→ Hague

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

RESTRICTED

Paris, 14th March, 1972

Environment Directorate

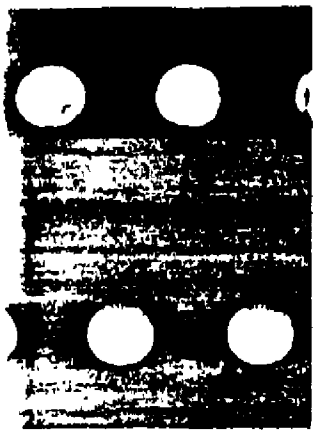
To : Members of the Sector Group on Unintended Occurrence of Chemicals in the Environment

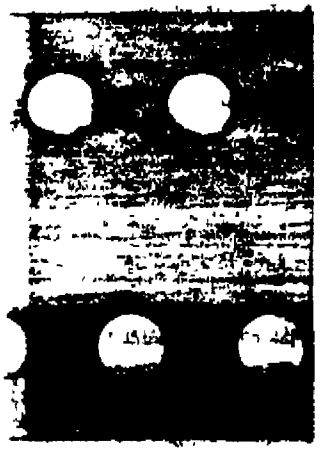
ADDENDUM IV

in relation to Item 7 of Agenda (NR/ENV/72.6) for 3rd meeting of the Group

Copy to : National Delegation

Or. Engl.





SECTOR GROUP ON UNINTENDED OCCURRENCE OF CHEMICALS IN THE ENVIRONMENT

Polychlorinated Diphenyls

- Note by the Secretariat -

Further to the proposals presented in Addendum III to the agenda of the 3rd Meeting of the Sector Group on Unintended Occurrence of Chemicals in the Environment, this document attempts to call attention to the questions that may have to be considered before recommendations in respect of control measures for the use of PCBs can be developed.

The document also contains the national reports submitted by the United Kingdom, Sweden and France in response to the request by the Sector Group for information on PCBs.

It is suggested that the delegates report on measures taken or contemplated in their countries to control the use or dispersal of PCBs.

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Polychlorinated Biphenyls

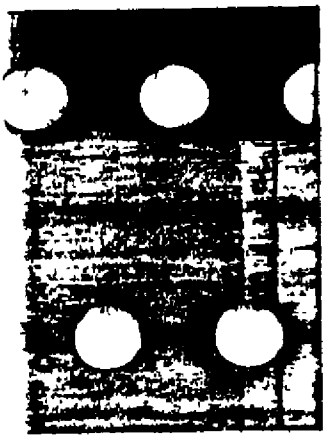
1. It has been estimated that 44,000 metric tons of PCBs are produced annually in the world. PCBs are usually high boiling point (low vapour pressure) liquids of high dielectric constant, soluble in organic media rather than water, extremely inert, stable to oxidation, to heat and to attack by acids and alkalis. They are used mainly in the electrical industry in transformers and capacitors, but also in heat transfer systems, hydraulic fluids, and as additives in pesticides, plastics, resins, rubbers, adhesives, waxes, paints, printing inks, carbonless carbon paper, etc.

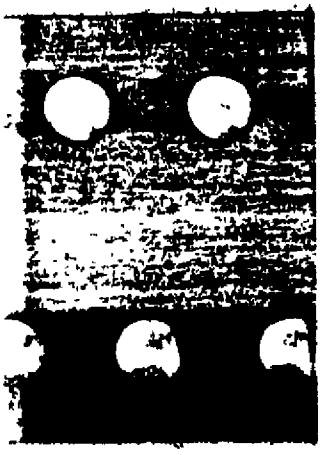
2. The amounts of PCBs produced in OECD Member countries are not known, partly because of the difficulty of obtaining production figures from a sole producer (e.g. Monsanto - in the U.S.A.). Other producer countries for which no figures are available are the U.K., Japan and Spain. For some countries production and use have been specified (see Table).

3. PCBs have been used since 1930, but their occurrence in the environment was not detected until 1966. Residues are now being found throughout the biosphere, particularly in the aquatic environment, but also in air, various species of animals, and man.

4. The biological significance of PCBs is not well understood, but certain effects, both chronic and acute, have been observed. Although the toxicity of PCBs is not generally considered to be high, impurities, such as dibenzo-furans that may develop during the manufacturing process, are known to be acutely toxic.

5. The question of toxicity is complicated not only by the existence of impurities, but also by the large number of different compounds - theoretically 210 - which are more or less chlorinated and may have different toxicities. The highly chlorinated biphenyls are the most persistent : a molecule containing four or more chlorine atoms requires a temperature of at least 800°C to be destroyed.





6. Important research projects are under way in many countries to study the toxicities of PCBs and to develop analytical techniques to distinguish between the various compounds.

7. Despite the incomplete knowledge of the effects of PCBs, steps have recently been taken by both governments and industry to reduce their use or dispersal. Monsanto Chemicals, the only manufacturer in the U.S., Canada and the U.K., have decided (August 1970) to limit their production to use in closed systems only, i.e. for use in transformers, capacitors, heat transfer systems and hydraulic fluids. For the latter two categories, the PCBs are also being replaced, allegedly by polychlorinated terphenyls. The replacement is estimated to be only about 10% more expensive according to Monsanto Canada, Ltd. The replacement of PCBs as plasticisers and in paints do not significantly increase the cost of the products.

8. Bayer, A.G. in Germany has followed the example of Monsanto, but there is no information as to whether similar measures will be taken by manufacturers in Italy, Spain or other unidentified producers. The responsibility of the distributors is not known.

9. The measures taken give rise to a number of questions that the Sector Group may wish to discuss :

   - How does the manufacturer ensure that the products sold are used strictly for their intended use in closed systems ?
   - How are leakages and spillages guarded against; what measures are taken in case of accident ?
   - How often do the PCBs in closed systems need to be replaced ?
   - Is the used product always returned to the manufacturer ?
   - How does the manufacturer dispose of it ?
   - How is the disposal problem solved in countries where there is no manufacturer ?

10. Action has also been taken by some Member governments. In Norway, for example, PCBs can now only be used with special permission. It would be appropriate for the delegates to the Sector Group to report other measures that may have been taken or are contemplated.

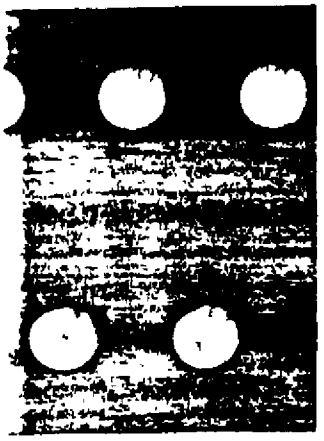
11. In the national report from the United Kingdom (Annex I), attention is drawn to the danger of creating international trade difficulties through unilateral action, for example by a government decision to ban PCBs, including the import of PCB-containing products. This raises the question of what manufactured goods contain PCBs, and to what extent this is known. At the ad hoc meeting on "Pesticides and Other Related Chemicals", which was convened by the Environment Committee in January, 1971, the Finnish Delegation submitted the following information :

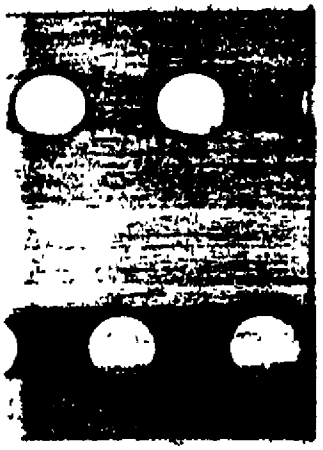
> "Some new regulations are under consideration in Finland. When these come into effect, the use of PCB-compounds will be allowed only when it is impossible to replace them by less dangerous compounds. According to the plan, the products containing PCB-compounds must have a special label indicating the PCB-content. The users of these compounds must be informed about the possible harmful effects caused by PCB-compounds in the environment. The disposal of waste products containing PCB-compounds will be allowed only by certain methods. This plan covers both imports and products made in Finland. In this context it would be useful to study whether the Member countries would be interested in creating a uniform system of warning labels to be used in the trade of these products".

