried out by T.N.O. on the identification and measurement of p.c.b.'s in environmental samples using gas chromatography/mass spectrometry.

2. Toxicology of p.c.b.'s in particular that related to impurities of the chlorinated dibenzofuran type isolated from commercial products (Aroclor, Clophen and Phenoclor).

DETAIL:

Originally it was hoped that Dr. J.H. Koeman would be present at T.N.O. but in the event this was not possible. However, a short telephone conversation was held with Dr. Koeman and some aspects of his work were discussed.

The contact with Mr. de Brauw was initially arranged to discuss analytical work on p.c.b.'s, specifically gas chromatography-mass spectrometry. However, a proposal was made at the recent Frankfurt meeting to assess various non-industrial scientific organisations with a view to possible contract work (analysis and toxicity trials) on p.c.b.'s and this possibility was also discussed.

A summary of the information discussed is given below :-

1. Koeman is studying the relative toxicity of various commercial p.c.b.'s (Aroclors, Phenoclor and Clophen) and has found that there are significant differences in toxicity between products from various manufacturers. This has led to a detailed study of the impurities (i.e. non polychlorinated biphenyls) present in the materials and he has isolated, using column chromatography, a number of compounds which initially appear to be of very much higher toxicity than the p.c.b.'s. In particular, he considers the chlorinated dibenzo furans to be potentially highly toxic.

   At present, it is difficult to assess the relevance of this information since the quantities of impurities isolated are in the region of approx. 1 - 30 ppm in the product and the fate of these compounds in the environment is unknown. It is, however, possible that the toxic impurities, which may be present in commercial materials, but which may be absent in residue samples may affect the reliability of toxicity trials made with commercial p.c.b.'s when results are related to p.c.b.'s in the environment.

   Of the materials from the three manufacturers, Clophen and Phenoclor have chlorinated dibenzo furans at approximately 20 - 30 ppm while Monsanto material has less than 1/10 this amount. In fact, the figure for Monsanto material is below the sensitivity of the analytical methods used and is based on the toxicity trials.

   This work will be published later in 1970, but he has promised to send Monsanto a copy of two manuscripts when these have been confirmed for publication (possibly in 4 - 6 weeks).

2. The water in the Rhine (at various sampling points) has been analysed at T.N.O. and a figure of approximately 0.1 ppb (10^9) of a p.c.b. similar to Aroclor 1260 has been found. Fish taken from the Rhine show the presence of p.c.b.'s containing from 3 - 10 chlorine atoms per molecule plus the usual chlorinated pesticides. It is again evident that the 42% chlorinated material is not being detected - possibly because analytical conditions are designed to elute the 54%, 60% and more highly chlorinated materials.

3. Identification of p.c.b.'s in residues is made at T.N.O. by gas chromatography (packed columns)/mass spectrometry (Atlas CH4 and Varian double focussing spectrometer). Mass spectrometry is only used to determine the molecular weight and chlorine content of the largest isomer in any composite peak - no further structure investigation, using this technique, is made. Because of the need for more detailed information, a synthetic programme is being carried out at present in conjunction with preparative gas chromatography to prepare pure isomers for comparative purposes. Of the ten compounds so far prepared, none have retention times identical to peaks in the p.c.b. "residue" chromatograms. This is thought to be due to the method of synthesis which produces isomers containing chlorine atoms mainly on one ring.

4. T.N.O. can carry out analytical work for industrial companies either on an ad hoc or contract basis. In the former case it is estimated that analysis by g.c./m.s. of an environment sample would cost between £30 and £60 and for contract work the cost would be subject to negotiation.

While it is unlikely that Monsanto would use the analytical services of T.N.O. this organisation can be recommended to customers who require analysis of samples on a limited basis.

It is also possible to arrange for toxicological studies to be carried out on a contract basis; this organisation seems very well equipped for such work and could be recommended as a European centre for such studies.

Arrangements for contracts should be made through the director, Dr. C. Engel.

H.A. VODDEN

R.A. LIDGETT

RAL/HAV/meh
23rd February, 1970.