EUROPE S.A.

1/26/67 X

FROM (NAME & LOCATION) : Brussels, Belgium

DATE : 26th January, 1967

SUBJECT : SWEDEN, AROCLOR

REFERENCE : DW:gb

TO : G. R. Buchanan - St. Louis

cc P. G. Benignus - St. Louis
D. S. Cameron - Brussels
Dr. D. V. N. Hardy - London
Dr. R. Emmet Kelly - St. Louis
R.A. Steenrod - St. Louis

Hart Hagerhoff - Brs

We recently sent you a translation of a Swedish newspaper article referring to the identification in nature of polychlorinated biphenols. Because some of the uses claimed for the materials fell in line with the uses of our own chlorinated diphenyls, we made a point, during our recent visit to Sweden, of visiting the research institute involved and discussing their particular programme of work.

To eliminate any earlier confusion that there may have been, I should like to emphasise that there is no doubt that the chemical which is the subject of the investigation and the news release, is chlorinated diphenyl i.e. Aroclor.

The company that supplied the mass spectrometer which was used in the research programme, in fact have recently put out a press release on this work. Although I am horrified by some of the headlines in this press release, it does basically describe the research programme carried out in Sweden, and describes in clear terms how chlorinated diphenyls were identified. I therefore, enclose a copy for your files.

Jensens only aim in life as an analytical chemist, was to identify the substances found in his research work on the occurrence of insecticides in nature. The unfortunate aspect of the situation is the comments which have been added to Jensens work. He showed what was present and unqualified people have made statements as to the possible effect of what he has found.

Summarising the publication position, there were original articles covering the Stockholm conference in the Swedish daily press, and these reports were picked up also by the Danish press. You will have seen from D.V.N. Hardy's memo of the 12th January that it has also been picked up by the Shell Chemicals Laboratory in Kent, U.K. Jensen also divulged that he had been contacted by the Swedish American press agency who intended to include information about this research work in their monthly review "The Swedish American Journal". There is additionally the press review issued by LKB Productor AB which I imagine to have been sent to a number of technical journals.

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.../...

Pf - Wood
EXHIBIT NO. 279
11/9/95 kg

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Effect in Sweden

This matter was raised with us by every capacitor manufacturer in Sweden that we visited. Fortunately there has not been too much adverse comment as yet from plant workers since they have not associated the polychlorinated biphenols mentioned in the article with Aroclor or Pyralene used in the Swedish factories. Jensen, however, stated that he had been approached personally by several workers associated with chlorinated diphenyls for non-electrical uses and these workers were quite worried as to the possible effect on their health.

Future Research

Arrangements are being made in Sweden for this work to be taken over by one of the medical institutes who hope to study the toxicology of the poloychlorinated diphenyl residues at the levels of concentration found by Jensen. Additionally a geographical survey is to be carried out to try and determine where the highest concentrations of residue are appearing and, if possible, to detect from this the method of escape so that more security precautions can be taken. We were asked by Jensen if it was possible for Monsanto to supply any samples of the pure isomers of chlorinated diphenyl since his work indicated at the moment that the lower chlorinated isomers are fairly easily metabolised, and the potentially more dangerous constituents are the more highly chlorinated members. If he can get hold of pure isomers, he would like to carry out some work on comparitive rates of metabolisation.

Jensen is forwarding me copies of his mass spectrographs and details of sample preparation so that we have all the details of his research work.

The point that I have made to Jensen is the need for care in any further publication of his work which is made. He accepts that the toxicology of chlorinated diphenyls should only be discussed with detailed information about exposure concentrations and exposure times and that generalised statements out of context can only arouse undue public concern. If any technical journal takes up the press release from the LKB Productor Company, there is little that Monsanto could, or should do in the way of publishing rebuttals. We do not want, personally as Monsanto to get too involved in this question. I am hopeful that we

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might persuade Jensen himself to write a letter defining the true extent of his own research work and placing his results in their proper perspective. It would certainly be helpful in gaining his further support if we were able to make available to him any small quantities of pure isomers.

Since we are not alone in supplying polychlorinated diphenyls to the Scandinavian market, I have drawn this matter to the attention of the other askarel manufacturers in Europe.

As you will see from the press release one of the major points that is made is the difficulty in disposing of waste chlorinated diphenyls and again I must mention that constructive recommendations for the safe disposal of our materials would be most helpful.

D. Wood.

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LKB

PRESS RELEASE

IN THE SERVICE OF SCIENCE

F. 1/10/67

Not for release until January 10, 1967

POISON! - LKB HELPS TO MAKE A SAFER WORLD

Swedish firm produces instrument that detects a previously unobserved poison in fish, fowl and mammal

The Nature of the Poison

The poison that has been isolated is a hitherto unobserved chlorinated hydrocarbon having eight chlorines in the molecule. This polychlorinated biphenyl (PCB) was isolated in residue analysis carried out with the LKB Combined Gas Chromatograph-Mass Spectrometer, LKB 9000.