12. The Sector Group may wish to consider this proposal, bearing in mind that such a measure would not solve the problem without being accompanied by a method of collection and disposal of the waste products. In this context two examples (from the U.S. and Sweden) may be quoted :

a) Recommendation by a Sub-Council of the U.S. National Pollution Control Council (June 1971)

> "In view of the suspected ecological hazard presented by state-of-the-art formulations of polychlorinated biphenyls, it is recommended that the electrical industry employ the following guidelines in the manufacture and servicing of electrical apparatus :





(i) Provision is to be made for qualified destruction of PCB waste materials, such that there will be no release of materials to the atmosphere or to ground or surface water significant from the standpoint of toxicity or adverse ecological impact. Initially, the only process which appears to meet these requirements is incineration under carefully controlled conditions. With proper adjustment of temperature residence time in the incinerator, and other parameters, products of combustion will be limited to HCl, CO_2, and H_2O (in the form of steam). The hydrochloric acid may be absorbed in a scrubber and the resultant solution neutralised with lime to form calcium chloride solution, $CaCl_2$. In the process described, the only effluents to the environment will be a plume of steam, carbon dioxide, and brine, the discharge of which must be held to regulatory limits.

(ii) All liquid waste is to be held in impervious containers pending disposal.

(iii) Solid wastes contaminated by PCBs are to be held in impervious containers pending disposal or purging. Purging may be accomplished by cleaning with proper fluids. The resulting contaminated liquids may be incinerated as above.

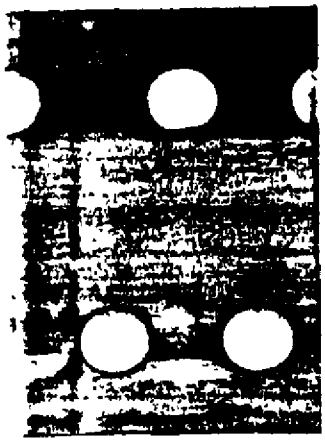
As the result of programmes undertaken since the industry was first alerted to indications of ecological harm from PCBs, the industry has progressed a long way toward the implementation of these recommendations. At least two enterprises are accepting liquid wastes for incineration; facilities are being prepared for the processing of contaminated solids; and a committee of the American National Standards Institute has been authorised to consider what standards may be appropriate".

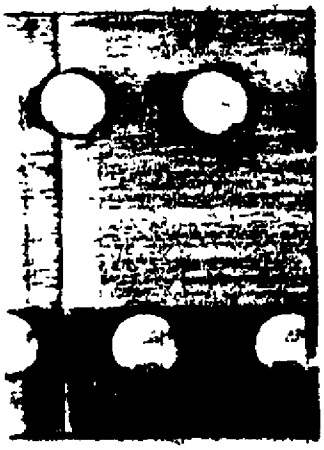
b) New Method for Disposal of PCBs (Sweden 1971)

"Recently the Swedish industrial group SUPRA presented a method for PCB disposal which shows great promise.

PCB disposal is a by-product of an arrangement for re-use of waste oil which SUPRA put into operation at the ammonia production plant in Kvarntorp in central Sweden.

The ammonia production uses large amounts of heavy mineral oil which is converted mainly to carbon monoxide and hydrogen. This is done at extremely high temperature (1,400 degrees centigrade)...





The extremely high temperature used in converting oil into process gas results in breakdown of many of the contaminants of waste oil. The National Environment Protection Board Research Laboratory has made careful analyses of the waste products and of process gas at various steps. They discovered that PCB was one of the substances that had been broken down.

Recycling and Disposal in One Package

In co-operation with a firm of consulting engineers, Terra Dona, an inventory of waste oil in central Sweden was carried out. The results showed that large amounts would be available if a suitable organisation for collecting the oil could be organised. This has now been done. The organisation, Reci, delivers oil to SUPRA under contract. Waste oil is collected from industries, garages, municipalities, etc.. A system which permits collection of quite small amounts from each individual subcontractor has been organised. Oils and waste products containing PCB are collected and added to the process. The method seems to show great promise as a model for solving several serious environmental problems in an economically attractive way".

13. In relation to the problem of PCBs, it is suggested that the Sector Group :

    a) arrange for available information on the effects of PCBs to be summarised (see Addendum III to the agenda for the 3rd meeting, NR/ENV/72.8);

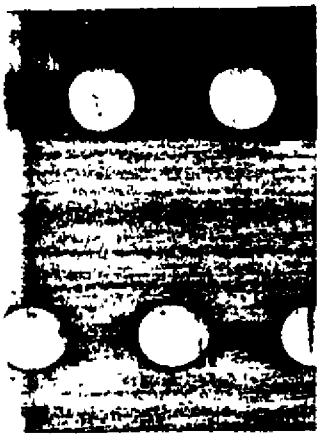
    b) discuss in what way recommendations for concerted action could best be developed.

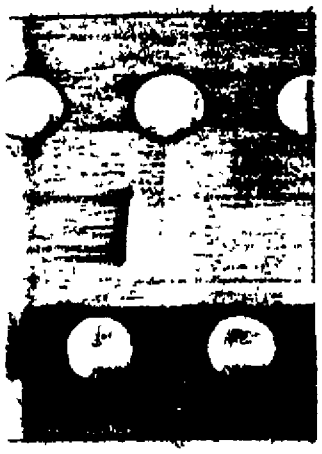
14. In view of the extensive control action already taken in respect of PCBs, it may be possible to draft recommendations for a policy without further delay. In order to develop such recommendations, and to ensure rapid action, the Sector Group might consider convening a special meeting together with the major manufacturers of PCBs. As a basis for discussion, the Secretariat could prepare an assessment of the measures already taken, including the technical questions posed in para. 9.

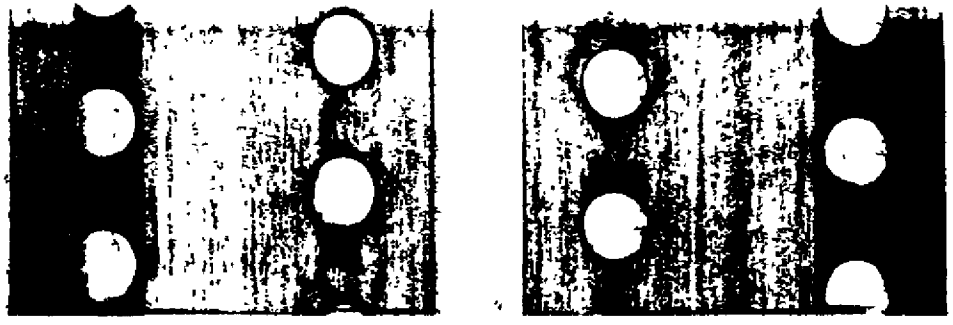
The meeting could then review :

- the costs of banning, replacing, re-using and disposing of PCBs and PCB-containing products;
- the possibility of restricting all production to certain uses;
- the feasibility of labelling PCB-containing products;
- the administrative machinery needed to implement measures for the control of PCBs;
- the question of who should bear the cost of return and destruction of used products;
- other compounds in use that are related to PCBs, such as the polychlorinated terphenyls or the polychlorinated biphenyls, etc..

Following this discussion the special meeting should formulate proposals for concerted action in Member countries for submission to the Council of the OECD.







PRODUCTION AND USE OF PCBs IN SOME OECD COUNTRIES (metric tons)

	Germany(1)	Canada 1)	U.S.A.	Finland 2)	France 1)	Italy	Norway 2)	Sweden 1)	Switzerland 2)
Production		2,260	5,000[5]	-	8,000	1,500	-	- -	-
Transformers/ Capacitors	4,500[3]	2,500[4]		200	5,000[6]		3-9	400	400
Heat Transfer systems	-							< 1	
Hydraulic Fluids	1,000							8-10	
Paints, Plastics Adhesives etc..	1,500[3]			30-40			25	80	

1) Figures from 1970
2) Estimated annual import
3) Sales by Bayer AG
4) Sales in Canada
5) Estimate based on consumer information
6) 80-90% sold to Electricité de France

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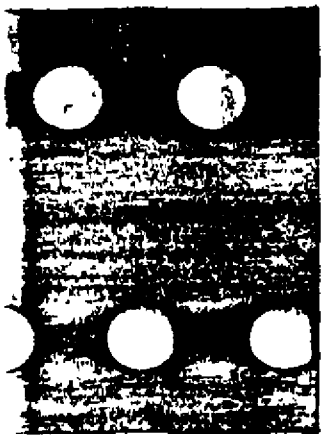
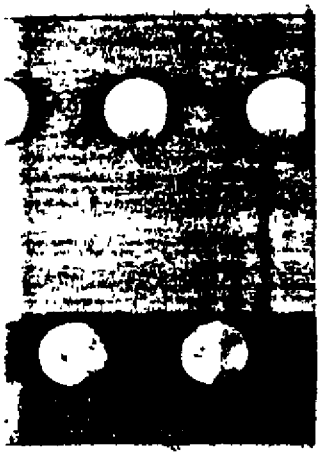
ANNEX I

