AROCLOR - WILDLIFE PROBLEM

Pollution of our environment by chlorinated hydrocarbons (CHC) has long been a subject of great concern and much attention has been paid to the ecological factors introduced by the wide spread agricultural usage of these chemicals for pest control.

When environmental samples are examined by gas chromatography using electron capture detection, peaks corresponding to CHC pesticides such as lindane, dieldrin, DDT and their metabolities and breakdown products appear on the resultant chromatograms. In addition to these peaks residue analysts had been aware that it was not unusual for an addition series of as many as 10 peaks corresponding to unidentified compounds to also appear on these chromatograms. Little was known of the structure and origin of these compounds except that they possessed gas chromatographic properties similar to CHC pesticides.

In about 1965, Roburn and co-workers established that these unidentified materials were organo-chlorine in nature, with substantial chlorine content and consequently possessed electron capturing properties.

In December, 1966 Swedish researchers at the Univertsity of Stockholm (Jensen and Widmark) announced that they had succeeded in identifying a series of such peaks as polychlorinated biphenyls (PCB), specifically Cl_4 - Cl_9, using gas chromatography -mass spectrometric techniques.

Initially pesticide analysts were concerned only about the interference of these materials with the accurate measurement of pesticides such as DDT. However, it soon became evident that these materials were contributing to some of the long range ecological problems previously blamed totally on the chlorinated hydrocarbon pesticides. At this point any number of workers began investigating the ecological effects and distribution of

polychlorinate biphenyls. (See attached outline.)

It now becomes evident that the PCB problem and the CHC pesticide or DDT problem are nearly one and the same.

First, it can be said that there is no clear cut scientific evidence proving that the levels of CHC being found in our environment can cause a specific amount or kind of harm to human beings. The acute toxicity of these materials is quite clearly defined and documented and is really not the major concern. The major concern is the long range effects of these persistent materials, for it is known that these materials can and do accumulate in increasing quantities in adipose tissues. Moreover tests with experimental animals and experience with wild life in the field have shown that CHC can affect the reproductive systems of birds and that they are probably responsible for the severe decreases in the population of several species of birds of prey. The immediate extrapolation of these affects to other forms of life including human beings has been carried out orally but not scientifically. Here again, there is no experimental evidence to back up this extrapolation.

Based upon the data we and other outside workers have generated since our confirmation of the Swedish findings, analogous statements can be made about the higher chlorinated biphenyls (Cl_5 and above).

The information to date indicates that we have a global pollution problem, at the moment restricted to aquatic areas because of the transport and concentration of marine inhabitants mechanisms.

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The levels of PCB reported are considerably higher in industrial areas than in the more remote areas so far examined. While the amounts being found (ppt, ppb, ppm) do not represent an acute toxicity problem they do represent long range toxicity problems. Again, this is because of the persistent refractory nature of the higher chlorinated biphenyls (Cl_5 and above) combined with their proven ability to interfere with the reproductive abilities of

birds and the oral extrapolation of this affect to other forms of life(with the exception of certain sensitive species).

Unfortunately the solution to the problem will initially involve our withdrawal of Aroclor 1254 and 1260 from the market place. Followed by a concerted effort to prove that Aroclor 1242 is biodegradable. If we can prove that Aroclor 1242 is biodegradable then with sufficient care the manufacture and use of this material can continue. The clearance of Aroclor 1242 will in turn clear materials such as 1221, 1232, etc. and possibly even Aroclor 1248.

In order to insure that there is no misunderstanding, it should be stressed that the probability of success of these studies is on the order of 75%. It could possibly be that the Cl_4 - Cl_9 PCB isomers being found are what is left after Aroclor 1242 has been biodegraded.

So far, the Aroclor 5400 series have not been reported as environmental contaminants.

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IDENTIFICATION TECHNIQUES

Analytically, the identification and quantitative estimation of PCB is not as clear cut as in the case of the CHC. Because of this, some comments about the detection methods employed are in order.

I. Electron Capture/Gas Chromatography
   A. Fairly specific but not an absolute identification technique.
   B. Extremely sensitive - detection limits in the nanogram range.

II. Microcoulometer/Gas Chromatography
   A. Specific for halogens
   B. Sensitivity - detection limits in the microgram range

III. Mass Spectrometry/Gas Chromatography
   A. Identification absolute
   B. Sensitivity - detection limits in the microgram range