100 (ng) of residue from 20 mg of fat, taken from a Sea Eagle found dead in the Stockholm archipelago, was used in the analysis which was made by Sören Jensen, of the Institute of Analytical Chemistry of the University of Stockholm, who has been engaged on this type of research for some considerable time. The dramatic importance of this discovery can best be understood by studying the main characteristics of PCB:

1. Very high stability. Capable of being boiled with nitric acid without destruction.
2. Has hardly any metabolism in living organisms. Can have a steady build-up in the human body and traces have been found in both adults and children.
3. If more than four chlorines are present PCB is non-inflammable.

As well as isolating a poison this research has drawn attention to the need for close co-operation in two parallel lines of investigation. The study of the persistency and toxic effects of herbicides, pesticides and related chemicals, which for some time now has caused general concern throughout the world, and the quest for improved methods of assessing the pollution of industrial waste.

How the Substance was Identified

Initial research seemed to indicate that this, then unknown, poison occured as a result of the use of insecticides; the usual organochlorines present in insecticide research were detected pp^1-DDT, pp^1-DDE and pp^1-TDE and certain unknown compounds

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were thought to be metabolites of the insecticides The location of the poisons in fish, in birds and on pine needles appeared to strengthen this theory. Further investigations however, including electron capture techniques, gave indications that this supposition was incorrect.

It was, at this stage, decided to use the LKB 9000 Combined Gas Chromatograph-Mass Spectrometer to obtain more definite knowledge of the chemical nature of these unknown compounds, their molecular weight, and number of chlorines for instance, as this was known to be the only method currently available which could give the highest degree of positive identification. Analysis had so far produced a chromatogram from which it was possible to estimate that the Eagle sample, previously mentioned, contained DDT and DDE in extractable fat at a concentration up to 13 g per kg, and the unknown compounds in more or less the same quantities. Many of the retention times however were not in agreement with those for any known pesticides and a high proportion of unknown peaks were present. The purified sample from the Sea Eagle was injected on the LKB 9000 and the mass spectrograms which were obtained of the unknown peaks showed their mass numbers to be as follows: 426, 392, 358 and 324. The molecular difference in each case being 34 mass units thereby showing a family relationship between the unknowns

Chlorine exists as a mixture of two isotopes with atomic weights 35 and 37 in proportions of 75:25. If the molecule has one chlorine, two peaks will be obtained, one for Cl_{35} and one for Cl_{37}. If there are two chlorines it is possible to have one peak with only Cl_{35}, one with both Cl_{35} and Cl_{37} and one with two Cl_{37} and so on, so the relationship between the peaks on the mass spectrogram were found to be:

Molecular weight:	324	358	392	426
Chlorine content:	5	6	7	8

Having obtained this information it was possible to calculate the molecular weight of the parent hydrocarbon (PHC) and this was found to be 154. The most probable formula for a compound having carbon and hydrogen and giving the molecular weight of 154 is $C_{12}H_{10}$ and this can only be satisfied when the parent hydrocarbon is biphenyl and the unknown polychlorinated biphenyl.

Once this fact had been established an approach to industry elicited the answer that PCB was fairly extensively used, and when a sample was obtained and run through the LKB Combined Gas Chromatograph - Mass Spectrometer it was found that the gas chromatograph gave the same retention time for both the Eagle sample and the industrial sample, and the mass spectrometer gave exactly matching peaks, thus providing absolute verification of the previous analyses.

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To cross check on the results and to more fully evaluate their significance, the feathers from a stuffed Sea Eagle (circa 1880), from a Stockholm museum were also ana-

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...trace of poison of any kind was discovered. This research was continued

with other dated specimens and the first trace of DDT and its metabolized DDT was discovered in a specimen circa 1948/49 and PCB in 1942.

It has been mentioned earlier that traces of PCB were found on pine needles which seemed to indicate wind-blown insecticide, but this is undoubtedly due to the fact that where PCB has 40% or more chlorines it is not consumed when industrial waste is burnt but is thrown out in the smoke and air-borne over considerable distances.

The effect of this poison on man is not yet fully known. In 1936 tests showed that 23 out of 24 men employed in manufacturing PCB suffered from an acne, which appeared 6 to 8 months after handling the substance, and in 1939 it was possibly responsible for the death of three young workers. Tests so far carried out on animals indicate that in all cases the liver degenerates and that generally the skin and the liver are the parts of the body susceptable to the poison.

Current Research

Jefferies and Walker of the Monks Wood Experimental Station in England have recently carried out experiments to determine the survival and reproduction of Bengalese Finches and have found a high proportion contain organochlorines. They are investigating the possibility of using the residue content of the liver as an indicator of the dose consumed.