CONTROL OF POLYCHLORINATED BIPHENYL POLLUTION IN THE UNITED KINGDOM



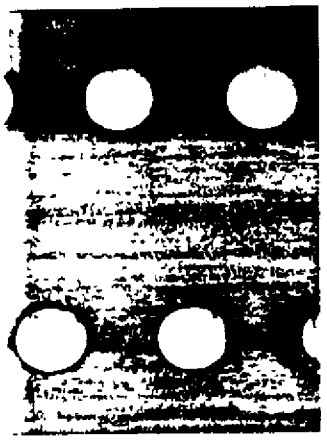


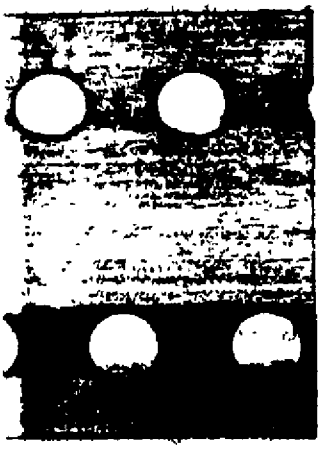
Introduction

In 1966 Jensen[1] established that polychlorinated biphenyls (PCBs) were present in pike (Esox lucius) and a white-tailed eagle (Haliaeetus albicilla) in Sweden. This discovery, largely arising by chance during studies in progress on DDT and other organochlorine insecticides, was the first intimation that this group of synthetic organic chemicals may have become widely distributed in the environment. Immediately following their identification in Sweden a programme of research was started in the United Kingdom to ascertain if the previously widely observed but unidentified compounds in wild animals in the British Isles, were identical with PCBs. This work not only confirmed that they were, but also that they were geographically widespread. Monsanto Chemicals Ltd., the sole manufacturer of PCBs in the United Kingdom, announced that from 1st March 1971 they would accept no further orders for PCBs except for "certain specified controllable uses". This paper gives an account of the investigations carried out in the United Kingdom to deal with the PCB problem, in the hope that the experience gained may help other countries which may be faced with this type of problem arising from the manufacture and use of these and other similar synthetic organic chemicals which are now being manufactured in increasing amounts in many parts of the world.

Manufacture and use

The manufacture of PCBs was first started by Monsanto in the United States of America in the early 1930s and in the United Kingdom, at one plant in Monmouth in South Wales, in the early 1950s. Prior to 1951 all the PCBs used in the United Kingdom were imported. Initially these compounds were used almost exlcusively in electrical transformers and then later also in capacitors. Because of their outstanding properties as a cooling and heat transfer fluid, combined with extremely low combustability, their principal use has remained in the electrical industry where they replace the more combustible oil products. The position before the control measure were introduced in 1971 was that although the major uses



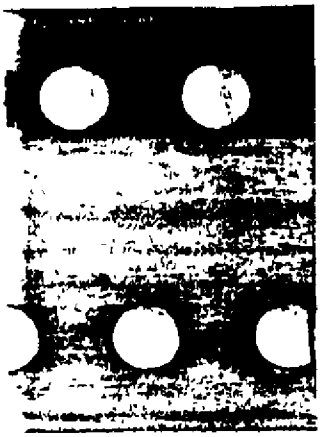


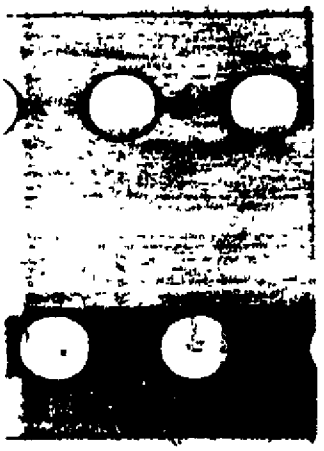
of PCBs sold in the United Kingdom were in the electrical industry, a substantial proportion was being used as additives in plastics, resins, rubbers, adhesives, paints and in heat transfer systems and hydraulic fluids. There was also latterly some use on an extremely small scale in vacuum pumps and in speciality lubricants.

Properties and Analysis

The PCBs are a series of chlorinated biphenyl compounds, the differences stemming from the degree of chlorination and the large number of possible homologues and isomers which can be formed. These different homologues and isomers may have different properties. Commercial products contain large numbers of different compounds in varying proportions. PCBs are very stable chemical compounds resistant to degradation by oxidation both chemically and biologically. They are relatively insoluble in water but are miscible with natural oils and fats. Only limited information is available on their toxicity. The acute LD 50 value to rats, using a commercial product containing 42% chlorine, was found to be about 4mg/kg. In other tests on small mammals levels of 1-10 mg/kg in feedstuff had no significant toxic effects, but at 100 mg/kg there were some indications of long-term effects(2). The estimated dose rate for 50% mortality at 56 days feeding Aroclor 1254 to the Bengalese finch (Lonchura striata) has been shown to be 254 mg/kg/day, suggesting that in this species this particular PCB has only 1/13 the toxicity of DDT(3). In the marine brown shrimp (Crangon crangon) the LC 50 for acute toxicity in 48 hours proved to be 0.3 mg/kg for Aroclor 1248 compared to 0.003 mg/kg for DDT(4). It has also been shown that at low levels PCB, like DDT, can induce sterioid hydroxylating enzymes in the liver of pigeons (Columba livia) and so may affect their breeding capability(5).

The PCBs thus have many of the physical and chemical properties of the organochlorine insecticides and appear to produce similar toxic effects in a number of animals, although generally apparently having a somewhat lower toxicity. It should be appreciated, however, that because of the large number of PCB compounds, and combinations of these, that are now available the toxicity of different types may vary considerably owing to the varied nature of the component parts.



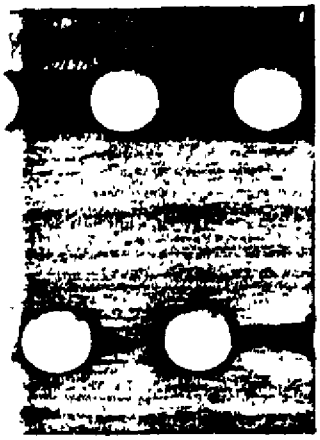


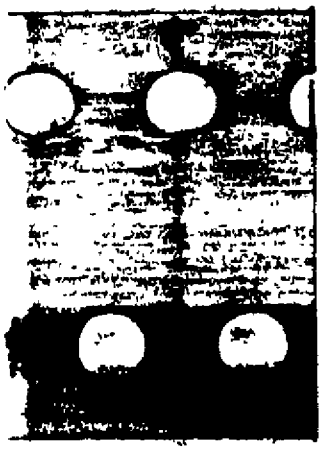
Analysis for PCBs has been by use of gas chromatography, using electron capture detection with occasional identification and structure confirmation by gas chromatography mass spectrometry. Because of the need to measure PCBs at extremely low levels (e.g. 1 in 10^7 or less), and the similarity of their chemical structure to that of the organochlorine insecticides which were frequently also present in the tissues of wild animals undergoing analysis, great care was needed in the development of a reliable standard technique that could be employed by separate laboratories to give comparable results. This was achieved in the United Kingdom by close liaison between the laboratories of the Department of Agriculture and Fisheries for Scotland; the Ministry of Agriculture, Fisheries and Food; the Government Chemist; and the Nature Conservancy (Natural Environment Research Council). This close liaison between the analytical chemists engaged in the investigatory work and the early establishment by them of agreed methods to be followed, was a major factor in the rapid confirmation and subsequent surveillance of the distribution and levels of PCBs in the British Isles (it is emphasized however that the results obtained are only indicative of the order of the amounts present rather than being quantitatively accurate).

Distribution

As they are persistent and fat soluble the PCBs, like the organochlorine insecticides, are retained in the tissues of animals. It was decided therefore that a good indication of the extent to which they had become dispersed in the British Isles could be obtained from an examination of fish, marine invertebrates and predatory birds (predators, because of their position in the food chains and because their diets include a wide range of different organisms, can be used to indicate whether or not organochlorine compounds are present in a very wide range of organisms).

