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BACKGROUND to the REGULATION
of
POLYCHLORINATED BIPHENYLS (PCB)
in Canada

PCB FILE

A report of the
TASK FORCE on PCB, April 1 1976
to the
ENVIRONMENTAL CONTAMINANTS COMMITTEE
of
ENVIRONMENT CANADA and
HEALTH & WELFARE CANADA

... are the major components of all the products in Table 29 except Aroclor 1254, which is mostly HCBP. The discontinued products Aroclor 1248 and 1260 are no doubt in use in equipment still in service. Aroclor 1260 is almost entirely HCBP; Aroclor 1248 contained major amounts of HCBP.

Such reports as are available suggest that PCR in waxes/resins for use in the investment casting process is mostly HCBP, and may contain a high proportion of decachlorobiphenyl.

7.3.6. Chemical species of particular toxicological importance
in
contained/or derived from commercial PCR

7.3.6.1. Chlorodibenzofuran (CDBF)

Certain CDBFs are known to be highly toxic to animals. CDBFs are known to be present in many commercial PCB samples. There is no reason to believe that the particular CDBFs in commercial PCBs are other than highly toxic.

There are no authenticated reports of CDBF in environmental samples. However, it is reported (Kuratsune 1975) that the PCB-based heat transfer fluid that was the cause of the Yusho incident contained exceptionally high levels of CDBF. It appears that much of the CDBF had been generated during use of the fluid in this high-temperature application. Three patients with Yusho who died between 1969 and 1972 were all shown to contain chlorinated dibenzofurans.

The occurrence of CDBF in commercial PCR has been investigated (Bowes et al. 1975); Table 30 reproduces the data.

TABLE 30
Chlorodibenzofuran Concentrations* in Commercial PCB Samples.

<u>PCB</u>	<u>CDBF Concentration</u>			<u>Total</u>
	<u>4Cl</u>	<u>5Cl</u>	<u>6Cl</u>	
Aroclor 1248	0.5	1.2	0.3	2.0
Aroclor 1254	0.1	0.2	1.4	1.7
Aroclor 1254	0.2	0.4	0.9	1.5

dehydrochlorination mechanism would yield dichloro- and trichlorodibenzofurans.

Transformers and capacitors that require PCB fluids normally operate at elevated temperatures up to 150°C. Power surges in these units are not uncommon and result in temperature excursions, internal arcing, electrical failure or mechanical rupture according to severity. The Task Force is not aware of any studies of the effects of service on the composition of askarels with particular reference to CNBF content.

7.3.6.2. Single isomers of particular homologs

Each of the toxicological effects attributed to PCB is probably comprised of contributions from a number of single isomers of the various chloro-homologs present. If, relative to the properties of other PCB isomers, some particular isomer manifests both the ability to cause exceptionally severe biological effects and an exceptional degree of environmental persistence, then it is likely that the presence of that isomer in environmental samples at concentrations capable of causing significant harm would be unrecognized unless special procedures were adopted. The adoption of such special procedures would pre-suppose knowledge of the existence and properties (including biological) of the particular isomer.

Information about the toxicological properties of individual chlorobiphenyls is limited, and there is not yet evidence that any one of them known to be present in commercial PCB causes exceptionally severe effects to the degree contemplated in the preceding paragraph. However, a chlorobiphenyl of exceptional persistence (i.e. stability to attack) may well not manifest any especially severe toxicological effects except those associated with very long term exposure; such effects are those least likely to

hydroxylated PCBs are expected to be more readily degraded in the environment than PCBs themselves, Jansson et al. (1974) have reported the detection of such hydroxylated compounds in seal and guillemot.

Metabolic studies with PCBs have shown that dihydroxy metabolites are formed and that epoxides (arene oxides) are intermediates. It is known that the carcinogenic action of some chemicals is through their epoxide metabolite. Further studies in this field are likely to be of particular importance in deciding whether any initial control actions recommended by the Task Force should be revised at a future date.

In particular, if arene oxide (Safe et al. 1975) formation proves to be a necessary step in the "carcinogenesis process" the occurrence in fish of PCB residues which are metabolised by this route is of crucial importance. A reasonable probability of arene oxide formation from a PCB requires the presence in the molecule of two vicinal unsubstituted carbon atoms. Among the structures that have been shown to be present in commercial PCBs, unsubstituted vicinal carbon atoms are likely to be found only in molecules containing fewer than six chlorine atoms. Because di- and tri-chlorobiphenyls are relatively non-persistent in the environment, human exposure to PCBs likely to give rise to arene oxides, centres on ingestion of tetra- and pentachlorobiphenyl in fish used as food. Every effort should therefore be made to establish what are present levels of these compounds in fish, to monitor trends through reexamination of existing chromatograms and through fresh analyses, and to determine whether (or which) present uses of Aroclor 1016 and 1254 are leading to contamination.

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are complex mixtures/ This is one of the factors that must be considered not only in the immediate deliberations of this Task Force, but also in applying the truly preventive aspects of the Environmental Contaminants Act in evaluating new commercial substances. Similar complicating factors have recently been noted in evaluating the hazards from chlordane and, earlier, toxaphene.

7.3.7. Consumption and Usage of Lower Chlorinated and Higher Chlorinated PCBs

7.3.7.1. Total PCB usage, 1957-1974

Total Canadian imports of PCB for the period 1957-1974 are estimated at:

- 22,000 tonnes, comprising
- 13,500 tonnes Aroclor 1254/1260 types
- 8,500 tonnes Aroclor 1016/1242 types

U.S. domestic sales for the same period are estimated at:

- 330,000 tonnes, comprising
- 110,000 tonnes Aroclor 1254/1260 types
- 220,000 tonnes Aroclor 1016/1242 types

7.3.7.2. PCR usage 1973 and 1974 and usage ratio

Data for 1973 and 1974 reflect the effects of Monsanto's sales curtailment and show that usage ratios of 1016/1242: 1254/1260 have altered markedly in the U.S.A. though not in Canada. Average import of bulk PCR into Canada per year

- 1968-70: 1750 tonnes
- 1973-74: 1450 tonnes.

Average U.S. domestic consumption of PCBs

- 1968-70: 31,000 tonnes
- 1973-74: 15,500 tonnes