Simmons and Tatton of the Laboratory of the Government Chemist, London, England have investigated organochlorine residues in human gallstones and have found them present in 28 patients from 2 hospitals.

These two lines of investigation have been concerned with insecticide and pesticides but they do serve to show the wide field in which traces of organochlorines occur.

Some twelve O.E.C.D. nations, among whom are the Scandinavian countries, U.S.A., Great Britain, France and Holland are co-operating in research into the prevalence of this virulent and dangerous substance.

LKB

LKB-Produkter AB is fully sensible of the dedication of the scientists taking part in this work in which it has had the honour and privelege to play an important role by providing an instrument, the LKB 9000 Combined Gas Chromatograph-Mass Spectrometer, to give them their first break-through by providing positive identification of PCB.

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Publicity Department

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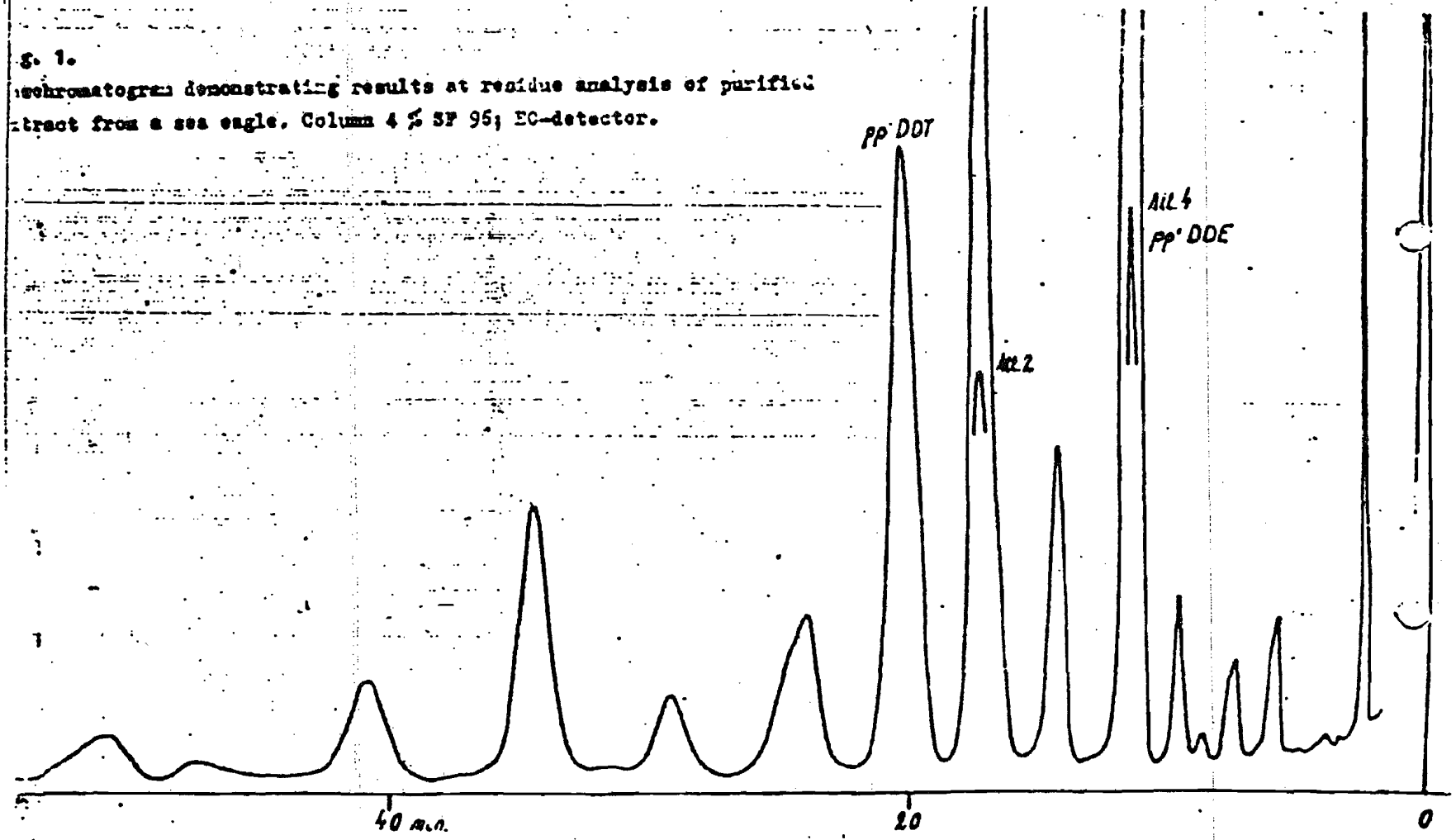
chromatogram demonstrating results at residue analysis of purified
tract from a sea eagle. Column 4 % SF 95; EC-detector.



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