Another factor which influenced the type of surveys undertaken was that work was already in progress in several of the government laboratories to investigate the levels of organochlorine insecticides present in fish and predatory birds. It was, therefore, a relatively straightforward matter to extend the analytical procedure to include the PCBs. During the late 1960s over 500 predatory birds and their eggs, together with large numbers of fish and invertebrates from many parts of the British Isles were examined for PCB residues. PCBs were found to be present in most

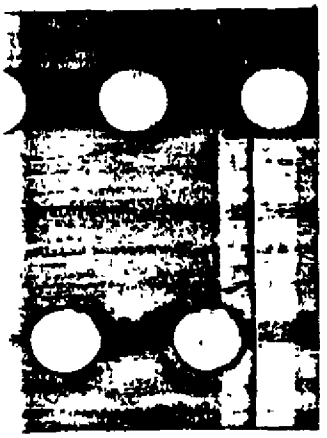


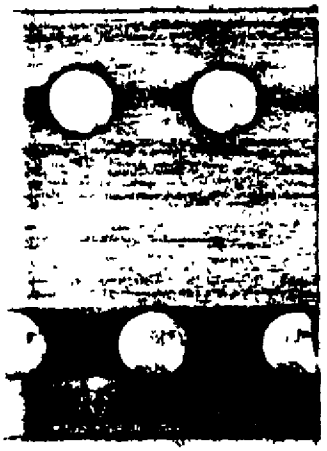


of the specimens examined from a wide variety of localities, including remote mountain regions of Wales and Scotland as well as industrial areas. The amounts present were not found to be correlated with any particular geographical locality but with habitat, the larger residues being present in aquatic species - both freshwater and marine. Thus the amounts present in the tissues of the essentially freshwater fish-feeding heron (Ardea cinerin) included one specimen with 0.900 mg/kg of PCBs in the liver, the arithmetic mean of PCBs in the livers of 16 adults examined being 98 mg/kg. The levels present in 101 eggs of this species ranged from those in which no PCBs were detected, to a maximum level of 80 mg/kg - the arithmetic mean being 5 mg/kg. Similarly, the fish-eating Great Crested Grebe (Podiceps cristatus) and Kingfisher (Alcedo atthis) contained up to 40 mg/kg. In contrast the level in tissues of omnivorous and herbivorous terrestrial species rarely exceeded 5mg/kg, with the bird-feeding terrestrial predators coming between the two(3).

Further confirmation of the presence of PCB compounds in the sea was obtained in the autumn of 1969 during an investigation into the mass mortality of over 12,000 sea birds in the Irish Sea. While no single cause for these deaths was established, the report of the incident concluded that "one of the most striking finds of the analytical programme was the presence in the livers of most of the dead guillemots (Uria aalg of unusually high levels of PCBs". During this investigation the level found in seawater (53 samples) was <0.01 µg/l; in zooplankton (7 samples) < 0.01 - 0.03 mg/kg; in mussels (whole, less shell, c 100 specimens) 0.01 - 1.8 mg/kg; and in 11 specimens of Norway lobster (Nephrops) <0.01 - 0.1 mg/kg. The levels in the livers of fish and seabirds went up to 2.6 mg/kg in herring (Clupea harengus) : 27,000 in whiting (Merlangius merlangus); 50 mg/kg in cod (Cadus morhua) and up to 800 mg/kg in guillemot(6). During the same period an investigation was carried out off the Cornish coast in the south-west of England into the deaths of about 40 grey seal (Halichoerus grypus) pups. The PCB levels in 11 specimens examined were found to be relatively high (17-90 mg/kg in the liver and 110-187 mg/kg in the blubber). It was concluded however that PCBs were not a contributory cause of death, which was attributed to normal juvenile mortality(7). A later more extensive study(8), which included both the common seal (Phoca vitulina) and the grey seal, has demonstrated that considerably higher residues of PCBs (mostly exceeding 100 mg/kg), are found in the blubber of adult seals from the coast of southern Britain (southwest and east England and Wales) than are found in seals from the coasts of northern England

and Scotland. In the extreme north of Scotland the PCB residues did not exceed 30 ug/kg. Also in the seals from southern Britain, the PCB levels greatly exceeded the total DDT concentrations. The opposite was found to be the case in seals from the Gulf of St. Lawrence in North America where industrialization is not so intensive.



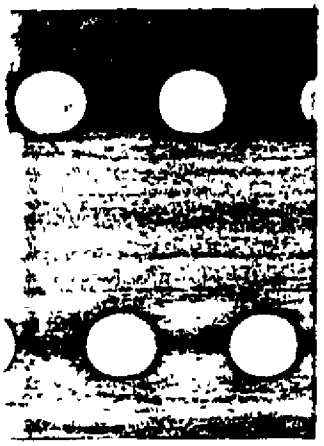


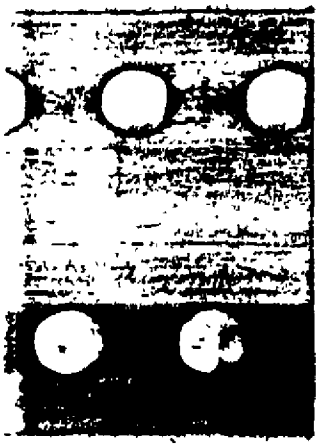
Pollution and Manufacturing

These discoveries led to consideration as to how the residues of PCB were getting into the environment. The high levels being found in freshwater and marine species suggested that contamination of inland waterways and direct contamination of the sea must be major factors. The most obvious ways in which this could come about are through pipelines from factories, as a result of atmospheric pollution following inefficient incineration (the PCB residues eventually being washed out with rain and again ending up in waterways and the sea), and in sewage sludge dumped into the sea[9]. The results of the surveys of the distribution of PCB residues however gave no indication as to which, if any, of these particular sources may have been primarily responsible for the existing pollution of the British Isles, and while higher levels have been found in the estuary of the river Clyde and off the south west coast of Scotland generally, there is no outstanding use of PCB products in this area to explain this.

The residues most commonly found in animal tissues have been of the highly chlorinated type. It should not be concluded from this however that there has been a greater use of this form of PCB and thus by using less chlorinated types pollution by PCBs could be avoided. These results are more probably a reflection of the pattern of decomposition of PCBs once they enter the natural environment and probably all the PCBs contribute to environmental pollution.

The manufacturing process of PCBs is "dry", so that aqueous effluent is not a by-product. Contamination of waterways from industry must therefore have come about as a result of carelessness or accident, or possibly because until recently those concerned were unaware that these compounds could result in environment contamination and so made no special provision for dealing with wastes containing PCBs. Provided that sufficient care is taken to contain spillages and leakages during manufacture, and after manufacture during handling e.g. when the PCBs are being loaded into drums or tankers, losses into drains and waterways can be avoided. The installation of sumps and interceptor pits in the factory drainage system, coupled with a regular monitoring of all effluent, should enable any loss from factories to be kept at an absolute minimum. Complete destruction by incineration can be achieved if a temperature of 600°C is maintained for at least 10 seconds.



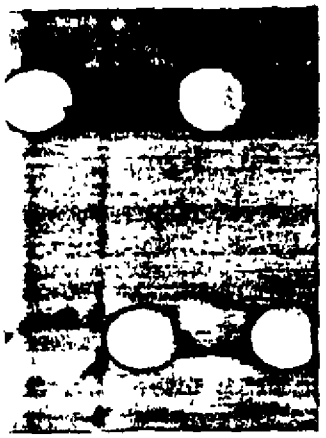


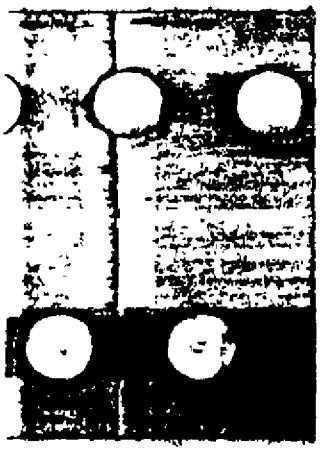
The Control Measures

Following the discovery of PCBs in the environment, the Monsanto Company itself is believed to have spent well over half a million pounds on its own programme of research into methods of analysis, identification and measurement of PCBs. From the beginning the company maintained close liaison with the Central Unit on Environmental Pollution of the Department of the Environment, the Natural Environment Research Council of the Department of Education and Science, the Laboratory of the Government Chemist of the Department of Trade and Industry, the Ministry of Agriculture, Fisheries and Food and the Department of Agriculture and Fisheries in Scotland - the Government Departments most directly concerned with the control of environmental pollution and for conducting research into environmental problems. In addition Monsanto staff visited the laboratories of these Government Departments and other industries where the actual analytical work was being carried out. They also maintained contact with voluntary bodies, such as the British Trust for Ornithology and the Royal Society for the Protection of Birds, who helped with the field studies and with the collection of many of the specimens. In this way they were able to discuss progress and methods with the scientists engaged in the work and keep themselves informed of the development and progress of the investigations. An important result of all this liaison was that they were able to draw conclusions from the results at an early stage.

The need for some form of control became apparent once it had been demonstrated that the PCBs were widespread in the natural environment and that the concentrations present, particularly in certain aquatic species, had reached the point where undesirable effects may be expected. Because of their stability and their miscibility with natural oils and fats, it could reasonably be concluded that continuation of their use, even on the present scale, would result in further increases in the levels present in a wide range of animals, including some used as food by man.

