Updated Inventory of PCB Releases in the UK

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Introduction

There is considerable concern within the regulatory and scientific communities, as well as the wider community, about the potential adverse effects of dioxin-like compounds. Although most attention has been focused on the chlorinated dioxins and furans (PCDD, PCDF) a number of polychlorinated biphenyls have been found to exhibit dioxin-like behaviour. Further, it has been suggested that these dioxin-like PCBs may have contributed approximately 40% of the average UK dietary exposure (measured in TEQ) to PCDD/F and PCBs in 1982 and in 1992 (1).

Whilst the sources of PCDD and PCDF have been extensively studied and detailed inventory studies are available there is comparatively little information available on the *contemporary* sources of PCBs to the environment. In contrast to PCDD/F which arise from a wide range of natural and anthropogenic sources PCBs are often considered simply as a man-made chemical that was used in years gone by and are thought to occur in food mainly as a result of accidents and historical activity.

Manufacture of PCBs in the UK was halted in the late 1970s and since 1986 the sole use has been in sealed electrical equipment. In 1997 the Department of the Environment published the UK Action Plan for phasing out and destroying remaining PCBs. With the removal of PCBs from use potential emissions from other sources and redistribution of previously emitted PCBs become more significant.

The Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT), an independent panel which advises the UK Department of Health, recommended that certain PCBs be considered in evaluating exposure to dioxin-like compounds and when comparing exposure against the tolerable daily intake (2). Further the COT suggested that levels of PCBs be monitored to confirm that exposures were reducing and that a further review be carried out with a view to determining how exposure could be reduced if levels do not fall.

As part of their work on dioxin-like compounds the Chemicals and Biotechnology Division of the UK Department of the Environment, Transport and the Regions (DETR) commissioned a review

of the sources of PCBs to the UK environment to update the inventory published in 1995 (3). This paper summarises the results of the review.

Methods

The study followed the established approach to inventory compilation based on the derivation of emissions factors representative of particular processes and activities and characterising the processes in terms of annual activity statistics. For consistency with UK inventories on releases of PCDD/F to air (4) and land and water (5) the base year was taken as 1993.

The study sought emission factors for UK processes in preference to those from overseas. Where UK information was lacking data from overseas was assessed and used if judged appropriate.

Releases of PCBs to all media were assessed where possible. It should be noted that the definition of a release to land is that used in UK legislation and includes materials disposed of in landfill sites.

Results and Discussion

Table 1 summarises the findings of the study. It is important to bear in mind that this is a preliminary study and estimates are therefore uncertain.

Whilst the problem of PCBs has been seen as a historic one and most concern has been focused on landfill disposed PCBs and old PCB containing equipment the findings of this work indicate that there may be significant contemporary emissions from a number of industrial processes. More recent data is required to make a full assessment and to establish whether PCBs are being formed in the processes or measurements are showing re-emission of existing PCBs.

In contrast to inventories of releases of PCDD/F where waste incineration processes are found to be major sources of releases to air and land, it can be seen that, at least for total PCBs, releases from incineration appear small in comparison to many other sources.

Of particular interest are thermal processes such as metal plants. There is a clear need here to establish a better data set and to investigate the origins of PCBs, their control and the congener patterns typical of the processes concerned.

A further significant potential for release of PCBs occurs with the processing of scrap metal. Parts of the waste stream have been contaminated with PCBs in the past through use in capacitors, transformers and similar equipment and it appears that PCBs are still present in the feedstocks fed to fragmentisers. Although levels are thought to be falling there may be a process of cross contamination occurring that is distributing the contamination widely within the scrap metal processing industry.

Since PCBs may be mobile in the environment there is also a need to establish the importance of transport of PCBs already present in the environment. It has been suggested, for example, that the major source of PCB emissions to the UK atmosphere is volatilisation from soils (6) although

this is expected to decrease as PCBs are transported away from the UK.

There is a need to establish protocols for measurement of PCBs from sources identified as potentially significant in terms of contributing to human and ecological exposure to dioxin-like PCBs. An assessment will be required as to whether the regulation of PCBs needs to evolve from a policy focusing on waste management, contaminated land and environmental behaviour to one dealing with PCBs as a trace emission from a range of processes.

The UK, in common with other countries, is working to identify and then decommission PCB containing equipment and although this will significantly reduce overall releases due to leakage measures may be needed to avoid a short term increase in releases during the removal, treatment and disposal of the equipment.

There are other potential sources of PCBs which it was not possible to evaluate such as other high temperature processes, paper and pulp processing (including recycling), emissions from building materials, vehicles and the chemical industry.

Table 1 Estimates of releases of PCB

Process	Release to air kg PCB/y	Release to land kg PCB/y	Release to water kg PCB/y	Comments
Leaks from transformers	60-90 [1]	88-260 [1]	NE	Great uncertainty over amounts remaining
Leaks from capacitors	4000-4800 [1]	950-4200 [1]	NE	As above
Fragmentisers	240 [1]	14,000-16,000 [1]	NE	Little data, release to air may be underestimated. Release to land is to landfill
Landfill of household waste	0.3-2.2 [1]	390-850 [2]	2.6 [3]	Release to land is the PCB in household waste.
Waste incineration	7.8-18.8 [1]	1 [2]	NE	Release to land from MSW incineration only
Manufacture of RDF	10 [1]	See landfill	NE	
Application of sewage sludge to land	99 [1]	280 [1]	34-42 [1]	Releases to water from sewage treatment
Coal combustion	260 [4]	18-35 [5]	Low	
Oil combustion	91 [4]	Low	Low	Very little data
Steel production (Basic Oxygen Process)	49 [4]	NE	NE	No UK data available
Steel produced in Electric Arc Furnaces	410 [1]	6.7-50 [1]	NE	No UK data available

Inventory of sources – continued

Sinter production	36 [4]	Low	Low	No UK data available
Combustion of wood	0.5-3.8 [5]	0.075-0.17 [5]	Low	
Combustion of straw	0.06 [5]	0.014 [5]	Low	
Combustion of tyres	0.06-0.11 [5]	0.009-0.043 [5]	Low	
Combustion of RDF	0.02 [5]	0.014-0.037 [5]	Low	
Dredging	NE	26 [6]	NE	Estimate based on inland waterways only
Releases by rivers and direct discharges to coastal waters	N/A	N/A	22-2113 [1]?	Not necessarily current releases
Total	5300-6100*	16,000-22,000	N/A	

- excluding soil evaporation. NE – not estimated due to insufficient information, N/A – not applicable

Notes to Table 3: Indication of the basis of reporting (if available)

(1) Sum of PCBs (sometimes calculated from an analysis of selected congeners)
(2) Sum of 7 congeners (PCB 28,52,101,118,138,153 & 180)
(3) Expressed as Aroclor 1260
(4) Sum of 6 congeners (PCB 28,52,101,118,153 & 180)
(5) Sum of 10 congeners (PCB 28,52,77,101,118,126,138,153,169,180)
(6) Sum of 44 congeners

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