The fact remained however that because of their industrial properties, particularly their low inflammability, they stil had some important (possibly vital) uses in industry, for example in certain electrical equipment covered by safety regulations which require the use of non-flammable fluids. A sudden complete withdrawal for all uses, in the absence of suitable replacement products, could therefore have serious consequences to industry and to human safety.



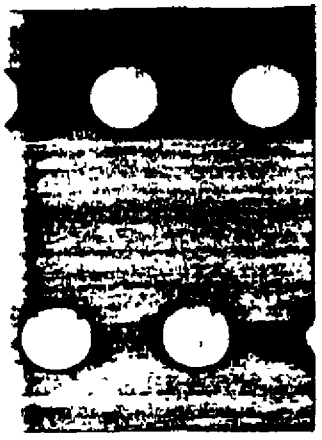


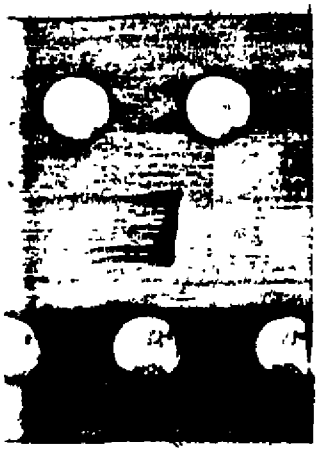
Fortunately, for most uses of this type, the PCBs can be enclosed in sealed systems. This, coupled with the fact that by exercising care during manufacture and transport, losses could largely be avoided and also that satisfactory methods of disposal have been developed, led to the conclusion that a partial ban affecting only non-controllabl uses would be sufficient to safeguard the environment. Accordingly from 1st March 1971 Monsanto, without any directive from the UK Government, introduced a voluntary ban on all uses where PCBs were not confined to a closed system. Recognising the problems of disposal of PCBs, Monsanto have undertaken to make arrangements whereby collection and disposal facilities are available in the UK.

Discussion

The initial discovery that the environment was becoming polluted with PCB residues came about largely as a result of chance. Until Jensen's discovery, nobody had suggested or even suspected that these compounds may be a possible source of environmental pollution, and had the research on the organochlorine insecticides - during the course of which the discovery of the PCBs was made - not been in progress, it is most probable we would still not yet be aware that a PCB problem exists. As the manufacture of PCBs is now undertaken in a number of countries, this leads to the questions: What other countries have a PCB problem ? This question can only be answered by an appropriate scientific investigation. To carry out an investigation of this type is an elaborate procedure, involving the employment of highly trained scientists and expensive, complex apparatus. Even when and where these are already available there is the need to develop a new analytical and evaluation procedure, which must then be agreed and adopted by different laboratories so that their results can be compared.

In the UK the relatively rapid manner in which the investigation of this problem was accomplished was very largely due to certain existing circumstances. These included the fact that (a) investigations into similar problems involving the organochlorine insecticides were already in progress in several Government laboratories, with the important result that chemists and appropriate apparatus were already available; (b) a liaison committee representing analytical chemists in the UK was already in existence, so that suitable methods for analysing the PCBs were agreed at an early stage; and (c) there were existing arrangements for the collection of suitable biological material for analysis from a large number of different geographical localities. Without these circumstances, even an industrialised country like the UK would have had to undertake extensive time-consuming and expensive procedures before investigations could be started. In the case of a developing country the task would be formidable.





Other important factors in the UK approach to the problem included the close cooperation that exists between Industry and Government (reflecting the responsible attitude of industry in Britain to pollution problems), and the well informed public attitude that exists which provides support and understanding for measures introduced to help combat pollution. In this particular case Monsanto were able to take independent and effective action at a much earlier stage than would have been possible had the necessarily protracted negotiations had to be undertaken with Government Departments, if it had been decided that legislation was necessary. A complicating aspect is that as long as PCBs are manufactured in other states, including both Western and Communist countries, the possibility exists of Monsanto's voluntary restrictions on sales of PCBs being undermined by imports. Their action in the UK was only practicable because they were a monopoly manufacturer. A further complicating factor in this question of imports an exports could arise because PCBs are often incorporated in electrical and other goods. If a country banned the use of PCBs, including their importation, this could have the result of disqualifying a whole range of products from being imported into that country. Discussions have already been held between some of the international manufacturing companies and in Britain the Government is watching the situation. But the trade implications of this specific problem, and the possible creation of non-tariff barriers if Governments find it necessary to impose statutory controls, merit discussion at intergovernmental level. OECD has already instituted, for a trial period, an "Early Warning System" for control or restrictions instituted by Governments on the sale or use of certain chemicals, although this does not cover unilateral action by industry unsupported by statute. The UK would welcome a discussion with other member Governments of the PCB problem, and a consideration of whether the "Early Warning" scheme could usefully be extended to this type of industrial policy. The UK would also welcome discussions about the economic aspects of this limitation of sales of PCBs by Monsanto. A similar restriction has also been imposed by Monsanto in the USA and it seems likely that other manufacturers may follow Monsanto's example or some Governments may contemplate the introduction of legislation.

(1) Jensen, S. (1966). "Report of a new chemical hazard". New Scientist, (32) 612.

(2) Lidgett, R.A. & Vodden, H.A. (1970). "PCB - The Environmental Problem". Report of the National Environment Protection Board, Sweden.

(3) Prestt, I; Jefferies, D.J. & Moore, N.W. (1970). "Polychlorinated Biphenyls in Wild Birds in Britain and their Avian Toxicity". Environmental Pollution, (1) 3-26.

(4) Portmann, J.E. (1971). "The Toxicity of 120 substances to Marine Organisms". MAFF Shellfish Information - Leaflet No.19.

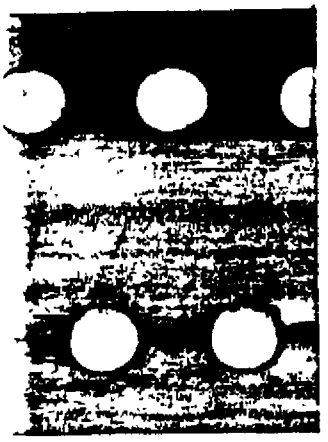
(5) Risebrough, R.W.; Rieche, P. ; Peakall, D.B.; Hermann, S.G. & Kirven, M.N. (1968). "Polychlorinated biphenyls in the Global Ecosystem". Nature, London, (220) 1098-102.

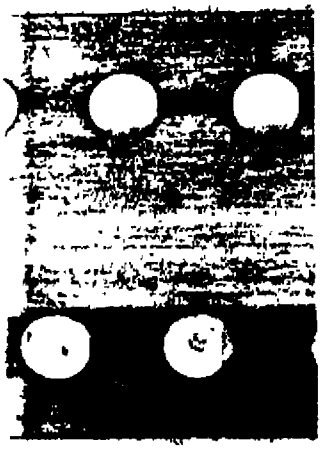
(6) Holdgate, M.W. (1971). "The Seabird Wreck in the Irish Sea Autumn 1969". The Natural Environment Research Council Publications (London) Series C, No.4.

(7) Bonner, W.N. (1970). "Seal deaths in Cornwall Autumn 1969". The Natural Environment Research Council Publications (London) Series C, no. 1.

(8) Holden, A.V. (in press) "Monitoring Organochlorine Contamination of the Marine Environment by Analysis of Residues in Seals". Proceedings of FAO Technical Conference on Marine Pollution and its Effects on Living Resources and Fishing, 9-18 December 1970, to be published by Fishing News International.

(9) Holden, A.V. (1970) "Source of Polychlorinated Biphenyl Contamination in the Marine Environment". Nature, London, (228) 1220-1221.





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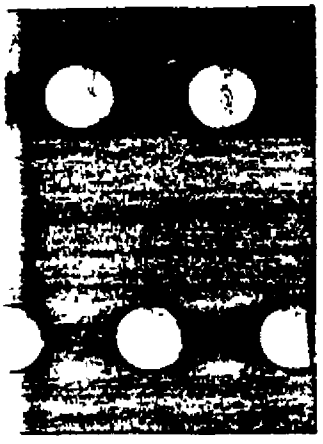
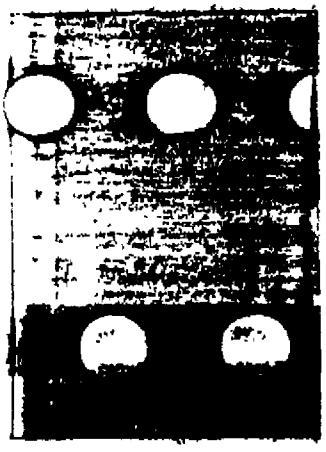
ANNEX II

PCBs (POLYCHLORINATED BIPHENYLS) IN SWEDEN





In 1966 some unknown substances were discovered in Sweden which interfered with the analysis of chlorinated pesticides. They were identified by Dr. S. Jensen to be polychlorinated biphenyls.

The history of the PCBs started in 1929, more than fifteen years before the introduction of modern chlorinated pesticides. Polychlorinated biphenyls were introduced by industry for use as highly inflammable oils in electric transformers, capacitors and in paints.

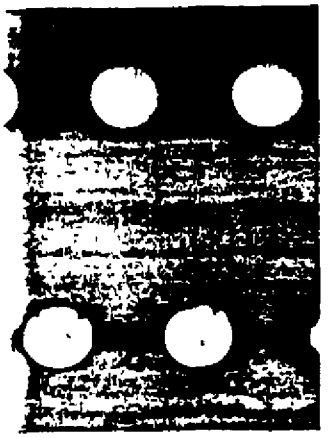
PCBs are not manufactured in Sweden. They are imported for use in Swedish industry mainly from USA and Great Britain (Monsanto), Germany (Bayer) and France (Prodélec). Furthermore there is an import into Sweden of PCBs as constituents in various industrial products manufactured abroad.

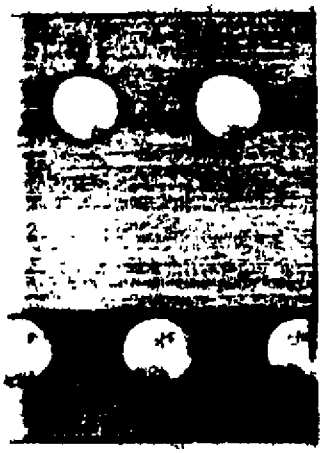
A new Swedish law was adopted on June 18, 1971, which will give the authorities in Sweden the power to forbid the use of PCBs or state conditions for their use, if a specific field of application constitutes a danger to the environment.

Sources

The annual consumption in metric tons of PCBs in Sweden is divided between the following industrial usages (approximate figures relating to 1970) :

1.	capacitors	375	(about 250 tons are reexported in industrial products)
2.	transformers	25	(about 150 tons have altogether been distributed in about 175 transformers in Sweden)
3.	paints	35	
4.	joint pastes	40-45	
5.	hydraulic oils	8-10	
6.	heat transfer media	<1	
7.	other (plasticizers, insulating material in electrical equipment, etc.)	?	





The total consumption in Sweden of PCBs in 1970 thus exceeded 485 metric tons. This does not mean that the total amount has been available as a source of environmental pollution. In fact, no Swedish data are as yet available which can indicate how much is released into the environment from each individual field of application.

It seems to be clear, however, that PCBs used in the capacitor industry mainly contains three chlorines per PCB-molecule, while PCBs with five chlorines are generally found in the environment e.g. in the Baltic. This fact seems to rule out the possibility that the 125 metric tons of PCBs annually used in capacitors operating inside Sweden constitute a major source of environmental pollution.

Furthermore, data from transformer refilling operations in Sweden indicate that at most a few kilograms of PCB are lost annually from this source to the environment.

In conclusion, usages other than that in the electrical industry seems to be the main source of environmental pollution with PCBs.

Distribution

PCBs are almost insoluble in water (ca 1mg/ton). On the other hand it is highly lipophilic. The transport of PCBs in the aquatic environment and the distribution in organisms is, therefore, thought to be intimately interrelated with lipids.

No actual data, however, are presently at hand in Sweden to elucidate the overall distribution (routes from the sources via food chains into the higher trophic levels) of PCBs in the environment.

Occurrence

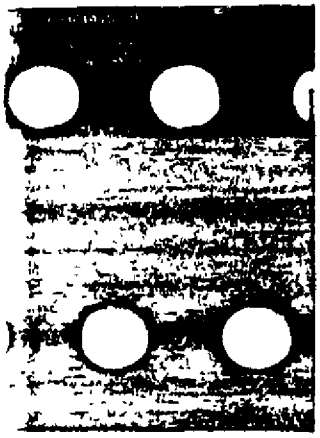
PCBs have been analysed in certain Swedish food products. In butter, margarine and a number of vegetable oils the PCB concentration in no instance exceeded 0.1 p.p.m.

In cow's milk the PCB concentration in fat never exceeded 0.5 p.p.m., while in mothers'milk 50 percent of the samples showed levels between 0.6 and 1.0 p.p.m.

In a number of food products of animal origin - meat from chickens, pigs, lambs, cows, etc. - the PCB content on a wet weight basis very rarely exceeded 0.1 p.p.m.

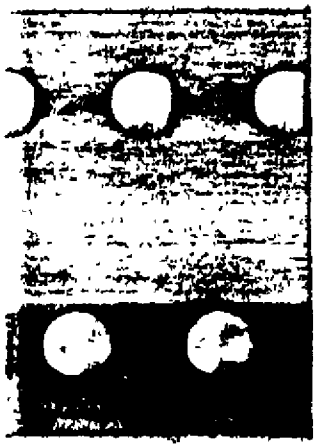
In herrings from the sea outside the Swedish west coast the PCB concentration on a fat weight basis ranged from 0.24 to 1.50 p.p.m., with an average of 0.75. In the Baltic, on the other hand, approximately ten times more of PCBs is found in the herrings (range, 0.5-23 and average, 6.8 p.p.m.).

PCB content in fresh water fish has also been studied in a Swedish lake. In 49 pike from Lake Bolmen the PCB concentration varied between 3.5 and 48 p.p.m. on a fat weight basis.



Among Swedish birds it seems as if predatory birds have the highest concentrations of PCBs. The average concentration in ten ospreys was found to be 138 p.p.m. (extractable fat basis). On the other hand, in analyses from fieldfares and yellow wagtails the concentrations of PCBs ranged between 2.1-12 and 0.64-0.92 respectively.

The highest concentrations have been found in white tailed eagles. The average PCB level in four eagles amounted to 14,000 p.p.m. on a fat weight basis (180 p.p.m. on a fresh weight basis).



Significance

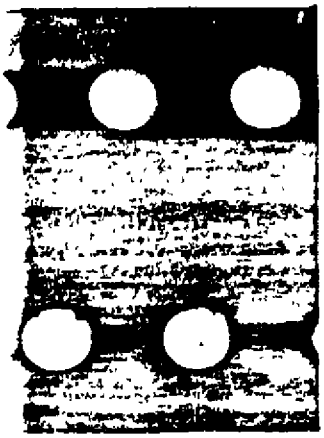
The survival of roe from Swedish salmon kept for breeding has been drastically impaired during the last decade. The PCB content varied between 16 and 34 p.p.m. on a fat basis in roe which exhibited a mortality between 50 and 100 percent. In roe from wild salmon the PCB concentration was appreciably less, 7-9 p.p.m., and the corresponding mortality was conspicously lower, 16-34 percent.

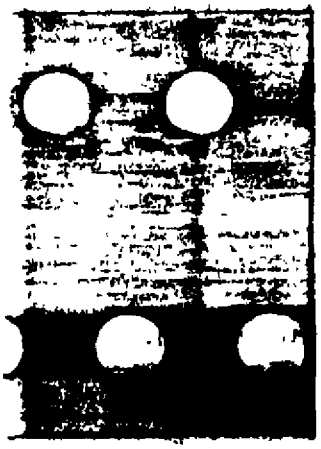
Robins in southern Sweden have been experimentally fed with PCB (55-65 μg per bird) over a period of two to three weeks, and their nocturnal migratory activity has been studied. PCB-looded birds were significantly more active than control birds. The PCB content in breast muscle of the treated robins was 164-467 p.p.b. (wet weight), that of control robins 51-120 p.p.b.

Since it has been shown elsewhere that the migratory activity of certain birds is correlated with the distance between the breeding and winter quarters, the above mentioned PCB effect on robins may have great ecological significance.

A reduction of eggshell thickness in Swedish and Finnish ospreys (Pandion haliaëtus) has been observed during the last two decades. This phenomenon has been tentatively correlated with increased output of certain chlorinated hydrocarbons in the environment (e.g. PCB and DDT). Similar observations have been made in other countries.

No studies concerning the effects of PCB on humans have been made in Sweden. However, cases of severe poisoning of humans by PCB have been reported from abroad.

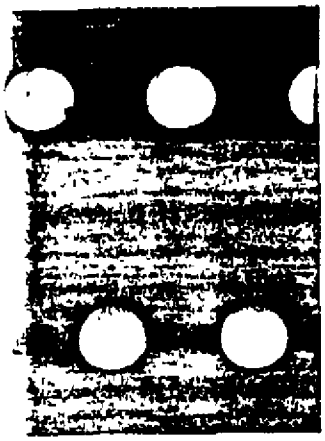


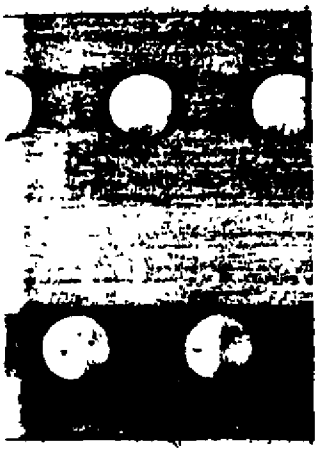


<u>Alternative substances, methods or other ways of preventing PCB pollution of the environment</u>

As a consequence of the new Swedish PCB law, the use of PCBs will be regulated in various ways in order to curtail pollution. The exact administrative procedure under the new law has not yet been determined in Sweden, but some tentative measures are listed below :

Capacitors	- the main use of PCBs is concentrated to fairly big units delivered to a few consumers. Destruction of used-up material will be left to certain authorized destruction plants.
Transformers	- filling, draining and other handling will be subjected to special regulations.
Paints	- in those cases where PCB has a pesticidal function it will be replaced by other agents.
Plasticizers	- new plasticizers under development will substitute for PCBs in paints and joint pastes.
Hydraulic oils	- PCB oil will be replaced by other fire-proof oils





ANNEX III

THE CHLORINATED BIPHENYLS

1. The PCBs appeared on the world market in 1945 and have been found in the environment since 1966.

2. They have three major uses :

   - they serve as additives in hydraulic circuits, and are used in certain transformers. This is their main use in France;

   - they are also used as plasticisers in polyvinyl chlorides and acetates, nitrocelluloss laquers, polyester resins, paints, varnish, packaging materials etc.;

   - they are further used as additives in organochlorine pesticides in order to prolong their time of action by impeding their degradation. An increase in toxicity of certain pesticides (lindane, DDT) has been noticed in the presence of these products.

3. In France two companies at present manufacture PCBs under the names :

   - Phénocolor by PROGIL
   - Pyralène by UGINE-KULHMANN

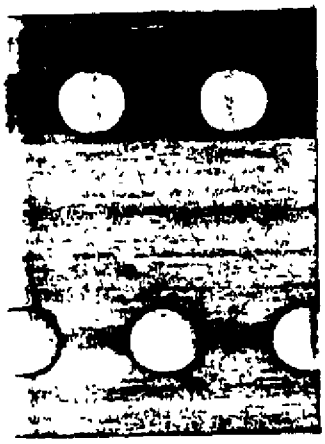
   both are marketed by the firm PRODELEC.

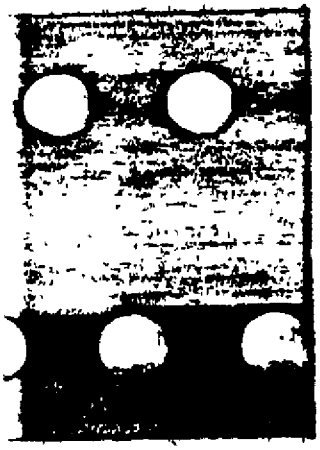
4. In 1970 these two companies provided PRODELEC with about 8,000 tons. Export accounted for about 3,200 tons with the remainder (about 5,000 tons) for use in France, 80 to 90% of which was sold to the Electricité de France.

5. PCBs are insoluble in water and are resistant to acids and alkalis; they are, however, soluble in fats. There is little or no knowledge of their biodegradation.

6. Environmental contamination is believed to be due essentially to the highly chlorinated compounds generally resulting from :

- leaching from soils treated with organochlorine pesticides containing PCBs, and subsequent contamination of aquatic organisms, with accumulation in the food chains;
- waste from industries using PCBs. In France further enquiry is needed on this point, but it seems that the manufacturers incinerate their residues;
- waste from hydraulic fluids and draining of transformers. An investigation of the fate of drainage products and leakages from installations is one of the first steps to be taken;
- residues that reach waste deposits and emit toxic vapours during incineration.





7. Toxicity studies have shown that these products are toxic to birds by induction of liver enzymes, to shrimps, etc.. In man it is primarily the liver and the skin that are affected.

8. Toxicological research is therefore essential to establish acceptable levels in foods, particularly those sold under plastic wrapping.

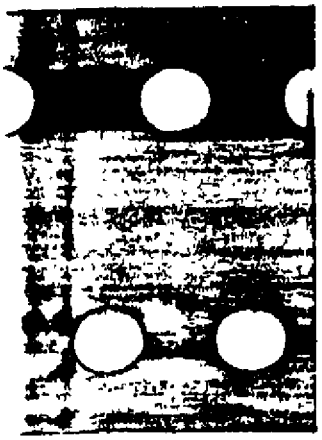
9. This question may be referred to the Ministry of Public Health. The food section of the Conseil National Supérieur d'Hygiène, which is charged with the study of the problem of plasticisers that may come in contact with foodstuffs, could study their effects on the human organism.

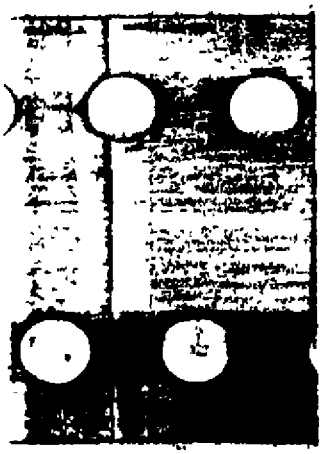
10. It is pertinent here to call attention to the research agreement that has been made with the Institute of Applied Chemical Research within the joint programme for water under the 5th Plan, to identify and measure the concentration of micro-pollutants by liquid - liquid extraction with chloroform. These studies are directed towards water delivered for consumption. For the samples supplied by IRCHA, the Centre d'Etude et de Recherches des Charbonnages de France has used a method of combined gas chromatography-mass spectrometry for the qualitative analysis. Although the final report is not yet available, it appears that PCBs have not been detected in drinking water.

11. Gas chromatography is not sufficient in itself to provide indisputable results. Combined experiments have shown that the peaks obtained for certain PCIs mask those obtained for organochlorine insecticides.

12. In 1971 the CERCHAR will be given the task of making an investigation of PCBs, their use and disposal; this study will include analytical techniques presently used, and the development of a specific method of combined gas chromatography and mass spectrometry.

13. In the framework of the European Scientific and Technical Co-operation (the group COST-Nuisances), France intends to collaborate in a study on advanced techniques for detecting this type of product.





ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Environment Directorate

ADDENDUM III

in relation to Item 6 of Agenda (NR/ENV/72.8) for 3rd Meeting of the Group

RESTRICTED

Paris, 1st March 1972

To: Members of the Sector Group on Unintended Occurrence of Chemicals in the Environment

[Copy to: National Delegations]

Or. Engl.

SECTOR GROUP ON UNINTENDED OCCURRENCE OF CHEMICALS IN THE ENVIRONMENT

Ad Hoc Meeting on Biological Effects of PCBs and Mercury

- Note by the Secretariat -

The 3rd Technical Meeting on Occurrence and Significance of Chemicals in the Environment proposed that the OECD organise ad hoc scientific meetings on biological effects of PCBs and mercury (see NR/ENV/72.9).

The purpose of the present note is to outline for examination the action that might be taken by the Group in respect of PCBs in the context of its programme of work.

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MONS 207638

Ad Hoc Meetings on Biological Effects of Polychlorinated Diphenyls and Mercury

1. The Third Technical Meeting on Occurrence and Significance of Chemicals in the Environment made clear once again the sporadic nature of the research directed towards biological effects of exposure to persistent chemicals. Even where such research is being undertaken, there is as yet little or no systematic attempt to relate the observed effects to the occurrence of residues in the environment. It was also clear, however, that intensive study is now being undertaken in many Member countries on biological effects, particularly of PCBs and mercury. A better appreciation of environmental damage caused by these substances can, therefore, be expected to develop fairly rapidly.

2. It was also recognised that the Sector Group on Unintended Occurrence of Chemicals in the Environment had urgent need to assemble and interpret the information available from on-going research related to those chemicals that have been designated for immediate investigation. It was, therefore, proposed that ad hoc meetings of scientists be convened to review the situation with regard to biological effects of low-level exposure to these chemicals.

3. Considering the programme of the Sector Group, it would appear that slightly different action could be taken in respect of the effects of PCBs and those of mercury. In relation to mercury the Group has already decided to investigate sources, ways and means of reducing emissions to the environment, and the economic implications of governmental action. This investigation will now require the establishment of a larger Working Party which might, as has been done in comparable investigations recently, convene a small specialised group of scientists to review the biological effects of mercury and research in progress, and contribute a section to the total report.

4. With regard to PCBs, the Sector Group may wish to discuss whether it is appropriate at this time to convene an ad hoc meeting of scientists as proposed by the 3rd Technical Meeting. In the light of the several meetings on PCBs that have been held recently, the Sector Group may prefer to convene a small group of experts to summarise, before its 4th meeting, the information available on the effects of PCBs. This might permit the Sector Group to move more rapidly and precisely into the area of recommendations to Member governments of control actions to minimise emissions.

5. Should the Sector Group choose this alternative, it may still wish to consider convening, at a later date, an ad hoc meeting of scientists from all countries engaged in research to determine long-term effects as a result of sublethal exposure to different PCBs or the impurities carried with them. A proposed mandate for such an ad hoc meeting is attached as Annex I.

6. A review of research into biological effects of PCBs as proposed by the 3rd Technical Meeting would, of course, serve two additional functions. This still being an early stage in a developing field of research, such a review might ensure that further study is directed to the most urgent aspects of the problems. It might also provide the possibility of encouraging continuing exchange between countries. If national information services can develop an appropriate classification for information of this type, future review and up-dating will become much easier. In this respect the Information Policy Group of the Committee for Scientific and Technical Policy is directly interested, and proposals for action could be developed in co-operation with its Environmental Quality Information Panel. A note as to the activities of the Panel is given in Annex II.

ANNEX I

Ad Hoc Scientific Meeting on Biological Effects of PCBs

In order to assist the Sector Group on Unintended Occurrence of Chemicals in the Environment in developing recommendations for action by Member governments, a review of available information on biological effects of the polychlorinated biphenyls is required.

The Group is agreed that there should be convened an ad hoc scientific meeting on the effects of PCBs in the environment, with the following mandate:

1. The meeting will be in the nature of a Working Party, which will

   - review all information available on biological effects of PCBs, such as effects on reproduction in animal species, enzyme induction, genetic changes, etc.

   - provide an assessment of the degree to which damage to the environment has been caused by these substances,

   - call attention to important gaps in research and make recommendations as to work most urgently required.

2. In order to fulfil this mandate, the meeting will consist of scientists directly involved in relevant investigations and representative of their various fields of research.

3. The meeting will be provided with material:

   a) for the evaluation of long-term effects of sublethal doses:

      in the form of one page abstracts of results obtained from past on on-going research projects;

   b) for the definition of research gaps:

      in the form of short descriptions of current projects and their intended contribution to the understanding of effects caused by PCBs.

4. Member countries will be invited to make this information available by advance designation of the laboratories and scientists involved and by requesting these same scientists to prepare the abstracts required according to a given format.

ANNEX II

Activities of the IPG Panel on the Management of EQ Information and Data

- Note Prepared by the Section for Scientific and Technical Information -

Background

1. The interest of the Information Policy Group (IPG) in the field of the management of information and data relating to the quality of the environment (EQ information) has been presented to the Environment Committee. At its meeting on 1st October 1971, this Committee recorded its interest in studies directed towards the definition of EQ information needs and harmonisation of the processing of the required data.

2. The Secretariat notes a convergence of interest between the Sector Group on Unintended Occurrence of Chemicals in the Environment, and on-going activities in the IPG Panel on the Management of EQ Information and Data (IPG Panel).

IPG Panel Activities

3. The IPG Panel has identified the need to further characterise and standardise definition of the main modes and kinds of EQ information, and to select one or two specific fields in which to encourage co-operation between interested Member governments in their national efforts.

4. In endorsing this programme item the IPG expressed concern that topics chosen should be practical, of immediate value to environmental management, and if possible of convergent interests to the information needs of the Environment Sector Groups.

5. Preliminary fact-finding studies by the Panel in 1971 focussed attention on the general information requirements of national bodies concerned with the assessment and regulation of the use of chemicals judged to present environmental hazards. Although in total a considerable amount of information is available, the needs of individual Member countries are not well met. Harmonisation of data collection and handling in this field could not only assist the work of the environmentalists concerned, but could also make a valuable contribution to understanding of the management problems associated with promoting a better flow of relevant, exchangeable information across a much wider environmental spectrum.

6. The current Panel programme is:

(i) Completion of negotiations with interested Member countries for extention of the fact-finding exercises started in 1971;

(ii) A series of Secretariat and consultancy visits to institutions in the agreed countries to collect comparative information about present data collection and storage practices, with particular reference to gaps and difficulties;

(iii) Production of a report analysing the material collected and identifying needs and opportunities for further OECD activity;

(iv) Discussion of the report by the IPC with a view to setting out guidelines for the Panel's future work. (This will take place on 25th-26th April 1972. Among the possibilities is that of setting up a workshop to develop and refine the areas where harmonisation is important and multinational support for suitable solutions would be assured).

Specific Information Problems

7. The 3rd Technical Meeting has outlined an urgent information management need in the field of data on sublethal biological effects. The value of the results of research in this field will be diminished unless the digested data can be aggregated for the benefit of those responsible for assessing the environmental damage due to these substances. This involves the harmonisation of data collection and storage at national level to support the maintenance of an up-to-date information base at international level.

8. Preliminary assessment of the proposals made by the 3rd Technical Meeting shows the information management problems not only to be of the same genre as those under investigation by the IPC Panel but also to be a subset of the same EQ information field. This appears to be confirmed by the national responsibilities of many of the delegates to the Sector Group.

Proposals to ensure Effective Intervention

9. It is proposed that the on-going IPC Panel fact-finding should be developed to encompass the specific topic of information relating to sublethal biological effects, which might otherwise not receive emphasis.

10. The effect of this would be:

(i) to provide a more comprehensive picture of the status quo, the current problems and aims of national bodies, and

(ii) to advance some constructive proposals involving choice from alternatives, as to how requirements might be met within the time scales and resources likely to be available, and within the context of wider on-going or projected national information programmes.

11. The time scale for the IPC and Sector Group activities fits well. It is therefore proposed that:

(i) an oral appreciation of the information management problems as seen during the IPC Panel Investigations be submitted at the Sector Group meeting for the purpose of discussion of the data needs on sublethal biological effects;

(ii) the conclusions and recommendations of the Sector Group be taken into account in the report to be submitted to the IPC in April, when the wider EQ information management problems are discussed; and

(iii) both groups, according to their needs and orientation, consider how effective interaction on this topic be maintained, if found to be appropriate.

SDA PRESS CLIPPINGS REPORT

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'Trying to Comply'

Soap Companies Not Supplying Ingredient List

By ROB ELDER
Herald Staff Writer

If you want to know every ingredient in your laundry detergent, you're supposed to be able to find out from the store where you buy it, according to a Dade County ordinance which took effect Sunday.

But a spot check Monday revealed that store clerks and managers of five major Miami food chains had no lists of ingredients to show customers.

An executive of one chain explained that only two of the smaller soap manufacturers have supplied such lists to his firm.

"We haven't received lists from any of the major manufacturers," he said. "When we do, we'll pass them on to the store managers."

THE LAW was passed July 13, requiring detergent makers to supply their distributors with lists of all the ingredients in cleaning products. The distributors in turn are required to make the information available to the stores, and the stores to the public.

Peter Baljet, county pollution control director who is responsible for enforcing the law, said Monday he would put the burden of compliance on the manufacturers.

ALL THE major manufacturers already have listed their ingredients with his office, Baljet said.

"They should also supply them to the stores and we will see that this is done," he said.

"The stores are directly dependent on receipt of the lists from the soap companies," he said, adding that he plans no action against the retail outlets unless they refuse to reveal ingredients to customers once they have the lists of detergent contents.

The law that took effect Sunday was a compromise requested by the Soap and Detergent Association, a trade group representing the major manufacturers.

It replaced an earlier requirement that would have forced the soap makers to list their ingredients on the packages which contain their products. That law was passed March 30 but was blocked by a court order obtained by the SDA. The court order expired Saturday.

In New York, a spokesman for the SDA said that the major manufacturers are making an effort to supply the lists.

"THE information is in the system and it'll be there shortly," he said.

The SDA official, Robert Singer, maintained that there may be some question as to when the lists are legally required, since the law says they are to be supplied quarterly.

"But in the spirit of the law, the manufacturers are trying to supply them as soon as possible," he said.

MONS 207645

Davies 3/2 OECD/PCB - reaction to proposal & actions ltg. in Eur.- mtg → agrt → / I said sure we'd favor int'l gov't-indy mtg to work out agrts. -- Bill send me doc't

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